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INDEX.

List of sub-headings :—AUTHORS, BANKRUPTCY PROCEEDINGS, CITY NOTES, CONTRACTS CLOSED AND OPEN, CORRESPONDENCE, INSTITUTION AND LECTURE NOTES, LEGAL, LIGHTING AND POWER NOTES, LIQUIDATIONS, NEW COMPANIES, NEW ELECTRICAL DEVICES, FITTINGS AND PLANT, OBITUARY, OFFICIAL RETURNS, PARLIAMENTARY, PROCEEDINGS OF SOCIETIES AND INSTITUTIONS, PROSPECTUSES, RAILWAY NOTES, REVIEWS, TELEGRAPH NOTES, TELEPHONE NOTES, TRAMWAY NOTES, WAR ITEMS,

ACCIDENTS, 119, 406, 685
Accidents in German mines, Electrical, 17
Accidents in mines for the year 1913, Electrical, 832, 864
Accidents in 1913, Electrical, G. Scott Ram's report, 84, 154
Accrington, Electricity from gas at, 121
Adventures of a G.E.C. man at the Front, 540
Aerials, The capacity of radio-telegraphic, by Prof. G. W. O. Howe, 319
Aeroplanes and ships, Optical signals for, 169
Aeroplanes, Gyroscopic stabiliser for, 62
Agencies, German, 451
Agriculture, Electricity in, 792
Airship over London, 408, 436
Alien enemies Patents and, 667
All-steel dynamos and motors, 261
Alternator connections eliminating triple-frequency harmonics, 17
America and the war, 342
America appoints more trade consuls, 593
American activity, 502
American electrical industry, The present condition of, 260
American exports of electrical goods, 377
American views on the war and the electrical industry, 299
American visit, An, 223
A.M.I.C.E., Improper use of the letters, 15
Ammonia from the nitrogen of the air, Manufacture of, 229
Anemometer, An electrical, 797
Anglo-American exhibition, Vickers exhibit at the, 277
Annealing furnace for brass and German silver ware, Electric, 384
Apology, About a personal, 775
Applications for Parliament to consider, Electrical, 778
Appointments vacant, 18, 62, 103, 138, 224, 257, 283, 311, 343, 372, 406, 437, 472, 503, 533, 567, 595, 631, 667, 697, 731, 762, 793, 857
Apprentices, Boy scouts as engineering, 85
Apprenticeship system at the works of the British Westinghouse Co., 868
Arbitration awards, Australian tramway, 774
Arc, High temperature, 855
Argentine, Republic, The, 177, 518
Argentine Republic, Trade in the, 777
Arrester, The "Zig" lightning and surge, 241
Atoms and electrons, 626
Australia and Havre, The British Association in, 16
Australia, British trade in, 323, 350
Australian customs tariff inquiry, 587
Australian tariff matters, 432
Australian tramway arbitration awards, 774
Australian wages award, Another, 43
Austria-Hungary, The electrical industry in, 675

AUTHORS—
Allo, O. E., on Trading in Italy, 483, 518, 548
Bailey, F., on The British Empire—and our work in it, 604
Baker, C. A., on Co-operation in trade expansion, 539
Barham, G. B., on Electro-depositing nickel: Its applicability to the printing trade, 231; on Electrolytic refining, 282; on Moving pictures without photography, 438
Beaver, C. J., on Cables, 706, 738, 768, 802
Bowden, J. H., on The standardisation of tariffs, 33
Broadbent, F., on Can we capture the German trade?, 680
Brodie, J. A., on Town planning in relation to tramways, 197
Clamer, G. H., and Carl Hering, on Electric brass melting, 573
Coates, W. A., on The rating of bare copper conductors, 411
Coker, E. G., and W. A. Scoble, on Temperature cycles in heat engines, 319
"Commercial," on The perfect system, 278
Davies, F. H., on Earth connections, 537
Dennis, T. H., on Notes on modern continuous current motors, 704

AUTHORS—*continued.*
Dey, H. E., on A differential relay for heavy work, 206
Edgcumbe, K., on Over-pressure protective gear for high-tension circuits, 712, 744, 775, 807
Guillett, Dr. L., on Electrolytic iron, 478, 532
Hering, Carl, and G. H. Clamer, on Electric brass melting, 573
Hollis, E. P., on The decline of the self-synchronising motor, 357
Howe, Prof. G. W. O., on The capacity of radio-telegraphic aerials, 319
Humphries, R., on Rail joints, 196
Hunter, P. V., Inaugural address to Newcastle Local Section of I.E.E., 767
"Ignotus," on Trade war, 444
Jeffrey, C. S., on "Poochees," 383
Johnson, W. L., on Utilisation of heat contained in slag, 479
Kapp, N., on Mechanical charging of blast furnaces, 458
Kimura, Prof. S., on The present state of electrical industries in Japan, 207
Lang, M. de, on The thermophone, 801
Lees, S., on Concerning switchgear, 3
Lowson, J., on Electrical equipment of the *Aquitania*, 735
Luiggi, Prof. L., on Irrigation works in Italy, 319
Mayne, R., on Newcastle Corporation tramways, 157
Moores, G., on Large induction motors, Some features of mechanical design, 452, 507, 515, 572, 601
Newstead, T. B. L., on Establishment charges, 230
Parshall, Dr. H. F., on Economics of electric railway distribution, 706
Railing, Dr A. H., Inaugural address, Birmingham Local Section, I.E.E. 801
Ralph, G. J., on Electricity in mines, 811
Ram, G. Scott, on Electrical accidents in 1913, 84, 154
Roles, T., Inaugural address, Yorkshire Local Section I.E.E., 672
Rothera, L., on Application of electrical driving to existing rolling mills, 510
R.S.T.V on "We can't take the risk," 839
Sahlin, A., on The use of liquid ferro-manganese in the steel processes, 543
Sayers, H. M., on Tramways in Brazil, 158; on Tramway rail joints, 163
Scoble, W. A., and E. G. Coker, on Temperature cycles in heat engines, 319
Scott, E. K., on Irrigation dams and hydro-electric power, 317, 348
Selvey, W. M., on Power plant testing, 803, 809
Shaw, F. B., on The Government electric power station at Bangkok, 612, 659, 691
Smith, F. E., on Absolute measurement of electrical resistance by Lorenz's method, 164
Snell, Sir John, Inaugural address to Institution of Electrical Engineers, 639
Stansfield, J. J. H., on Unemployment insurance amendments, 232
Stelling, A. R., on Individual driving of small and medium size machine tools, 251
Stoney, F.R.S., G. G., on The effect of vacuum in steam turbines, 840
"Surplus," on Costing, 381, 412
Thompson, H. J., on A transmission system suitable for heavy internal-combustion locomotives, 605
Thornton, Prof. W. M., on The limiting conditions for the safe use of electricity in coal mining, 350
Tinson, H. A., on Wireless telephony in railway operation, 244
Tunzelmann, G. W de, on Russia as a field for British electrical trade, 680
W. B. S., on Electricity supplies for kinematographs, 270, 297
Wheelwright, P. P., Inaugural address, Manchester Local Section, I.E.E., 673
"Would-be-Reformer, A," on Problems of Industry, 475
Automobile to the Central Station, Relation of the, 542
Auto-Regulator system for direct current traction, 262

BADGE of essential industry, War, The, 743
Bachelet Levitated Railway (innocence at Saffron Hill), 38
Balance in surgery, Hughes induction, 697
Balderton electric lighting, 338
Bangkok, The Government electric power station of, by F. B. Shaw, 612, 659, 691

BANKRUPTCY PROCEEDINGS—
Atkinson, A., 334, 398, 492
Behrens, F., 215
Blake, C., 557
Boddington, G. H., 527
Bristol International Exhibition, 334
Brockie, J., 718
Burgess, G., 97, 308
Davis, W. H., 215
Garsden, J. W., 54, 215
Godfrey, H. J., 367, 432, 527, 557
Graham, H. B., 688
Hipkins, G. E., 753, 786, 819, 848
Johnson, F. T., 308
Kitching, C. H., 97
Lee. G. P., 10
Loader, A. J., 753, 786
Maisner, H., 492
Moore, T., 177, 215, 279, 398, 492, 627, 753
Nixon, J. D., 367
Oxley, H. H., 819
Pease, H., 848
Swainson, J., 718
Walker, W., 654, 753
Watts, F. H., 97, 279
Wedge, W. R., 130, 654, 753, 819
Wood, W. H., 718, 753, 819
Woodcock, T. M., 215
Banks and Government contracts, 593
Barcelona exhibition, 343
Battery vehicles in Boston, U.S.A., 137
Batti-Wallahs' outing, 37
Belgian State railways, Electrifying the, 38
Belting, Centrifugal effects in, 222
Berlin elevated and underground railway, 21
Berlin, The future of electricity supply in, 123
Betulander relay automatic telephone system, The, 17, 44
Blackpool exhibition, A, 804
Blast furnaces, Mechanical charging of, by N. Kapp, 458
Board of Trade and German capital, 372
Board of Trade electrical exhibition, A, 806
Boiler results and projects at Detroit, Mammoth, 290
Boring, Rotary well, 728
Boy scouts as engineering apprentices, 85
Bradford electrical exhibition, 312, 371
Brass melting, Electric, by G. H. Clamer and Carl Hering, 573
Breakdown, The L.C.C. tramways, 837, 856
British Association, 283
British Association for the Advancement of Science, Australia, 1914, 317, 348, 359
British Association in Australia and Havre, 16, 257, 541
British Electrical and Allied Manufacturers' Association annual dinner, 593
British Electrical and Allied Manufacturers' Council, 436
British Electrical and Allied Manufacturers' Association, New chairman of the 15, 731
British electrical export trade, 791
British Empire—and our work in it, by F Bailey, 604
British Honduras, 666
British Thomson-Houston Co.'s works, The, 335
British Westinghouse Co., The apprenticeship system at the works of the, 868
Brolt electric engine starter for motor-cars, The, 517
Bulbs for electric lamps, British, 415
Burley Colliery, Electric winding plant at, 442

CABLE censorship, 515
Cable-makers' syndicate, The German, 83
Cable-making machine in the world, The largest, 20
Cable-repairing steamship, A new, 401
Cable ship *Edouard Jéramec*, The new, 139
Cable telegrams, Censorship of, 515, 742, 823
Cable transport vehicles, 256
Cables, by C. J. Beaver, 706, 738, 768, 802
Cables and codes, 450
Cables in war time, 311
Cables, West Indies and, 323
Calculations relating to electrical conductors, 831
Canada, 820
Canada, British trade in, 82, 155
Canada, Hart battery works in, 786
Canada, Lamps for, 398
Canada, Municipal borrowing in, 791
Canada, Notes from, 52, 420, 771
Canadian inquiries, 472
Canal tow-boat, Electrical, 344
Cancer treated by heat, 223
Capture the German trade? Can we, by F. Broadbent, 680
Carbons in war-time, British-made, 307
Carnarvon wireless telegraph station, The, 315
Catalogues for South Africa, Import duty on, 377
Ceiling roses, 343
Censorship, Cable, 515, 742, 823
Central station, Relation of the automobile to the, 542
Centrifugal effects in belting, 222
Ceylon, 595, 785
Charges, Establishment, by T. B. L. Newstead, 230
Charging of blast-furnaces, Mechanical, by N. Kapp, 458
Cheap electric trucks, 762
Chicago underwriters' code, The, 53
Chile, 367
China, 176, 214
China, Electrical imports of, 849
China, Electrical loan for, 502
China, Telegraphs and telephones in, 306
Chosen (Korea), 654
Churton & Co., Ltd., Leeds, The works of Messrs. T. Harding, 399
Cinder removal at New York power stations, 325

CITY NOTES—
Aberdeen Suburban Tramways Co., 314, 376
Adelaide Electric Supply Co., 795, 826
Alabama Traction, Light & Power Co., 375
Alldays & Onions' Pneumatic Engineering Co., 795
Allgemeine Elektrizitats Gesellschaft, 732
Aluminium Corporation, 30, 64, 149
Amalgamated Wireless (Australasia), 506
Amazon Telegraph Co., 670, 699
Anderston Foundry Co., 597
Anglo-American Telegraph Co., 108, 570
Anglo-Argentine Tramways Co., 795
Anglo-Portuguese Telephone Co., 569
Aron Electricity Meter, 25, 794
Auckland Electric Tramways Co., 534, 599
Automatic Telephone Manufacturing Co., 827
Automatic Telephones (Australia), 409, 440
Babcock & Wilcox, 505, 597
Bank Rate, 187, 226
Barbados Electric Supply Corporation, 535, 598
Barcelona Traction, Light & Power Co., 764
Belgium, 67, 149
Bell Telephone Co of Canada, 859
Bell's United Asbestos Co., 286
Berlin Electrical Works, 733
Betulander Telephone Co., 149
Blackpool and Fleetwood Tramroad Co., 186
Blackpool, St. Anne's & Lytham Tramways Co., 827, 860
Bombay Electric Supply and Tramways Co., 26
Bournemouth and Poole Electricity Supply Co., 147
Brazilian Traction Light and Power Co., 149, 409, 569, 765

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CITY NOTES—*continued.*
Brisbane Electric Tramways Investment Co., 570, 634
Bristol Tramways and Carriage Co., 188
British Aluminium Co., 409
British Columbia Electric Railway Co., 108, 825, 857
British Continental Electricity Co., 144
British Electric Traction Co., 64, 148, 568, 765
British Electric Transformer Co., 375
British Insulated and Helsby Cables, 409
British L. M. Ericsson Manufacturing Co., 345
British Radium Corporation, 473
Bromley (Kent) Electric Light and Power Co., 409
Brompton and Kensington Electricity Supply Co., 258
Brown-Boveri & Cie, A. G., 225, 630
British Electrical Engineering Co., 226
Buenos Ayres, 473
Buenos Ayres Port and City Tramways, 144, 345
Buenos Ayres Tramways Co. (1904), 634
Bullers, 670
Burmah Electric Tramways & Lighting Co., 861
Calcutta Electric Supply Corporation, 149, 376, 570, 599, 733
Calcutta Tramways Co., 506
Callender's Cable and Construction Co., 597
Callender's Share and Investment Trust, 764, 794
Canada, 409
Canadian General Electric Co., 440, 765
Cape Electric Tramways, 795
Cape Town Consolidated Tramways and Land Co., 27
Castner-Kellner Alkali Co., 702
Central Electric Supply Co., 765
Central London Railway Co., 147
Charing Cross, West End and City Electricity Supply Co., 296
Chatham and District Light Railways Co., 188
Chelsea Electricity Supply Co., 186
Chili Telephone Co., 64, 149
Chilian Electric Tramway and Light Co., 65
Chloride Electrical Storage Co., 702
Churchill & Co., C., 29
City and South London Railway Co., 147
City of Buenos Aires Tramways (1904), 187
City of Carlisle Electric Tramways Co., 186
City of London Electric Lighting Co., 64, 226
Clontarf and Hill of Howth Tramroad Co., 67
Clyde Valley Electrical Power Co., 375
Companies Struck off the Register, 148
Consolidated Diesel Engine Manufacturers, 27
Consolidated Electrical Co., 28
Consolidated Gas, Electric Light and Power Co., 795
Continental, 67, 149, 187, 226, 313, 345, 795, 827
Cordoba Light, Power and Traction Co., 764, 859
Costa Rica Electric Light & Traction Co., 858
County of Dorset Electric Supply Co., 149
County of Durham Electrical Power Distribution Co., 473
County of London Electric Supply Co., 186
Craigpark Electric Cable Co., 634
Credenda Conduits Co., 26
Crompton & Co., 67, 107
Crossley Bros., 345
Cuba Submarine Telegraph Co., 505
Davis & Timmins, 375
Dick, R. & J., 764
Dick, Kerr & Co., 505, 569
Direct Spanish Telegraph Co., 409
Direct United States Cable Co., 108, 506
Direct West India Cable Co., 409
Douglas Southern Electric Tramways, 861
Drake & Gorham, 473, 534
Dublin United Tramways Co. (1896), 64
Dumbarton Burgh and County Tramways Co., 375, 409
Dundee, Broughty Ferry and District Tramways Co., 410, 473
Eastern Extension, Australasia and China Telegraph Co., 409, 795
Eastern Telegraph Co., 30, 409, 795
Edison & Swan United Electric Light Co., 669, 700
Edmundsons' Electricity Corporation, 26, 66, 107
Electrical Securities Trust, 827
Electric and General Investment Co., 66
Electric Construction Co., 733
Electric Supply Co. of Victoria, 375, 409
Electric Welding Co., 569
Electrolytic Co. (Spain and Portugal), 186
Fairbairn, Lawson, Combe Barbour, 375
Ferranti, 568, 633
Folkestone Electricity Supply Co., 473
France, 67, 149, 258

CITY NOTES—*continued.*
Fraser and Chalmers, 764
Fuller Accumulator Co., 861
General Electric Co., 65
German electrical companies, 149, 187, 634, 669, 701, 858
Globe Telegraph and Trust Co., 409, 795
Greenwood & Batley, 29
Hadfields, 285
Halifax and Bermudas Cable Co., 409
"Harper" Electric Piano (1910) Co., 26
Henley's Telegraph Works Co., W.T., 286
Hongkong Tramway Co., 701, 795
Hornsby & Sons, H., 733
Hurst, Nelson & Co., 473
Hydro-Electric Power and Metallurgical Co., 258, 285
Imperial Tramways Co., 30
India-Rubber, Gutta-Percha and Telegraph Works Co., 826
Indo-European Telegraph Co., 536
International Light and Power Co., 795
Isle of Thanet Tramways and Lighting Co., 860
Italy, 795, 827
Japan, 29, 67, 188, 440
Kalgoorlie Electric Power Co., 473, 506
Kalgoorlie Electric Tramways, 188, 225
Kaministiquia Power Co., 147
Kensington and Knightsbridge Electric Lighting Co., 226
Lanarkshire Tramways Co., 188, 258
La Plata Electric Tramways Co., 473, 570
Lima Light, Power and Tramways Co., 67, 634, 732
Lisbon Electric Tramways, 597
Liverpool Overhead Railway, 147
Llanelly and District Lighting and Traction Co., 313
Lobito Benguella and Catumbella Electric Light and Power Co., 314
London and Suburban Traction Co., 147
London Electric Railway Co., 149
Mackay Companies, 314, 764
Madras Electric Tramways (1904), 440
Manaos Tramways and Light Co., 285, 345
Manila Electric Railroad and Lighting Corporation, 375, 795
Manx Electric Railway Co., 827
Marconi International Marine Communication Co., 66, 827
Marconi's Wireless Telegraph Co., 105, 144, 258, 345
Mather & Platt, 187, 409
Melbourne Electric Supply Co., 535, 795, 826
Mersey Railway Co., 861
Metalite, 825
Metropolitan District Railway Co., 149, 187
Metropolitan Electric Supply Co., 345, 634
Mexican Companies, 505
Mexican Light and Power Co., 765
Mexico Tramways Co., 670, 776
Monterey Railway, Light and Power Co., 188, 376
Montevideo Telephone Co., 535, 598
Montreal Light, Heat and Power Co., 25, 149, 568
Nairobi Electric Power and Lighting Co., 148, 376
National Boiler and General Insurance Co., 226
National Electric Construction Co., 312
National Gas Engine Co., 186
National Telephone Co., 27
National Telewriter Co., 860
New British Ever-Ready Co., 670
Newcastle & District Electric Lighting Co., 313
Newcastle-on-Tyne Electric Supply Co., 108
New Issue, 827
New St. Helens and District Tramways Co., 597
Northampton Electric Light and Power Co., 186
Northern General Transport Co., 506
Northern Light, Power and Coal Co., 733
North Metropolitan Electric Power Supply Co., 634
Norway, 187, 226
Norwich Electric Tramways Co., 570
Official Notices re Companies, 506, 599, 669, 861
Oldham, Ashton and Hyde Electric Tramway, 226
Oriental Telephone and Electric Co., 535
Oxford Electric Co., 375
Paisley District Tramways Co., 187
Paris North-South Railway, 147
Paris Tramways Co., 144
Parsons' Foreign Patents, 314
Parsons Marine Steam Turbine Co., 568
Potteries Electric Traction Co., 314
Power-Gas Corporation, 827
Provincial Tramways Co., 733, 765
Puebla Tramway, Light and Power Co., 376
Rangoon Electric Tramway and Supply Co., 506
Rawlings Bros., 702
Reduction of Capital, 634
Rio de Janiero Tramway, Light and Power Co., 597
River Plate Electricity Co., 596
Roumania, 67

CITY NOTES—*continued.*
Rushden and District Electric Supply Co., 30
Russia, 536
Russian Wireless Telegraph and Telephone Co., 28
Ruston, Proctor & Co., 733
St. James and Pall Mall Electric Light Co., 147
Sao Paulo Tramway, Light and Power Co., 67, 597
Shawinigan Water and Power Co., 440, 827
Sheerness and District Electric Power and Traction Co., 67
South American Cable Co., 258
South American Light and Power Co., 26, 66
South London Electric Supply Corporation, 375
South Metropolitan Electric Light and Power Co., 285, 345, 409, 473
South-Western Electrification, 506
Spain, 313, 345, 440
Spanish and General Wireless Trust, 569, 597
Stewarts & Lloyds, 314
Stock Exchange Notices, 26, 64, 147, 258, 314, 764, 827
Stothert & Pitt, 795
Switzerland, 187
Telegraph Construction and Maintenance Co., 67
Telephone Development Co. (1912), 67
Trafford Power and Light Supply (1902), 30
Turkey, 67
Tyneside Electrical Development Co., 285
Tyneside Tramways and Tramroads Co., 258, 285
Underground Electric Railways Company of London, 64, 147, 187
United Alkali Co., 226
United Electric Car Co., Ltd., Preston, 375, 440
United Electric Tramways Co. of Caracas, 634, 669
United Electric Tramways of Montevideo, 795
United River Plate Telephone Co., 506
Uxbridge and District Electric Supply Co., 596
Venezuela Telephone and Electrical Appliances Co., 764
Vera Cruz Electric Light, Power and Traction, 633
Vickers, 186
Victoria Falls and Transvaal Power Co., 105
Waste Heat and Gas Electrical Generating Stations, 258
West African Telegraph Co., 634
Western Telegraph Co., 597, 634, 700, 795
West India and Panama Telegraph Co., 702, 765
Westminster Electric Supply Corporation, 188
White & Co., J. G., 29
Yates & Thom, 570
Yorkshire Electric Power Co., 188, 225
Yorkshire (West Riding) Electric Tramways Co., 827
Zurich Bank for Electrical Undertakings, 794

Civilisation, Electricity and, 773
Clearing house system, The goods, 103
Coal-cutting machinery and the output of coal, 460
Coal-handling plant at Southend-on-Sea, 52
Coal in Victoria, Brown, 466
Coal mining, The limiting conditions for the safe use of electricity in, by Prof. W. M. Thornton, 350
Coal strike, The, 138
Coal transportation, Pneumatic, 512
Coded messages and export trade, 295
Codes, Cables and, 450
Colliery, Electric winding plant at Burley, 442
Colliery winding gear, 432
Columbia, Trade in, 9
Commutators with moulded insulation, 373, 398
Competition with Germany and Austria-Hungary in neutral markets, Electrical, 284
Compressed air, 234
Conductors, Calculations relating to electrical, 831
Conductors, Heating and insulation deterioration of current-carrying, 643
Conductors, The rating of bare copper, by W. A. Coates, 411
Congress postponed, Electrical, 630
Congress, The Tramway, 157, 196
Connections, Earth, by F. H. Davies, 537
Connections eliminating triple-frequency harmonics, Alternator, 17
Constable, The Special, 482, 646
Consular notes, 129, 176, 214, 367, 492, 557, 594, 654, 666, 785
Consuls, America appoints more trade, 593
Consumer's terminals, Definition of, 698
Consulting engineers, Fees of, 711
Continuous-current motors, Notes on Modern, by T. H. Dennis, 704
Contracting, Electrical, 481
Contractors' Association of Scotland, Electrical, 61
Contractors combining, Electrical, 103
Contractors, Electrical, 797

CONTRACTS CLOSED—
Aberaman, 341
Aber Bargoed, 639
Aberdare, 135, 282
Aberystwyth, 761
Accrington, 60
Admiralty, 135
Albury, N.S.W., 630
Ashton-in-Makerfield, 531
Ashton-under-Lyne, 102, 823
Atherton, 102, 761
Attercliffe, 435
Australia, 14, 60, 102, 181, 282, 311, 370, 406, 471, 531, 565, 591, 630, 664, 696, 761, 823
Aylesbury, 219, 501
Bacup, 371, 664, 823
Ballyconnell (Co. Cavan), 531
Barking, 14
Barnsley, 591
Barrow, 60, 181
Basingstoke, 282
Batley, 60
Battersea, 136, 722, 823
Belfast, 14, 435
Belgium, 14
Bexhill-on-Sea, 182
Bexley, 219
Birkenhead, 219
Blackpool, 60, 471, 501, 761
Blyth, 790
Bolton, 135, 219, 501, 761
Bradford, 102, 182, 282, 341, 531, 591, 630, 790
Bridlington, 255
Brighton, 60, 565, 855
Brisbane, 664
Bristol, 14, 102, 790
Brodsworth, 531
Burnley, 60, 501
Burslem, 471
Burton-on-Trent, 135
Bury, 501, 630
Buxton, 371
Calcutta, 60
Canada, 14
Canterbury, 60, 135, 219
Cape Town, 182
Cardiff, 591
Chesterfield, 565
Clacton-on-Sea, 60
Cleckheaton, 471, 591, 790
Colne, 60, 219
Coventry, 182, 761
Crewe, 255, 855
Crown Office for the Colonies, 135
Croydon, 182, 219, 855
Cunard Co., 823
Dartford, 60, 371, 531, 722, 790
Darwen, 60
Derby, 219, 371, 591
Dewsbury, 371, 501, 790
Doncaster, 60
Dorchester, 630
Dorset, 696
Dover, 14
Dublin, 182
Dundee, 501
Ealing, 102
Eastbourne, 591
Eccles, 60, 219, 371, 501
Edinburgh, 60
Erith, 219
Faversham, 255, 722
Felixstowe, 60
Finchley, 761
Fleetwood, 135
Folkestone, 60
France, 761
Fulham, 60
General Post Office, 630
Gillingham (Kent), 531
Glasgow, 255, 565, 664, 722, 790
Gloucester, 531
Government Contracts, 135, 435, 565, 696, 855
Gravesend, 102
Grimsby, 60, 255, 501
Hackney, 102, 136
Halifax, 14
Hammersmith, 60, 182, 435, 722
Harrogate, 282, 435
Haslingden, 135
Hebden Bridge, 761
Hereford, 722, 790
Heston, 14, 471
Heywood, 823
High Wycombe, 435
Holywell, 371
Hornsey, 565, 761, 790
Horsham, 102
Huddersfield, 135
Hull, 501
Ilford, 471, 761
India, 591
Ipswich, 664
Isleworth, 14, 471
Islington, 722, 855
Keighley, 182, 664, 823
Kingston-on-Thames, 14
Kirkcaldy, 182
Lancaster, 219
Launceston (Tasmania), 371
Leeds, 219
Leicester, 722
Lewisham, 565
Leyton, 219, 501
Lindley, 182
Liverpool, 591
Llandudno, 790
Loftus, 696
London, 14, 60, 102, 136, 182, 219, 255, 311, 341, 371, 435, 471, 502, 531, 565, 592, 630, 664, 696, 722, 761, 790, 823, 855
London County Council, 14, 60, 102, 136, 182, 311, 531, 565, 855
Lowestoft, 60
Luton, 219, 592, 855
Macclesfield, 790
Maidenhead, 501
Maidstone, 60, 501, 630

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CONTRACTS CLOSED—*continued.*
Malvern, 565
Manchester, 60, 255, 341, 371, 501, 630, 664, 761
Mansfield, 592
Margate, 14, 136
Marlborough, 696
Marylebone, 182
Metropolitan Asylums Board, 102
Middleton, 255
Morecambe, 311
Morley, 790
New Zealand, 136, 255, 664
Normanton, 664, 790
Northampton, 502, 630, 664
Norwich, 435
Nuneaton, 823
Office of Works, H.M., 311
Paddington, 182
Paisley, 855
Pelton (Co. Durham), 182
Peterborough, 60
Poplar, 60, 136, 592, 790
Post Office, 135
Ramsgate, 136
Rawtenstall, 136
Rochdale, 592
Rochester, 471
Rotherham, 371, 531
Rugby, 15, 565
Ruthin, 696
St. Pancras, 255, 531, 722
Salford, 15, 182, 219, 255, 341, 502, 531, 592, 791, 855
Scarborough, 311
Sheffield, 61, 255, 531, 664, 722, 791,
Shipley, 60, 761
Ship lighting, 791
Shoreditch, 136
Skelton and Brotton, 102
Southampton, 102, 136, 182, 471, 565, 791
Southend-on-Sea, 311
Southport, 282
Southwark, 14, 102, 471, 531, 592
Spain, 855
Stalybridge, 341
Stepney, 471, 592, 664, 790
Stockport, 471, 565
Stoke-on-Trent, 15, 136, 182
Stretford, 15, 61, 371, 664, 791
Sunderland, 61, 282, 664, 791, 823
Swansea, 102, 220, 406, 823
Swinton, 435
Taunton, 696
Todmorden, 502
Torquay, 225, 791
Tottenham, 471
Tramway Contracts, 183
Tunbridge Wells, 15, 183, 696, 791
Tynemouth, 722
Victoria, 664
Wakefield, 791
Wallasey, 220
Walsall, 220, 406, 664, 722, 823
Walthamstow, 136, 435
Wandsworth, 219, 371, 435
War Office, 135
Warrington, 61, 341, 502, 592
Watford, 532
West Bromwich, 61, 183, 502
West Ham, 183, 406
Whitby, 406, 435
Whitefield, 255
Whitstable, 183
Wimbledon, 15
Winchester, 102, 855
Wirrall, 664
Wolverhampton, 102, 255, 406, 532, 823
Woolwich, 182, 502, 592, 696, 790
Works, H.M. Office of, 135
Worksop, 102, 502
Worthing, 220
Wrexham, 61
Yarmouth, 183
York, 15, 220, 406, 502, 791

CONTRACTS OPEN—
Aberaman, 281, 310
Aberdeen, 629, 663, 761
Adelaide, 101, 181, 218, 254, 281, 310, 370, 405, 434, 470, 501, 530, 564, 591, 629, 790, 822, 855
Aldershot, 59, 181
Argentina, 59, 218, 790
Ashton-under-Lyne, 59, 690
Athens, 790
Atherton, 629, 663, 690, 761
Auckland, 14
Australia, 13, 59, 101, 135, 181, 218, 254, 281, 310, 341, 370, 405, 434, 470, 501, 530, 564, 591, 629, 690, 721, 761, 790, 822, 855
Austria, 134, 181
Aylesbury, 13
Bacup, 370, 761, 822
Ballaghadereen, 13
Barnes, 591
Barnet, 629, 663, 690
Batley, 310
Battersea, 721
Beaufort West (Cape Province), 59
Beckenham, 530, 564
Belfast, 181, 218, 254, 282, 501
Belgium, 13, 59
Belsal Green, 690, 721
Birkenhead, 135, 181, 218, 405, 434, 501, 822, 855
Birmingham, 310, 341, 501, 530, 564
Blackburn, 101, 181
Blackpool, 501, 530, 564, 591, 629, 663
Blackrock, 13, 59
Bolton, 13, 59, 405, 434
Bradford, 101, 181, 530
Bradwell (Staffs.), 855
Brighton, 501
Brisbane, 101, 134, 181, 218, 254, 341, 405, 434, 470, 501, 530, 564, 629, 663, 690, 761
Brussels, 59
Bulgaria, 181, 218

CONTRACTS OPEN—*continued.*
Burnley, 341, 370, 405
Bury (Lancs.), 434
Canada, 135
Canary Islands, 564, 663
Cardiff, 564
Chatham, 629
Cheshire, 663
Chichester, 101
China, 135, 181
Clayton (Bradford), 310, 341
Colchester, 761
Colwyn Bay, 434, 470, 501, 530
Connah's Quay, 530, 564, 591
Coxhoe, 254
Croydon, 135, 181, 629, 663
Dartford (Kent), 59, 629, 663
Dewsbury, 101
Dover, 135, 855
Dublin, 530, 564, 591, 629, 663
Dundalk, 721, 761, 790, 822
Dundee, 282, 310, 822
Earsdon (Northumberland), 218, 254
Easington, 822
Eastbourne, 101, 181, 218, 254
East London (S.A.), 255
Eccles, 341, 370, 405, 721
Edinburgh, 59, 218, 254, 663
Elmton-with-Cresswell, 822
Enniskillen, 721
Epsom, 135
Erith, 13
Finchley, 564
France, 13, 59, 218
Germiston (Transvaal), 255
Gillingham (Kent), 13, 59
Gisborne, 530, 565, 591
Glasgow, 761, 790
Greece, 790
Greenock, 59, 101
Grimsby, 59, 761
Hackney, 13
Halifax, 181
Hammersmith, 565, 591
Harrogate, 282
Hawarden (Flint), 564, 591, 629
Heywood, 435, 470, 501, 530, 564
Hong Kong, 822, 855
Hornsey, 405, 435, 471, 761, 790, 822, 855
Huddersfield, 310, 341, 530
Hull, 790
Innsbruck, 134
Jaraiz (Caceres), 341
Johannesburg, 341, 370, 406, 435, 471, 761, 790, 822
Kalgoorlie, 341, 370
Kelloe, 254
Kingston-upon-Hull, 101, 181, 218, 254, 282
Lancaster, 13, 59
Leeds, 790, 822, 855
Leicester, 471, 501, 530
Leigh, 663
Leith, 370
Leyton, 822, 855
Limerick, 341, 370, 405
Lincoln, 822
Lisnakea, 218, 254
Littleborough, 435, 471, 501
Liverpool, 370
London, 13, 59, 135, 181, 218, 254, 282, 311, 341, 370, 406, 435, 501, 530, 565, 591, 663, 690, 721, 761, 855
London County Council, 13, 59, 135, 181, 218, 254, 282, 341, 370, 406, 565, 663, 690, 721, 761, 855
Madeira, 13
Manchester, 59, 254, 282, 311, 341, 406, 435, 471, 501, 629, 663, 690, 721, 761, 790, 822, 855
Matlock, 181, 219
Melbourne, 59, 101, 134, 181, 218, 254, 281, 310, 341, 370, 405, 434, 470, 501, 530, 564, 591, 629, 663, 690, 721, 790, 822, 855
Middlesbrough, 254, 282, 311, 341, 370
Montenegro, 59
Nalinnes, 59
Neath, 591
Newcastle-on-Tyne, 690
New Plymouth (N.Z.), 101, 254
Newport (Mon.), 181, 219, 254, 663
New Zealand, 14, 101, 254, 282, 311, 341, 501, 530, 565, 591
Normanton (Yorks.), 663
Nottingham, 790, 822
Nuneaton, 181, 219
Office of Works, H.M., 591, 721, 761
Oldham, 135, 181, 219, 254, 282
Oldmachar (Aberdeen), 282
Paisley, 14
Palmas (Majorca), 219
Paris, 59, 254
Pendlebury, 181, 219, 255
Perth (W.A.), 13, 59, 101, 254, 281, 310, 370, 405, 434, 501, 530, 564, 663, 690
Pittington (Durham), 14, 59
Pontypridd, 501, 530
Port Elizabeth, 629, 663
Porth, 501, 530
Port of London Authority, 761
Preston, 761
Ramsbottom, 59
Ramsey (Hants), 14
Rathmines (Co. Dublin), 254
Rauch (Argentina), 218
Richmond (Victoria), 101, 181, 218
Rochdale, 135, 181, 282, 435
Rotherham, 14
Rugby, 219
St. Pancras, 341, 406
Salford, 59, 102, 135, 341, 530
Shanghai, 855
Shrewsbury, 855
Skegness, 14
South Africa, 59, 255, 282, 341, 370, 406, 435, 471, 530, 565, 663, 696

CONTRACTS OPEN—*continued.*
Southampton, 59, 134, 181
Spain, 59, 135, 219, 254, 282, 311, 341, 370, 406, 435, 501, 530, 565, 629, 663, 696, 721, 761, 790, 822
Stalybridge, 135
Stockport, 471
Stockton (N.S.W.), 219
Stockton-on-Tees, 59, 663, 696
Sunderland, 181, 219, 255, 406
Swansea, 282, 435, 471, 501
Swinton, 181, 219, 255, 565
Sydney, 13, 59, 101, 134, 181, 218, 254, 281, 310, 341, 370, 405, 501, 530, 564, 591, 629, 790, 822, 855
Taunton, 471
Tavistock, 102
Teddington, 761
Thorne (Yorks.), 14
Tientsin, 135, 181
Tonbridge, 181
Torpoint, 311, 790
Torquay, 102
Truro, 14
Tunbridge Wells, 501
Turton, 59
Wakefield, 406, 565, 591, 629, 663, 696, 722
Walsall, 14, 59, 102, 181, 219, 370, 406, 435, 629, 663, 696, 722, 761
Walthamstow, 219, 255, 761, 790, 822
Warrington, 14, 59, 311, 341, 370, 406, 435, 471, 501, 790
Wellington (N.Z.), 341
West Ham, 14, 59, 722, 761
West Hartlepool, 181, 219, 255
Whitby, 311, 341, 370, 406, 435
Whitefield, 406, 435
Whitstable, 14, 60
Wigan, 282, 435, 591, 629, 696
Winchester, 696, 722, 761, 790
Wisbech, 135
Wolverhampton, 311, 341
Woodford Green, 255
Worthing, 102
Wrexham, 60
York, 14, 60, 102, 531, 565, 591, 629
Cooking, Discussion at the Point Five Association on electric, 673
Cooking, Electric, 284
Cooking in marine service, Electric, 250
Cooking installation, A military, 723
Cooking on the U.S.S. *Texas*, Electric, 32
Coolidge high-power X-ray tube, The, 519
Co-operation, 677
Co-operation in Italy, 857
Co-operation in trade expansion, by C. A. Baker, 539
Co-operation in trade expansion, 418, 451
Copper, 43, 61, 129, 162, 222, 266, 335, 451, 502, 547, 646, 665, 729, 743, 792, 856
Copper conductors, The rating of bare, by W. A. Coates, 411
Copper contraband, 533
Copper in Russia, 18
Corea, 367, 492

CORRESPONDENCE—
"Advertising and progress," by J. Hart, 521
A.E.G. exporting activity, by "A Constantinople Correspondent," 717
A.E.S.E., The policy of the, by W. J. Ebben, 89; by C. Ashmore Baker, 127
American activity in the Australian market, by "U. Soon Approached," 816
America and export trade, by A. M. Turner, 359
Appointments in Hong Kong, by "No. 2," 846
Appointments in West Africa: A warning, by "A Victim," 167
Arbitrary action of a public authority, by Advocate of patriotism in time of peace, 388, 454; by F. W. Purse, 423, 484
Arc lamp globes, by S. W. Baynes, 388
Armorduct v. Defries, by W. Schmahl, 607
Assisting the enemy, by "X.," 650
Black tape, A new use for, by Black Tape, 845
British Electrical and Allied Manufacturers' Association and "The state of war," by D. N. Dunlop, 424
British firms and the home trade, by E. A. Pinto, 422
British (?) firms: A suggestion, by S. S. Galsworthy, 333
British industry and the war, by J. Taylor Peddie, 632
British-made telephones, by A. W. Cox, 426; by Sterling Telephone and Electric Co., 426
British manufacturers and German trade, by V. H. Coates, 521
British manufacturers and their sales methods, by V. H. Coates, 649
Cable censorship, by F. Ward, 644
Cab tire sheathed cable, by St. Helens Cable & Rubber Co., 208
Canada, Difficulties in, by M. S. Parnell Smith, 89; by W. A. Coates, 89, 126
Capturing German trade, by F. G. Turquand, 422; by E. J. Fox, 454; by "Atlantic," 644
Carbons, by "Inquirer," 374, 408; by General Electric Co., Ltd., 288; by "In Tenebris," 567

CORRESPONDENCE—*continued.*
Colonial appointments, by "M.I.E.E.," 209
Commutator bars, by A. Bergtheil, 607
Constructive British business, by S. F. Ricketts, 648
Cooking apparatus, Electric, by "Ptah," 299; by R. F. S. Venner, 342
Crisis and provisional order notices, The, by R. W. Rowland-Hill, 342
Deterioration of red cable, by W. Gibbs, 359
"Earthing" an extra? Is, by "Extra," 422; by "Inspecting Engineer," 454
Eck and the Union Electric, Mr., by Evershed & Vignoles, 488
Electrical apparatus for shearing wool, by J. G. Bomford, 208
Electrical engineers and the war, by W. Ellerd-Styles, 209, 248; by "M.I.E.E.," 247, 272
Electrical trades and motor ambulances: A proposal, by "Alpha," 846
Electrical Trades Benevolent Institution, by F. B. O. Hawes, 247
Electrical treatment of milk, by A. Shelmerdine, 209
Electricity supply in London, by L. H. Hordern, 5, 48
Enemy factories, by "W.H.B.," 426
Enemy's trade, The, by A. H. Seabrook, 395
Engaging a foreman, by Armitage & Co., 247
Englishman, A compleat, by J. Eck, 331; by Langdon-Davies Motor Co., 393
Expenses of applicants for appointments, by "Disillusioned," 845
Financial control of electricity supply undertakings, by "Efficiency," 521
From the front, by M. D. Boddy, 714
Geissler tubes, by "Medico," 6
Generators, The mechanical design and construction of, by R. Livingstone, 780; "The Reviewer," 780
German agencies, by "Contractor," 816
German culture, by A. A. C. Swinton, 453
German electrical success: A suggested inquiry, by "T.G.A.," 454
German menace, by "A Rejected One," 303
German or British? by F. Wylde Ball, 846; by "Contractor," 846
German trade and German vandalism, by A. S. E. Ackermann, 428
German trade, To capture, by C. H. Luke, 488
Half-watt lamp patents, by The Electrical Engineering & Equipment Co., 359; by F. W. Willcox, 436
Handles for electric ovens, by W. H. Allen, 781
Hanover Square School of Electrical Engineering, by F. J. Moffett & L. W. Wild, 6
Lamp industry, by "Atlantic," 426
Lightning and trees, by K. Hedges, 5
L.B. & S.C. Railway electrification, by "A British Manufacturer," 436
Manufacture of carbons, by "Carbone," 273
Mica and micanite, by Wiggins & Sons, 88; by H. W. H. Warren, 167
Modern continuous-current motors, re Notes on, by E. F. Butler, 748
Mysterious behaviour of a generating set, by J. Wood, 248; by "W.H.D.," 272
Nationality and naturalisation, by G. E. Kerss, 488; by J. E. Gray, 488, 526, 526
No connection, by Switchgear and Cowans, 750
No reply, by H. T. Gerry, 521
Not a German firm, by J. Sax & Co., 330
Not paying at present, by Nalder Bros. & Thompson, 365, 396
Panama, Berlin and fraternity, by "Innocens," 332
Patent position of half-watt lamps and tungsten lamps, by F. W. Willcox, 436
Picture play photography, by H. M. Lomas, 664
Proposed Central Testing Institution, by C. H. Wordingham, 124; by G. St. John Day, 168; by "Atlantic," 272
Protection of engineering works, by W. R. Eustace, 248
Qualifications of a consulting electrical engineer, by "Unqualified," 90
Radiators, About electric, by The Jackson Electric Stove Co., 650; Ferranti, 683; F. Barron, 683; T. Smith, 715; Belling & Co., 715
Rear lights on vehicles, by H. England, 846
Safety rules, U.S.A., by G. W. Stratton, 779
Seizing the enemy's trade, by "Britannicus," 484
Signalling supplies wanted, by R. Macleod, 781
Spagnoletti, Ltd., by The Park Royal Engineering Works, 594

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CORRESPONDENCE—*continued.*
Special constables, by A. H. Seabrook, 521
State of war, The, by "Foresight," 372; by D. N. Dunlop, 372
Stereopyrometer wanted, A, by W. Hibbert, 816
Strange behaviour of a motor, by A. F. Cranford, 388; E. J. Walsh, 423
Street lighting in Chicago, by Engineering and Arc Lamps, 607; G. H. Stickney, 779
Strike, End of the London wiremen's, by L. G. Tate, 248
Switchgear, Concerning, by The Micanite & Insulator Co., 49
Switchgear contracts, Expenses of tendering, by D. N. Dunlop and H. Faraday Proctor, 89
Technical errors in the lay press, by A. C. Booth, 169
Temporary substitutes, by R. Ritchie, 422
Timber drying, by Erith's Engineering Co., 6
"Too old at forty," by A. E. Short, 273
Trade war, The, by A. M. Turner, 607; by L. E. Boxall, 607
Trade, Why Great Britain loses, by "Canada," 780; "A Sufferer," 780
Trading with the enemy, by Dorman & Smith, 393; F. B. O. Hawes, 393; "A Correspondent," 652; G Weston, 683; "Fairplay," 748; T. W. Coles, 781
Training of the instrument maker, The, by N. Ingleby, 6; by "Scientific Instrument," 48; by R. W. Paul, 126; by C. H. Wright, 168
Tubular light sources, by H. B. Howard, 167
Unemployment, Lessening, by T. C. Smith & Co., 366
Unpatriotic English manufacturer, by D. G. E. Barrie, 303
Vehicles, re Electric, by F. A. Yerbury, 793
War and science, by H. W. Weysz, 643
War and South African trade, The, by "Loyalist," 485
War and the enemy, by "Yorkshire Tyke," 521
War and the neutrality of science, by "X.," 484
War and trade, The, by F. R. Davenport, 273
What constitutes a British firm? 312; by the Walsall Electrical Co., Ltd., 333; by "Fairplay," 334; by "X," 334; by H. F. Friederichs, 334; by A. A. C. Swinton, 342, 395; by G. A. Anson, 361; by F. B. Sinclair, 361; by E. J. Williams, 361; by "Electrical Contractor," 361; by "Tohill," 361; by F. Broadbent, 362, 394; by R. Hammond, 362; by the Sterling Telephone & Electric Co., 363; by J. E. Kingsbury, 363; by "Common Sense," 363; by "Britisher," 363; by J.S., 393; by "British Investors," 393; by H. C. Levis, 394; by "A.M.Inst.C.E.," 394; by G. E. Kerss, 394; by T. Stevens, 394; by J. Frankenburg & Sons, 394; by H. S. Hohne, 395; by "Censor," 395; by R. C. Pierce, 395; by C. C. Garrard, 424; by Justus Eck, 425; by H. T. Gear, 425; by "Siemens Employés," 425; by E. Jacob, 425; by J. E. Gray, 425; by Guy Burney, 426; by "W.H.B.," 426
What's in a name, by "J.E.G.," 751
Who can help?, by L. W. Woodman, 567, 644
Why Great Britain loses trade, by "Canada," 780; by "A Sufferer (India)," 780; by "Observer," 845
Willesden workhouse supply, by A. W. Blake, 748
Wireman or electrical fitter?, by "Elles," 299; by "Hopeful," 333
Workhouse supply, by "An institution engineer," 779
Zero resistivity, by A. T. Scott, 49

Cost of the electric vehicle, The, 741
Costing, by "Surplus," 381, 412
Costs, Electric vehicle operating, 666
Costs in the United States, Electric fire brigade vehicle, 374
Costs of electrical motor fire engines in Berlin, The running and maintenance, 245
Crane and lift design, Recent advances in electrical, 829, 866
Credit, Export trade and long, 417
Creditors' remedies, Supervision of, 387
Crypto Electrical Co.'s Works, The, 465
Cyanamide works, Proposed new, 836

DEEDS of assignment, 468, 719, 786
Definitions, Electrical terms and, 72
Denatured electricity, 223
Destruction of pests, Electrical, 341
Dielectrics, The insulating properties of solid, 593
Diesel electrical locomotive cars, 592
Differential relay for heavy work, A, by H. E. Dey, 206
Direct current traction, Auto-regulator system for, 262
Dock at Hull, The new, 22
Driving to existing rolling mills, Application of electrical, by L. Rothera, 510
Dust deposition, Electrical system of, 411
Dynamos and motors, All-steel, 261

EARTH connections, by F. H. Davies, 537
Ebonite supplies, 491
Economics of electric railway distribution, by Dr. H. F. Parshall, 706
Edison & Swan Co.'s new City showrooms, The, 247
Edison omnibuses for South Shields, 142
Edison works destroyed, 791
Ediswan glass works, 311
"Edouard Jéramec," The new cable ship, 139
Educational notes, 18, 103, 224, 256, 283, 311, 343, 372, 407, 437, 504, 730
Efficiency, Task setting and, 387
Egyptian market, Prospects in the, 419
Egypt, 1913, Trade statistics of, 446
Electrical engineers, National service for, 255
Electrical exports from Sweden, 655, 786
Electrical industry, A proposed testing institution for the, 193
Electrically-propelled tower wagons, 288
Electrically propelled U.S. warship, 658
Electrical trades and the war, The, 242, 552, 582, 614
Electrical trade, The promotion of the, 843
Electrical Trades Union Conference, 203
Electrical treatment of milk, 169
Electricity and civilisation, 773
Electricity in mines, by G. J. Ralph, 811; by W. Maurice, 812
Electricity in the London Fire Brigade, 137
Electricity in warfare, 483
Electricity on the farm, 798
Electricity supply, 645
Electricity supply in Germany, 667
Electricity supply, London's, L.C.C. Report, 198
Electricity supply, London's, 1, 161, 190
Electricity supplies for kinematographs, by W.B.S., 270, 297
Electric light and Roman Catholicism, 209
Electric motor vehicles, 159
Electric tractor, A new, 413
Electric Vehicle Association, U.S.A., 316
Electric Vehicle Committee, 214, 447, 576, 856
Electric vehicle convention, American, 160
Electric vehicle equipment of the London Fire Brigade, Some notes on the, 296, 324
Electric vehicle manufacture at Ipswich, 816
Electro-depositing nickel, Its applicability to the printing trade, by G. B. Barham, 231
Electro-Harmonic Society, 437, 472
Electrolytic iron, by Dr. L. Guillet, 478, 532
Electrolytic refining, by G. B. Barham, 282
Electro-magnetic hammer, New, 262
Electromagnets for war surgery, 593
Electrons, Atoms and, 626
Electro-percussive welding, 666
Elliott Bros. works, Power and light at, 141
Embezzling car fares, 503
Employment improving, 502
Enemy, Trading with the, 391, 709, 730
Engineering on race removal, The influence of, 293
Engineering Standards Committee, 77
Engineers, The practical training of, 577, 636, 671
Establishment charges, by T. B. L. Newstead, 230
Examinations of the I.E.E., The, 111
Exhibition, A 1916, 15
Exhibition, A Blackpool, 804
Exhibition, A Board of Trade electrical, 806
Exhibition at Manchester, 215
Exhibition at Wolverhampton, Electrical, 131
Exhibition, Barcelona, 343
Exhibition, Bradford Electrical, 312, 371
Exhibition, International Rubber and Allied Trades, 37
Exhibition, Panama, 334
Exhibition, Vickers exhibits at the Anglo-American, 277
Explosions, Electric mains, 74, 84, 97
Explosions, Gaseous, 360
Explosions, The report on electric mains, 41
Export trade and long credit, 417
Export trade, British electrical, 791
Export trade, Coded messages and, 295
Exports and imports of electrical goods during June, 153; July, 287; August, 441; September, 571; October, 703; November, 863
Exports, German, 235, 291, 292
Exports of electrical goods, American, 377

FACTORIES, Fire precautions in, in, 857
Fans v. fire, 576
Faraday Society, The, 414
Fares and traffic, 437
Farm, An electrical, 256
Farm, Electricity on the, 798
Fatalities, 18, 62, 103, 138, 223, 257, 344, 372, 407, 532, 566, 594, 631, 667, 697, 730, 762, 792, 824, 857
Fees of consulting engineers, 711
Ferro-concrete poles, 679
Ferro-manganese in the steel processes, The use of liquid, by Axel Sahlin, 543
Financier wanted to develop an American scheme, 820
Fire, 492, 518, 763, 786
Fire, American station proof against, 223
Fire at Edison plant in U.S.A., 823
Fire Brigade, Electricity in the London, 137
Fire Brigade, Some notes on the electric vehicle equipment of the London, 296, 324
Fire brigade vehicle costs in the United States, Electric, 374
Fire-damp indicator, The Williams, 15
Fire engines, The running and maintenance costs of electrical motor, 245
Fire patrols for factories, 472
Fire precautions in factories, 857
Fire prevention, 502, 592
Fire protection of St. Paul's Cathedral, 730
Fire risks, 792
Fire service, Special, 437
Fire v. fans, 576
Flat plates, The strength of, 544
Fly-wheel into pit, Lowering, 606
Foreign and Colonial tariffs on electrical goods, 159, 235, 319, 416, 448, 512, 772
Foreign supply works in belligerent countries, 807
Foreign trade in June, 62; July, 264; August, 372; September, 503; October, 664; November, 791
Four-hundred-mile transmission completed, 408
"F" rays exploded, 137
French railways, Electric signalling on, 92
Fuel, Powdered, 624
Fullagar gas engine, The, 86
Furnace for brass and German silver ware, Electric, 384
Furnace, The latest type of Rennerfelt 112
Furnaces and electric steel production, Electric, 351
Furnaces, Large electrical smelting, 378
Future of electricity supply in Berlin, The, 122

GARAGE, Electric heating in the, 729
Gas, 33
Gas at Accrington, Electricity from, 121
Gas engine, A new type of, 82
Gas engine, A "Sewage," 283
Gas engine, The Fullagar, 86
Gaseous explosions, 360
Gas on trains, 532
Gatun hydroelectric development for the Panama Canal, 267
Gear changing, Electric, 791
General Electric Co. man at the front, Adventures of a, 540
German agencies, 451
German cable-makers' syndicate, The, 83
German capital, The Board of Trade and, 372
German electrical industry, The situation of the, 806
German electricity monopoly, A, 228
German exports, 291, 292, 322
German papers, Electrical news in, 593
German rules for electrical installations, 114
German supply undertaking, A large, 707
German? Swiss or, 839
German trade? Can we capture, by F. Broadbent, 680
German trade: How to ensure success, Capturing, 549
Germany, 215
Germany and Austria-Hungary in neutral markets, Electrical competition with, 284
Germany, Co-operative purchasing in, 9
Germany, Electrical exports from, 235
Germany, Electricity supply in, 667
Glass works, Ediswan, 311
Government and foreign trade, The, 858
Government, War and trade: An appeal to the, 545
Government works, 238
Greece 176
Greenock torpedo factory, Electrical workers at, 435
Guatemala, 654
Gyroscopic stabiliser for aeroplanes, 62
Gyrostatic control, 836

HACKNEY electricity works extension, 755
Half-watt lamp, 18
Half-watt lamps, British, 373
Half-watt lamps for lighthouses, 223
Half-watt street lamps at Chicago, 504
Hammer, New electro-magnetic, 262
Heat contained in slag, Utilisation of, by W. L. Johnson, 479
Heat engines, Temperature cycles in, by Prof. E. G. Coker and W. A. Scoble, 319
Heater for oil wells, Electric, 344
Heating and insulation-deterioration of current-carrying conductors, 643
Heating in the garage, Electric, 729
Helium in France, 284
High-speed electric passenger locomotive, 604
High temperature arc, 854
High-tension circuits, Over-pressure protective gear for, by K. Edgcumbe, 712, 744, 775, 807
Hong Kong University, 666
Hughes induction balance in surgery, 697
Hull, The new dock at, 22
Hydro-electric plant operated without an attendant, 222
Hydro-electric power, Irrigation dams and, by E. K. Scott, 317, 348

IGNITION magnetos, The supply of, 257
Ilford case, The I.M.E.A. and the, 593
Imperial College of Science and Technology, 560
Imports of electrical goods during June, exports and, 153; July, 287; August, 441; September, 571; October, 703; November, 863
Import trade of Sweden, 638
Incorporated Municipal Electrical Convention, 33, 76; ditto and the Ilford case, 593
Individual driving of small and medium size machine tools, by A. R. Stelling, 251
Induction motors: Some features of mechanical design, Large, by G. Moores, 452, 507, 515, 572, 601
Induction regulators as phase displacers, 220
Industry, A proposed testing institution for the electrical, 193
Industry, Problems of, by "A Would-be Reformer," 475
Industry, The organisation of the electrical, by C. A. Baker, 46
Industry, The present condition of American electrical, 260
Industry, The war and British electrical, 265, 273, 295, 321, 353
Inquiries, 137, 312, 342, 372, 407, 472, 503, 533, 567, 593, 666, 762, 857
Inquiries for British traders, 730
Installations, German rules for electrical 114
Installations, Sparking distances in electrical, 222

INSTITUTION AND LECTURE NOTES—
American Association for the Advancement of Science, 256
American Institute of Electrical Engineers, 103
Association of Consulting Engineers (Incorporated), 17
Association of Electrical Station Engineers, 594
Association of Engineers-in-Charge, 533
Association of Mining Electrical Engineers, 567, 631, 697, 731, 792
Association of Supervising Electricians, 533, 697, 731, 763
Birmingham and District Electric Club, 697
Birmingham Wireless Association, 533
British Association of Managers of Textile Works, 856
Diesel Engine Users' Asscoiation, 856
Electrical Vehicle Association of America, The, 343
Faraday Society, 665, 824
Greenock Electrical Society, 436, 504, 631, 697
Igraric Engineering Society, 594
Institute of Metals, 343
Institution of Civil Engineers, 792
Institution of Electrical Engineers, 18, 567, 631, 824, 856
Institution of Electrical Engineers (Manchester Local Section), 594, 665
Institution of Electrical Engineers (Newcastle Local Section), 731
Institution of Electrical Engineers (Scottish Local Section), 594, 792
Institution of Electrical Engineers (Western Section), 504
Institution of Electrical Engineers (Yorkshire Local Section), 697
Institution of Engineers and Shipbuilders in Scotland, 594
Institution of Marine Engineers, 472, 567
Institution of Municipal Engineers, 792
Institution of Municipal and County Engineers, 138
Institution of Post Office Electrical Engineers, 533
Iron and Steel Institute, 631
Ironmongers' Association (Birmingham Branch), 665
Junior Institution of Engineers, 138, 472, 631, 666, 697, 763
Manchester Association of Engineers, 533
Midland Institution of Mining, Civil and Mechanical Engineers, 138, 665, 763
North-East Coast Institution of Engineers and Shipbuilders, 256

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INSTITUTION AND LECTURE NOTES—*continued.*
North Staffs. Institute of Mining and Mechanical Engineers, 631
Nottingham Society of Engineers, 631
Physical Society of London, 665, 697
Polytechnic Engineering Society, 631
Railway Students' Association, 665
Rontgen Society, 631
Royal Institution, 697, 824
Royal Society, 697
Royal Society of Arts, 697
Society for Electrical Development, 343
South African Association for the Advancement of Science, 312
South African Institute of Electrical Engineers, 138
South African Institution of Engineers, 138
Victorian Institute of Electrical Engineers, 697
Wireless Society of London, 666

Institution of Electrical Engineers and the war, 238, 372, 436
Institution of Electrical Engineers: Inaugural address by Sir John Snell, 639
Institution of Electrical Engineers (Birmingham Local Section), Inaugural address, by Dr. A. H. Railing, 801
Institution of Electrical Engineers (Manchester Local Section), Inaugural address by P. P. Wheelwright, 673
Institution of Electrical Engineers (Newcastle Local Section), Inaugural address by P. V. Hunter, 767
Institution of Electrical Engineers: Mr. J. Lowson's address to the Scottish Section, 735
Institution of Electrical Engineers' Theatre, 838
Institution of Electrical Engineers, The examinations of the, 111
Institution of Electrical Engineers (Yorkshire Local Section): Inaugural address by T. Roles, 672
Insulating properties of solid dielectrics, 593
Insulation, Commutator with moulded, 373
Insulation deterioration of current-carrying conductors, Heating and, 643
Insurance amendments, Unemployment, by J. J. H. Stansfield, 232
Internal-combustion locomotives, A transmission system suitable for heavy, by H. J. Thomson, 605
International Engineering Congress, 1915, 737
Iron and steel industry, Electricity in the, 593
Iron, Electrolytic, by Dr. L. Guillet, 478, 532
Irrigation dams and hydro-electric power, by E. K. Scott, 317, 348
Irrigation works in Italy, by Prof. L. Luigi, 319
Italian trade, 718
Italy, 214
Italy, Co-operation in, 857
Italy, Irrigation works in, by Prof. L. Luigi, 319
Italy, Trade statistics of, 509
Italy, Trading in, by O. E. Allo, 473, 518, 548

JACKS on tramcars, 110
Japan, 557
Japan, E.H.T. transformers for, 110
Japan, 1913, Trade statistics of, 477
Japan, The present state of electrical industries in, by Prof. S. Kimura, 207

KINEMATOGRAPHS, Electricity supplies for, by W.B.S., 270, 297

LAMP development, Electric, 284
Lamp globes, Marble as material for, 491
Lamp, Half-watt, 18
Lamp patents, Wire, 120
Lamp works, The Osram, 463
Lamps, British bulbs for electric, 415
Lamps, Miners' demand for electric, 311
Lamps, Strength of tungsten, 857
Lamps, The manufacture of Tantalum and Wotan, 421
Law, Overhead wires and the, 204
Lawyer, The poor man's, 123
Leads, 83, 202, 279, 294, 386, 482, 579, 679, 774
Lead poisoning, 223, 567
Lecturers, Lack of, 284
Legal—
Accident claim, 173
Alien enemies to sue, The rights of, 407
Alien enemy cases in Court, 486
Arbroath Electric Light Co.'s valuation appeal, 781
Armorduct Manufacturing Co., *v.* H. Defries & Co., 554, 651, 715
Attorney-General at the relation of Long Eaton Gas Co. *v.* Long Eaton U.D.C., 617
Attorney-General *v.* Ilford U.D.C., 735

Legal—*continued.*
Baillie *v.* Oriental Telephone and Electric Co., 619, 847
Barton *v.* Lancashire Brass Founders, 817
Beck Engineering Co. *v.* The Foster Engineering Co., 343 374, 619
Bosch Magneto Co., 372, 618, 716
Bourne *v.* South Staffordshire Tramways Co., 174
British Thomson-Houston Co., *v.* Duram, 749
British Thomson-Houston Co. *v.* The Electric Trading Co., 818
British Thomson-Houston Co. *v.* Union Electric Lighting Co., 175
Brush Electrical Engineering Co., 584
Buckley & Sons, G., *v.* Buckley and Taylor, 50
Carbons, The disputed, 416
Charge against an electrician, 303
Charge of stealing, 472
Compensation case, A (British L. M. Ericsson Co.), 249
Cunningham, Ltd., 684
Distraint on electrical contractor, The King *v.* Landlord: 175
Eclipse Electric Sign Co. *v.* Ashton, 437
Edinburgh Corporation, Claim against 818
Electric light arrears, 415
Electrical Engineering & Motor Co. (Carlisle), 584
Electrical Installations *v.* Line, 716
Electricity in mines, An appeal, 847
Electro-steel Foundries, 750
Engaging a foreman, 173
Factory Act prosecution, 366
Fee, An electrical engineer's, 203
Frank *v.* Hankow Light & Power Co., 554
Goodbody *v.* Poplar Corporation, 683
Hagen Accumulator Works *v.* F. L. Mitchell & Co., 343
Hastings Dolter surface-contact tramways, 174
Ilford Gas Co. *v.* Ilford Urban District Council, 49
Jamaica Electric Co., Powers of, 173, 213
Kenna *v.* Dublin United Tramways Co., 7
Kite and a colliery, A, 213
Leitner Electrical Co., 532
Licensing motor vehicles, 277
Lift case, A, 213
London Electric Railways Parliamentary deposits, 16
McDonald *v.* Fyfe, Wilson & Co., 619
Magnet Galvanising Co., 716
Marconi and Marconi's Wireless Telegraph Co. *v.* Helsby Wireless Telegraph Co., 7, 50, 94, 174
Marconi Co.'s Memorandum, 818
Marylebone battery arbitration, 729
Miller *v.* Telford, Grier & Mackay, 749
Moreland & Son *v.* Bosch Magneto Co., 618
Morris, H., *v.* Saxelby, 553, 618
Moyle & Wing *v.* Adnil Electric Co., 750
National Electric Construction Co., 684
North British Wireless Schools *v.* Mayne, 651, 847
Nottingham Corporation *v.* H. W. Cox, 617, 716
Oriental Telephone & Electric Co., 213
Osram Lamp Works *v.* Corona Lamp Works, 553, 748, 781, 817
Osram Lamp Works *v.* Pope's Electric Lamp Co., 129
Overhead wires in Aberdeen: Postmaster-General and Town Council, 93
Patents and alien enemies, 630
Postmaster-General *v.* Darlington Corporation, 95
Prosecution against Shotts Iron Co., 485
Read & Brooks *v.* The Stella Conduit Co., 584, 684
Renischel *v.* Dunbar, 523
Rights of alien enemies to sue, The, 407
Roberts Bros. *v.* Howarth, 174
Robin Electric Lamp Co. *v.* B.T.H. Co. and Siemens Bros. & Co., 50
Ronco *v.* W. H. Muller & Co. (London), 683
Seizure of Lelios lamps, 175
Senghenydd prosecutions, 6, 129
Sentence, A well-deserved, 61
Shock claim, An Edinburgh, 793
Shock claim in Canada, 16
Slander action, 818
Smoke nuisance, 618
South London Electric Supply Corporation.—Undue preference, 817, 857
Stealing electricity, 372
Stealing magnetos, 415
Stolen electric plugs, 521
Stolen metal: Sentence, 533
Street improvements: Electric railway company's liability, 16
Telegraphists' camp, 749
Torpoint U.D.C. *v.* Torpoint Electric Supply Co., 618
Trading with the enemy, 651
Tramway accident claim, 129, 554
Tramway contractor, Action against 684
Tramway ticket, A, 213
Turnbull & Jones *v.* Taihape Borough Council, 303
Tyneside Tramways Co., Action against, 249

Legal—*continued.*
Underground Electric Railways *v.* F. W. Dunkley, Ltd., 174
Unemployment benefit, 584
Vandam *v.* Armorduct Manufacturing Co., 95
Workmens' compensation, 6, 129, 277, 554, 717, 817

Legal Query Column, 213, 366, 554, 782
Lift design, Recent advances in electrical crane and, 829, 866

LIGHTING AND POWER NOTES—
Aberdeen, 368, 433, 468, 558, 627
Aberdovey, 10, 308
Abingdon, 655
Accrington, 132, 493, 627
Acton, 558
Ainsdale, 527
Aldershot, 132, 252, 433, 588, 627, 719
Altrincham, 368, 527, 655, 688, 820
Ammanford, 55
Arbroath, 468, 849
Ardsley, 10, 766
Argentina, 10, 339, 588, 688, 753, 849
Arrowthwaite, 280
Ascot, 433
Ashford (Kent), 627, 688
Ashton-in-Makerfield, 719
Ashton-on-Mersey, 280, 820
Ashton-under-Lyne, 98, 398, 820
Atherton, 178, 308, 368, 493, 688
Australia, 55, 98, 178, 280, 308, 339, 368, 433, 558, 588, 627, 655, 688, 719, 754, 849
Austria, 10, 216, 309
Austro-Hungary, 688
Aylesbury, 215, 398, 468
Ayr, 433
Bacup, 55, 252, 308, 368, 468, 527, 655
Baildon, 849
Ballyconnell, 468
Banchory, 433, 849
Barford, 339
Barking, 588, 627
Barmborough, 98
Barnes (Surrey), 178, 688, 820
Barnsley, 786, 820
Barrow, 252, 398, 588
Basingstoke, 10, 527
Bath, 468
Batley, 56, 655
Battersea, 787
Beckenham, 719
Bedford, 98
Belfast, 10, 132, 433, 468, 493, 627, 655, 719, 849
Bermondsey, 57, 719
Bethnal Green, 11, 627
Bettws-y-Coed, 493
Bexhill, 55, 215
Bexley, 527
Birmingham, 719, 787
Bishopstoke, 469
Bishop Stortford, 368
Blackburn, 132, 178, 252, 468
Blackpool, 10, 433, 527, 589, 754, 787, 820
Blackrock, 468
Blyth, 132, 688
Bolton, 178, 308, 339, 368, 398, 719, 787, 820
Boston, 98, 754, 787
Bournemouth, 215
Bradford, 98, 178, 280, 339, 368, 468, 527, 558, 589, 655, 787, 820
Bramhall, 528
Brentford, 214, 469
Brentwood, 558
Bridlington, 754
Brighouse, 754
Brighton, 56, 178, 214
Bristol, 178, 655
Broadstairs, 433
Bromley (Kent), 558
Brotton, 99, 494
Brymbo, 398, 469
Buckie, 98, 178
Buckinghamshire, 787
Bundaberg (Queensland), 368
Burnley, 10, 754
Burscough, 56
Burton-on-Trent, 132, 178, 787
Bury, 10, 178, 433
Bury St. Edmunds, 132
Bushey, 433
Buxton, 589
Canada, 132, 205, 252, 280, 308, 493, 656, 754, 787
Canterbury, 214
Cardiff, 216, 627
Carlisle, 178
Carrickmacross lighting, 213, 787
Carshalton, 527
Cassop, 216
Castletownbere (Co. Cork), 820
Caton, 493
Cefn Mawr, 216
Chelmsford, 589
Cheshunt, 56, 252
Chester, 98, 627
Chile, 308, 627, 688
China, 656
Chippenham, 132, 398, 787
Chipstead, 56
Chobham, 178, 252, 309
Clayton, 656
Cleckheaton, 216, 339, 398, 469
Cleethorpes, 433, 627
Clevedon, 627
Clewer, 527
Clonakilty, 433, 719
Clun, 558
Clones, 56, 132, 339, 433, 469
Coleraine, 98
Colwyn Bay, 787
Coniston, 527
Connah's Quay, 216, 627

LIGHTING AND POWER NOTES—*continued.*
Consett, 688
Continental, 10, 56, 98, 178, 216, 252, 280, 309, 368, 469, 528, 656, 688, 719, 754, 820
Coventry, 11, 754
Coxhoe (Co. Durham), 56, 98
Crayford, 98, 719, 849
Croydon, 568
Crewe, 56, 368
Criccieth, 56, 98, 493
Crompton, 849
Crook, 11
Croydon, 56, 719
Cuddington, 132, 179
Dalkeith, 179
Dartford, 56, 589, 656
Darwen, 216, 493, 589
Deal, 339, 589, 627
Dewsbury, 398, 493
Dolgelly, 469
Donaghadee, 309
Doncaster, 179, 849
Douglas (Isle of Man), 98
Dover, 252, 398, 528, 627, 656, 754, 787
Droylsden, 398
Dublin, 98, 132, 280, 309, 787
Dundalk, 11, 280
Dundee, 398
Durham, 11, 56, 280, 627, 787
Durham County, 132
Ealing, 98, 558, 688, 820
Easebourne (Sussex), 558
Easington, 132
Easingwold, 98
Eastbourne, 11, 252, 627, 787
East Grinstead, 132
East Ham, 216, 589
Eastleigh, 469
East Preston, 656
Eccles, 216, 528, 589, 787
Edinburgh, 132, 216, 433, 493, 558, 589, 627
Egham, 589
Ely, 11, 56
Enniscorthy, 589
Epsom, 719, 820
Erith, 754
Exeter, 493, 589, 754
Failsworth, 849
Fairlie (Ayrshire), 56
Falkirk, 493, 589
Farnborough (Kent), 339
Farnworth, 179, 368, 656, 787
Fife, 754
Finchley, 11, 493
Finland, 216
Flaxton, 252
Fleetwood, 469, 589, 849
Flint, 433, 528, 558
France, 252, 719
Freetown (Sierra Leone), 434
Frodsham, 11
Fulham, 720
Gelligaer, 528, 589
Germany, 56, 98, 179, 754
Gildersome, 433
Gillingham (Kent), 216
Glasgow, 56, 98, 252, 280
Glastonbury, 132
Gloucester, 216
Golcar, 56
Goole, 132
Grappenhall, 368, 787
Gravesend, 98, 280
Greasbro, 820
Great Harwood, 98, 252, 280, 528
Great Ouseburn, 252
Great Yarmouth, 132, 563
Greece, 98
Greenock, 309, 398, 627, 656, 719, 820
Greetland, 469
Grimsby, 11, 98, 179, 216, 719
Guernsey, 132
Guisborough, 98
Guiseley, 368
Hackney, 368, 719
Halifax, 11, 179, 253
Hammersmith, 179, 627, 719
Hampstead, 99
Harlech, 368
Harrogate, 280, 433, 689, 849
Haslingden, 253, 849
Hastings, 253, 558
Hawkhurst, 179
Haworth, 589
Hayle, 132, 787
Hazel Grove, 528
Heckmondwike, 98
Heckeyfield, 309
Helsby, 309, 433
Hemsworth, 398
Hendon, 627, 689
Hereford, 216, 787
Hessle, 528
Heston-Isleworth, 216
Heywood, 469, 558
Hexham, 404
Hindley, 563, 820
Holland, 98
Holmfirth, 132, 253, 339, 469, 787
Hornsey, 56, 433, 754
Horsham, 493
Horton-in-Ribblesdale, 719
Hove, 493, 787
Hoylake, 11
Huddersfield, 98, 589, 689
Hull, 528
Hungary, 280
Hurst, 563
Hyde, 849
Hythe (Kent), 820
Iceland, 179
Ilford, 754
Ilfracombe, 179
Ilkley, 179, 656
India, 98, 179, 253, 309, 340, 469, 689
Ingleton, 493
Ipswich, 56

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LIGHTING AND POWER NOTES—*continued.*
Irlam, 56, 309, 589
Irvine, 787
Isle of Man, 469
Islington, 217, 719
Italy, 368, 820
Japan, 56, 132, 216, 689
Junee (N.S.W.), 368
Keighley, 11, 132, 404, 433, 528, 563, 656, 820
Kelso, 404
Kendal, 56, 528
Kensington, 496
Kingston-on-Thames, 253, 309, 340
Kintore, 655
Kirkburton, 368
Kirkby Stephen, 754
Kirkcaldy, 132, 719
Knaresborough, 656, 754, 787
Knowle, 179, 589
Lambeth, 589
Lanarkshire, 820
Lanchester, 528
Lathom, 56
Leeds, 56, 179, 656, 689
Leek, 99, 754
Lees, 493
Leigh, 98, 787
Leyton, 787
Lewisham, 434
Library lighting, 259
Lindley, 99
Litherland, 132, 689
Littleborough, 433
Little Crosby, 404
Liverpool, 309, 368, 589, 820
Llandudno, 133, 340, 494
Llandyssul, 179, 216
Llanfairfechan, 99
Llanidloes, 368, 754
Llantrisant, 56
London, 11, 57, 99, 133, 179, 216, 368, 404, 434, 469, 493, 528, 563, 589, 627, 656, 719, 754, 787, 820
London County Council, 179, 469, 528, 563, 689, 656, 787, 849
London electricity supply, 99, 626, 628, 656, 754, 787, 820
Lossiemouth, 133
Lothingland (Norfolk), 720, 788
Loughborough, 99
Loughton, 179
Lowestoft, 656, 821
Luton, 57, 528, 839
Lytham, 494, 821
Maidenhead, 216
Maidstone, 340, 368, 494, 628, 754
Malling (Kent), 689
Malvern, 368
Manchester, 57, 368, 494, 589, 689
Manorhamilton (Co. Leitrim), 589
Mansfield, 133, 656
Mansfield Woodhouse, 720
Margate, 11
Marylebone, 11, 99, 493, 627, 656, 754
Melbourne, 433
Melksham, 99
Mexborough, 99, 469
Mexico, 309, 368
Middlesbrough, 628
Middlesex, 216
Middleton, 309, 628, 788
Midhurst (Sussex), 368, 434, 563, 628
Midsomer Norton, 133
Monmouth, 99
Montgomery, 469
Morecambe, 469
Mountain Ash, 720
Mutford, 720
Mytholmroyd, 434
Neath, 849
Nelson, 11
Nelson (near Cardiff), 133, 368
Newbridge (Co. Kildare), 821
Newcastle (Co. Down), 179
Newcastle Emlyn, 368
Newcastle-under-Lyme, 57, 656, 821
Newmarket, 11
Newport, 216, 280, 563, 759
Newtown, 57
New Zealand, 133, 280, 528, 563, 628, 656
Nigeria, 550
Normanton, 99, 589
North Bierley, 133, 628
Norway, 10, 179, 309, 469, 528, 719
Norwich, 216
Norwood Green, 99
Nuneaton, 11, 434, 563, 689, 821
Mitford, 788
Oakworth, 469
Oban, 434
Oldham, 57, 133, 469, 589, 628, 657, 759, 849
Ormskirk, 179
Ossett, 281
Oswestry, 528
Oulton Broad, 528
Parkhurst, 720
Pendlebury, 469, 563, 788
Penistone, 404, 821
Penrith, 720
Penyfford, 217
Perth, 720, 759
Peterborough, 281
Pickering, 528
Plymouth, 216
Plympton St. Maurice, 99
Pontefract, 404
Poplar, 57, 469, 589, 656, 787
Portaferry, 57, 133
Port Glasgow, 11, 494
Portishead, 469
Portrush, 253, 340
Portsmouth, 133
Portugal, 528
Prestwich, 563
Queensferry, 849
Radstock, 133
Ramsbottom, 528
Rawtenstall, 309, 434, 494, 689
Reading, 720

LIGHTING AND POWER NOTES—*continued.*
Redditch, 57, 179, 720
Redruth, 11
Reigate, 57
Rhyl, 253
Rhymney, 281, 528
Riccall, 821
Rochdale, 368, 689
Rochester, 217, 368
Ross (Herefordshire), 217, 434
Rotherham, 253
Royston, 368
Runcorn, 788
Russia, 56, 179, 216, 309
Ruthin, 133
Saddleworth, 340, 849
St. Annes-on-Sea, 217, 368
St. Germans (Cornwall), 720
St. Helens, 657
St. Mellons, 99
St. Pancras, 132, 494, 589, 821
Salford, 11, 57, 253, 369, 494, 589, 759, 788
Sandown, 849
Sandygate, 821
Scarborough, 831
Scremerston, 99
Selby, 253, 720, 759
Shanklin, 656
Sheffield, 57, 369, 404, 494, 528, 657, 788, 821
Shepley, 404
Sherborne, 133
Shipley, 57, 340, 628
Shoreditch, 133
Shoreham (Sussex), 253
Sierra Leone, 434
Skelton, 99, 494
Skerries (Co. Dublin), 788
Skipton, 434, 628, 849
Slaithwaite, 528, 689
South Africa, 11, 179, 217, 469, 563, 657
Southampton, 99, 179, 404, 469, 589, 628, 759
Southend-on-Sea, 179, 369, 628, 849
Southport, 253, 469, 628, 788, 821
South Shields, 309, 689
South Wales, 99, 404
Southwark, 11, 656
Spain, 280, 656
Springhead, 281
Stainborough, 589
Stainland, 494
Stalybridge, 99
Stamford, 369
Stanley, 759
Stepney, 57, 133, 469, 656
Stockbridge, 528
Stockport, 253
Stockton-on-Tees, 788
Stoke-on-Trent, 469, 657, 769, 849
Street, 217
Stretford, 657, 788
Stroud (Gloucester), 788
Sudbury (Suffolk), 253
Sunderland, 369, 689
Surbiton, 133, 849
Sutton, 217, 404
Swansea, 57, 404, 528, 821
Sweden, 179, 656
Swinton, 469, 563, 788
Switzerland, 56
Tasmania, 11, 368, 720
Taunton, 99, 179, 281, 821
Tavistock, 253, 528, 689
Teignmouth, 99, 528
Thelwall, 133
Thorne (near Doncaster), 469, 720
Todmorden, 340, 469, 563
Torpoint, 11, 57, 369, 494, 628, 689
Torquay, 369, 404, 657, 788
Torrington, 133
Troon, 469
Trowbridge, 133
Truro, 11, 563, 657
Tsingtao (China), 656
Tullamore, 720
Tunbridge Wells, 57, 179, 528, 720, 759, 788
Turkey, 98
Turton (Lancs.), 494, 788
Tynemouth, 404
United States, 309, 628, 849
Uruguay, 309
Uxbridge, 759, 788
Wadebridge, 99
Wakefield, 281, 369
Wallasey, 133, 217
Walmer, 57, 339, 369, 589
Walsall, 11, 99, 217, 405, 469, 528, 657, 821
Walthamstow, 179, 590
"War" lighting, 494
Warrington, 57, 217, 369, 494, 528, 589, 689, 759
Warrnambool (Victoria), 368
Waterford, 528
Watford, 217, 528, 657, 720
Wednesbury, 217, 821
Wells, 99
Welshpool, 563
West Bromwich, 57, 494
West Ham, 99, 469, 788
West Hartlepool, 657
West Kirby,
Westminster, 57, 99, 720
Weymouth, 528
Whitehaven, 217, 563, 759
Whitstable, 11, 133, 340, 788
Whitworth (Lancs.), 469, 563, 821
Widnes, 340
Wigan, 689
Willesden, 12, 281, 590, 720
Wimbledon, 99, 340, 494, 594, 759
Windermere, 217
Windsor, 590
Wirrall, 494
Witney, 788
Wolverhampton, 99, 405, 628, 821
Wombwell, 10, 179
Woodford, 821

LIGHTING AND POWER NOTES—*continued.*
Wood Green, 529
Woolwich, 57, 216, 434
Worcester, 57, 529
Worsley, 134, 689
Wotton Without, 253
Wrexham, 57, 217, 369, 529
York, 217, 253, 281, 405
Ystradgynlais, 529, 821

Lighthouses, Half-watt lamps for, 223
Light sources, Tubular, 104
Lighting of trains in U.S.A., Electric, 834
Lightning and surge arrester, The "Zig," 241
Lightning in Australia, 373
Lightning sketch, A, 95
Limiting conditions for the safe use of electricity in coal mining, by Prof. W. M. Thornton, 350

LIQUIDATIONS AND DISSOLUTIONS—
Accumulator Industries, 215
Adams & Fox, 178
Apparatus & Accessories, 786
Bennet & Whitehead, 467
Boddy Life-saving Appliances, 718
British Economical Lamp Co., 252
British Metal Engraving Co., 752
British Power Co., 9, 96
Cambridge Electric Tramways Syndicate, 54
Canadian Electric Traction Co., 367
Cheap Power Supply & Engineering Co., 96
Clifton Electrical Engineering Co., 752
Consolidated Diesel Engine Manufacturers, 54, 96, 252, 433, 467, 527
"D.A.C." Accumulator Syndicate, 96, 130
Demon Vacuum Cleaner Co., 252, 280
Diesel Engine Co., 54
Dry Gas Electric Fire Extinguisher Co., 215
Easton, Anderson & Goolden, 848
Ecuador Telephone Co., The, 527
Electric Flash-Lights, 398
Electric Utility Co., 819
Electrical Supplies Co., 280
Electromobile Co., 848
Electromotor Equipment Co., 178
Electro Steel Founders, 688
E. M. F., 96
Eureka Clock Co., The, 308, 339
Fell & James, 96
Foreign & Colonial Lighting, 215
Garrett, Hartley & Co., 9, 527
General Electrolytic Parent Co., 786
Gyroscopic Motor Syndicate, 688
Jandus Arc Lamp (Continental Patents) & Electric Co., 752
Kent Electric Power Syndicate, 54
Leitner Electrical Co., 718, 751, 818
Leskole Co., 468
Llanelly Motor & Electrical Engineering Co., 718, 752
Lumen Fittings Co., 398
Mellier & Co., Ch., 467
Midland Electric Corporation (1900), 786
Midland Ignition Co., 178
Mordey-Fricker Electricity Meter Co., 339, 367, 398, 718, 752
National Electric Time Co., 280
No Cell, 54, 178
Oldham Boiler Works Co., 786
Perth Electric Tramways, 467
Pioneer Pump Patents, 688
Pontifex, S., & Co., and T. S. Borradaile, 626
Premier Lighting & Engineering Co., 718, 752
Pump & Power Co., 54, 558
Rankine Patent Feed Water Filter Co., 367
Rapid Light Controlling Syndicate, 130
Reader's Patents & Engineering Co., 819
Ridings Arc Lamp Co., 433
Rossendale Belting Co., 9
Roundhay and District Electric Lighting Co., 654
Rushmore Lamps, 9
Salusbury Lamps, 654
Sambidge, H. W., & Son, 367
Sandwich, Deal & Walmer Electricity Supply Co., 848
Spiral Regulating Dynamo Co., 492
Stellar Signs, 626
Stolz Electrophone Co. (1913), 433
Storey & Sons, L., 54, 96
Uitenhage Electric Light & Power Co., 9
Universal Belting Co., 9
Wright's Electrical Sales Co., 558

Liverpool, New turbine plant at, 851
Liverpool strike, The, 16
Locomotive cars, Diesel electrical, 592
Locomotive, High-speed electric passenger, 604
Locomotives, A transmission system suitable for heavy internal-combustion, by H. J. Thomson, 605
London County Council and electrical trades list of wages and hours of labour, 566
London County Council tramway deficit, 3
London County Council tramways breakdown, The, 837, 856
London County Council wages, 533
London electrical engineers, The, 136
London railway electrification contracts, 53
London's electricity supply, 1, 161, 190
London's electricity supply, L.C.C. report, 198
Looking ahead, War and industry, 353
Lorenz's method, Absolute measurement of electrical resistance by, by F. E. Smith, 164
Lowson's address to the Scottish Local Section of the I.E.E., Mr. J., 735

MACHINE tools, Individual driving of small and medium size, by A. R. Stelling, 251
Magneto manufacture in Great Britain, 416
Magneto position, The, 558
Magnetos for British motor-cars, British-made, 300
Magnetos, The supply of ignition, 257
Mains explosions, Electric, 84
Mains explosions, The report on electric, 41, 74, 97
Maintenance, Road, 122
Mammoth boiler results and projects at Detroit, 290
Manchester, Engineering societies in, 793
Manchester 15,000-KW. turbine set, 19
Manchuria, 654
Marble as material for lamp globes, 431
Marconi, Honour for Mr., 162
Marine service, Electric cooking in, 250
Measurement of electrical resistance by Lorenz's method, Absolute, by F. E. Smith, 164
Melting, Electric brass, by G. H. Clamer and Carl Hering, 573
Mercury rectifier for large outputs, The development of the, 210
Mercury-vapour light for inspecting translucent products, 223
Meter approved, 280
Mexico, 214, 654
Military cooking installation, A, 723
Milk, Electrical treatment of, 169
Miner and the war, The, 266
Miners' demand for electric lamps, 311
Miner's fallacy, The, 82
Miners' safety lamps, 805
Mines, Electrical accidents in German, 17
Mines, Electricity in, by G. J. Ralph, 811; by W. Maurice, 812
Mines for the year 1913, Electrical accidents in, 832, 864
Mines, Metalliferous, 62
Mint report, Royal, 566
Monopoly, A German electricity, 228
Montenegro, 367
Moratorium—and after, The, 356, 436
Morocco, British Trade with, 120
"Motograph" sign, A large, 630
Motor, A hard-worked, 753
Motor-cars, The standardisation of electrical fittings on petrol, 16
Motor-cars, The standardisation of electrical installations on, 374
Motor fire engines in Berlin, The running and maintenance costs of electrical, 245
Motor-generator for high-pressure direct current, Pressure-reducing, 289
Motor, New three-phase replusion, 209
Motor repair wagon, 792
Motors, Notes on modern continuous-current, by T. H. Dennis, 704
Motors, Simpler control for rolling-mill, 592
Motors: Some features of mechanical design, Large induction, by G. Moores, 452, 507, 515, 572, 601
Motor, The decline of the self-synchronising, by E. P. Hollis, 357
Motor vehicles for electrical work, 777
Motor with shunt regulations by brush displacement, Schrage patent three-phase commutator, 445
Moving pictures without photography, by G. Basil Barham, 438
Municipal Electrical Convention, 33, 76
Municipal Ownership Commission, 136

NATAL contracts and public tendering, 384
National Physical Laboratory during 1913, Electrical work at the, 115
Neutrality of science, War and the, 449
Newcastle Corporation Tramways, by R. Mayne, 157

NEW COMPANIES REGISTERED—
Acetylene & Carbide, 764
All-British Electrical Co., 794
Allies Electric Lamp Co., 632
Alpha Electrical Co., 596
Aluminium Foil Co., 186
Anti-German League, 408
Bachelet Levitated Railway Syndicate, 143
Baily & Sons, W., 596
Ballyconnel Electric Light & Power Co., 534
Barford Electric Supply Co., 596
Belco, 64
Boonzaiers, 375
Booth & Bomford, 668
British African Agencies, 732
British Arc Welding Co. (Scotland), 699
British Bachelet Flying Train Syndicate, 568
British Battery Co., 534
British Chamber of Commerce in the Argentine Republic, 143
British Electrical Accessories, 143
British Electrical Export Co., 596
British Industries Support Federation, 433
Carville Site & Power Co., 794
"Ceag" Miners' Supply Co., 668

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NEW COMPANIES—*continued.*
Chemico-Electric Co., 224
Cicoy Magneto Co., 534
City of Freetown (Sierra Leone) Electricity Co., 596
Coniston & District Electric Supply Co., 794
Custodis, 505
"D.A.C." Accumulator Syndicate, 224
Davis, J., & Co. (Southampton), 285
Defries & Goldman, 699
Derby Day & Night Sign Co., 596
Derby Lamp Works, 473
Direct Copper Production Syndicate, 24
Duncan's Electricity Supply, 25
Economic Electric, 143
Electrical Power Engineering Co. (Birmingham), 731
Electrical Sales Promotion, 143
Electro-Magneto Motors, 183
Electromobile (Leeds), 224
Electro Motor-Hiring, 24
Electropathic Institute, 408
Evans, E. M., & Son, 285
Gilkins & Co., A. V., 408
Granville, Burgess & Co., 143
Harvac, 344
Health Humidifier Co. (Blackburn), 186
Highfield & Co., 375
High Speed Steel Alloys, 632
Hodgson Pump Co., 824
Horrabridge & District Electric Supply Co., 143
Implitico, 632
International Bleachers' Corporation (1914), 224
International General Artificial Coal & Fuel Co., 143
Jersey Electric Lighting & Power Co., 731, 764
"Krisco" Patents, 64
London Battery & Manufacturing Co., 764
Loughrea Electric Power & Lighting Co., 224
Market Securities, 143
Masham and District Electric Supply Co., 732
Mason & Co., C. H., 668
Maud & Turner, 824
Metal Scrap, 596
Midland Magneto Co., 764
Morris, Warden & Co., 186
New High-Pressure Gas Light, Chemical & Electric Supply Co., 534
N. I. Z., 764
North British Electric Welding (Eastern), 505
Parana Tramways Co., 473
Perks, F., 186
Patentees Attorneys, 143
Phœnix Electric Heating Co. (1914), 375
Rex Accumulator Co., 824
Ruthin Electric Supply Co., 596
Sanders & Co., W., 568
Self-Protector, 186
Simplex Self-Starters, 375
Small Electric Motors, 568
Smith, S., & Sons (Motor Accessories), 143
South Wales Wireless Training Colleges, 24
Stentophone Magneto Works, 857
Stoneybridge Electrical Co., 408
Tattersall, H., 224
Telephone Co. of Pernambuco, 63
Thomson-Bennett (Magneto), 764
Trantmann's Patents Co., 64
Tredegars, 794
Tyne Glass Works, 632
United Kingdom Manufacturers' Representatives' Associations, 408
Universal Electric Canoe Co., 285
Vulcan Electric & Mechanical Co., 534
Watson Magneto Co., S. J., 568
Wezdon Lamp Co., 794
Whitehouse, J., 24
Winco Manufacturing Co., 794
Windibank, H., & Co., 505
Wiring, 596
Witt & Beesley (Blackpool), 668

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT—
"Altior" process of die casting, 171
Aster generating set, 455
Automatic furnace, Screw-feed, 127
Bar mill, A converted, 454
"Bec" suction cleaner, 172
Belting griller-boiler, 746
Bell-pushes and connections, 390
"Best" electric fires, 725
"Beta" type midget automatic accumulator switch, 38.
Boiler-plate cubicle switchboards, 682
Brighton Royal Pavilion, Electric cooking, 747
Candlestick, self-contained electric, 118
Chromolyte batteries, 78
Circuit-breakers, G.E.C. explosion-proof, 78
Circuit-breakers, Totally-enclosed, 305
Colliery plant, Electrical, 211
"Comfy" electric fire, 616
Continuity grip fittings, 681
Cooking apparatus, Carron, 616;
Eclipse, 650
Copes Feed-water regulator, 615
Cosdenda electric fires, 304
Cosdenda electric kettles, 726
Current transformers, New type, 117, 173
De Forest high-frequency generator, 126

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT—*continued.*
"Dim-a-lite," 327
Dimmer fittings, Simplex, 615
"Eclipse" heating and cooking apparatus, 424, 782
Ediswan door heater, 746
Ediswan heaters, 454
Ediswan traction lamp, 816
Electric control gear for machine tools, 555
Electrolytic rectifier, 211
"El Radio" radiator, 725
Emergency generating sets, 727
"Eye-rest" wall bracket, 327
Ferranti electric cooker, 815
Fires, New electric, 423
Fittings, Electric, 305
Fullarton vibrometer, The, 275
Fuller cell, 367
Furnace-charging machine, An electrically-driven, 326
Fuse-box, New weatherproof, 173
General Electric explosion-proof circuit-heating fixtures, 724
General Electric Co. lighting and heating fixtures, 724
Generating set, Aster, 455
Glasine radiators, 726
"Grundy" temperature control apparatus, 39
Half-watt fittings, Benjamin, 815
Half-watt lamps, New, 127, 651
Hand-lamp, Electric, 388
Hand-lamps, New, 389
Heaters, Ediswan, 454
Hoists for wharf use, Electrically-driven, 389
Hollow bars, 390
"Hot-bar" radiator, 846
Interphones, New, 391
Ironclad switchgear, E.A.C., 327; B.T.H., 615
"Jumper" control gear, The, 304
Keystone stoker, The, 555
"Klip-on" shadeholder, 727
Lamp lock, New, 389
Letter signs, Miniature electric, 390
Lightning arresters, B.T.H. aluminium, 118
"Linisher" surface grinder, The, 746
Magneto, Another new British, 486
Magneto, B.T.H., 389
Magnetos for British motor-cars, British, 367
Main regulators, G.E.C., 682, 782
"Marvel" cooker, 117, 127
Mazda lamps, 170
Mining switchgear, 847
Motor-converter, A large, 726
Mining switch, A new, 747
Neutral point earthing resistance, 327
"Nite Lite" transformer lamp, 681
Number controller and indicator, 485
Oil-electric set, 584
Ozone generators, 118
"Panma" fuse-board, 128
"Pivot Intermediate" switch, New 10-ampere, 79
"Pilexsim" heat projector, The, 555
Plug switch for shipwork, etc., New, 727
Police lamp, The Thomson, 650
Pulleys, Stamped steel, 328
Pump bucket, The N.P., 390
Push-button speed control, 38
Railway motors, B.T.H., 171
"Safuse" fuse, The, 523
Sealing-wax heater, 127
Searchlights, 248
Self-acting starter for polyphase pump motors, 212
Self-contained electric fountain, 173
Silver, A device for cleaning, 39
Simplex conduit fittings, 455
Simplex watertight lampholder, 746
"Sirocco" air washer, 815
Sliding contact resistances, 326
Steaming oven, An electric, 485
Steel works plant, Modern, 79
Stoker, The Keystone, 555
Street lighting fitting, New, 583
Switch, Automatic dimmer, 79
Switch, New 10-ampere "Pivot Intermediate," 79
Switch with adapters, Ironclad, 117
Temporary wiring, 212
Thermo-electric generator, The, 274
"Thermoid" flexible, 523
Tower ladder, A new, 172
Townshend's fittings, 523
Transformer, New, 171
Transformer oil dryers and filters, B.T.H., 522
Triangle toaster stove, 816
"Underwood" digger, The, 782
Universal electric grill, 119
Vacuum cleaners, The Apex and Cleveland, 119
Variable precision condensers, 78
Vibrometer, The Fullerton, 275
Weather-proof lanterns, 814
Winch, Arc lamp, 423
"Witton" traction switchboard, A, 248
"Woolwich" tape (Improved type), 617
Wotan traction lamps, 275

Newfoundland and New Brunswick markets, 785
Newfoundland, Trade statistics of, 608
Newport (Mon.) electricity works, Recent extensions at, 239
New type of gas engine, A, 82
New York power stations, Cinder removal at, 325
Nickel: Its applicability to the printing trade, Electro-depositing, by G. B. Barham, 231
Nitrogen of the air, Manufacture of ammonia from the, 229
North Sea, Boiling the, 503
Norway, 177
Norway, The Vamma water-power plant in, 647

OBITUARY—
Adams, W., 764
Armitage, E., 285
Bono, A. F., 24
Broadbent, A. D., 632
Broadhurst, J., 138
Brownlee, Ex-Provost, 224
Clarke, C., 632
Clayton, D. S., 285
Cordingley, C., 285
Dobson, A., 534
Guernsey, Captain Lord, Irish Gds., killed, 437
Hall, C. J., 504
Hamer, J., 473
Holliday, T. B., 375
Home, E., 504
Hope-Jones, R., 472
Hudson, H. R., 344
Langdon, W. C., 731
Macleod, A., 595
Merthyr, Lord, 344
Newington, S. W., 105, 138
Packham, H. E., 375
Richardson, S., 632
Riley, E., 437
Shore, J. E., 224
Smith, F., 344
Snow, F., 63
Stroh, A., 699
Trotter, Lieut. A. N., 595
Westinghouse, Mrs. G., 24
Woolley, G., 504

OFFICIAL RETURNS—
Aberdare Electrical Co., 633
Ackroyd & Best, 224
Aldeburgh Electric Supply Co., 375
Allen, Son & Co., W. H., 505
Allen West & Co., 344
Anchor Cable Co., 186
Aron Electricity Meter, 258
Bagdad Tramways & Electric Lighting Syndicate, 143
Barbados Electric Supply Corporation, 732
Bat Meter Co., 764
Best's Safety Lamps, 64
Betts & Co., L. B., 409, 668
Birkdale District Electric Supply Co., 186
Birmingham Guild, 668
Bombay Electric Supply & Tramways Co., 596
Brecknell, Munro & Rogers, 699
Brilliant Arc Lamp & Engineering Co., 857
British Arc Welding Co., 438
British Continental Electricity Supply Co., 438
British Thomson-Houston Co., 225
Brotherton Tubes & Conduits, 438, 505
Brush Electrical Engineering Co., 438
Carmarthen Electric Supply Co., 596, 633
Carrara-Versilia Electric Railway & Power Co., 64
Central Wireless Co., 344
Chemico Electric Co., 409
Chesham Electric Light & Power Co., 312, 345
Chilian Electric Tramway & Light Co., 408
Chipping Norton Electric Supply Co., 633, 699, 764
Collingwood & Co., 257
Collis, J., 64
Compagnie Des Cables Sud Americains, 344
Corona Lamp Works, 285
Cutting Bros., 64, 633
Dartmoor Electric Supply Co., 345
Davis & Co., J. (Southampton), 375
Davis & Son, J. (Derby), 344
Dick, Kerr & Co., 764, 857
D.P. Battery Co., 345
Dudley, Stourbridge and District Electric Traction Co., 225
Eastern & South African Telegraph Co., 143
Edison & Swan United Electric Light Co., 825, 857
Efandem Co., 438
Egyptian Delta Light Railways, 257
Electrical Co., 143
Electric Hose & Rubber Co., 699
Electric Supply Co., of Victoria, 764
Electric Supply Corporation, 64
Electro-Flex Steel Co., 186, 568
Electrolite, 344
Electromotors, Ltd., 143
Enfield Electric Cable Manufacturing Co., 732
Everett, Edgcumbe & Co., 143
Evershed & Vignoles, 345
Fardon & Carpenter, 186
Feld Bros., & Co., 764
Fisher Humphreys & Co., 64
Foote & Milne, 568
General Electric Tramways Co., 143
Harrow Electric Light & Power Co., 345
Helsby Wireless Telegraph Co., 225
Henley's (South Africa) Telegraph Works Co., 408
Highfield & Co., 505
Hong Kong Tramway Co., 375
Hydro-Electric Concessions, 64, 764
Indian Electric Supply & Traction Co., 345
I.T.C., 143

OFFICIAL RETURNS—*continued.*
Keith, James, & Blackman Co., 1
Jones & Co., F., 699
409, 668
Kingolite, 143
Lithanode, 825
Liverpool Electric Cable Co., 596
Liverpool Electric Welding Co., 64
Llangefin Electric Light & Power Co., 699
Llangollen and District Electric Light and Power Co., 596
London Electric Works Co., 534
Manaos Tramways & Light Co., 568
Nairobi Electric Power & Lighting Co., 312
Naylorgraph, 224, 473, 794
Newcastle & District Electric Lighting Co., 285
Newcastle-upon-Tyne Electric Supply Co., 732, 764
New Phonopore Telephone Co., 794
Newtons, 596
North-Eastern Electric Smelting Co., 312, 668, 825
North Wales Power & Traction Co., 438
Northwood Electric Light & Power Co., 534
Nu-Lines Manufacturing Co., 375
Oliver Arc Lamp, 825
Oriental Telephone & Electric Co., 64
Pacific & European Telegraph Co., 825
Paignton Electric Light & Power Co., 312
Penarth Electric Supply Co., 258
Penrose & Co., A. W., 312
Pernambuco Tramways & Power Co., 64, 732
Peterborough Electric Traction Co., 258
Pontelec Welding Patents, 64
Premier Electric & Hardware Co., 186
Reason Manufacturing Co., 632
Reside & Co., 857
River Plate Electricity Co., 64
Robertson & Co., W. H. A., 668
Rural Districts Electric Undertakings, 668
St. Austell and District Electric Lighting & Power Co., 186
St. Helens Cable & Rubber Co., 632, 732
Salford Electrical Instruments, 794
Sheerness and District Electric Power & Traction Co., 64, 857
Shipston Electrical Co., 143
Sisson & Co., W., 505
Sloan Electrical Co., 473
Smith & Co., H. W., 764
South American Light & Power Co. 505
Southern Brazil Electric Co., 438
Spanish Telephone Co., 345
Spencers, 64, 633
Spensers, 225
Stratford-on-Avon Electricity Co., 568
Suffolk Electricity Supply Co., 764
Sutcliffe (of Crumpsall), 409
Sykes Interlocking Signal Co., W. R., 699
Telephone Co. of Egypt, 64
Telephos Domestic & Street Lighting Co., 794
Tilney Manufacturing & Testing Co., 186
Topsham Electricity Supply Co., 633, 732
Trafford Power & Light Supply Co., 186
Tucuman Tramways, Light & Power Co., 257
Turner, Atherton & Co., 505
Underground Electric Railways Co. of London, 186
United Electric Car Co., 375
United River Plate Telephone Co., 505
Urban Electric Supply Co., 186
Vaughan & Son, 764
Venner Time Switches, 285
Ward, T. W., 699
Wellingborough Electric Supply Co., 312
Western Telegraph Co., 825
West India & Panama Telegraph Co., 64
Whitehouse, J., 732
Whitstable Electric Co., 375
Winscombe Electric Light & Power Co., 64
Wright & Co., A., 164
Yale Electric Power Co., 732
Yarmouth (I.W.) Electricity Supply Co., 764
Yorkshire Cable Co., 668
Yorkshire Incandescent Electric Lamp Co., 534, 699, 732
Yorkshire (West Riding) Electric Tramways Co., 64

Oilfields, Electric pumping at, 407
Oil wells, Electric heater for, 344
Omnibus, An electric hotel, 142
Omnibuses for South Shields, Edison, 142
Optical signals for aeroplanes and ships, 169
Orders, Records of progress and completion of manufacturing, 979
Ore separation, Electrostatic, 623
Organisation of the electrical industry, The, by C. A. Baker, 46
Osaka, 595
Osmium-platinum alloy, 533
Osram Lamp Works, The, 463
Overhead wires and the law, 204
Over-pressure protective gear for high-tension circuits, by K. Edgcumbe, 712, 744, 775, 807

Digitized by Google

PALACE engineering works, The, 856
Palmer's shipbuilding electrification, 468
Panama Canal, Gatun hydro-electric development for the, 267
Panama Canal opened, 284
Panama Exhibition, 334
PARLIAMENTARY—
Brighton line, Electrification of the, 128
Bristol Tramways Bill, 176, 214
Glasgow Corporation Bill, 176
Incorporated M.E.A. Bill, The, 32
Light Railways Acts, 406
Light Railways and the Development Bill, 176
Manchester Corporation Bill, 214
Newcastle Corporation Bill, 176
North Eastern Railway Bill, 128
North Metropolitan Electric Power Bill, 8
Oxford & District Tramways Bill, 176
Royal Assent, 104, 214
Second Readings, 61
Third Readings, 61, 104, 128
Walsall Corporation Tramways, 128
York Corporation Bill, 176
Parliamentary Notices, 730
Parliament to consider, Electrical applications for, 778
Patent restoration, 76, 416, 527, 588
Patents and alien enemies, 492, 527, 594, 630, 667
Patents application, 53, 271
Patents, New, and Published specifications, 40, 80, 120, 160, 200, 236, 264, 292, 320, 352, 384, 416, 448, 480, 512, 544, 576, 608, 644, 676, 708, 740, 772, 804, 836, 868
Patents of enemy subjects, 342
Patents, Wire lamp, 120
Perfect system, The, by "Commercial," 278
Perry's retirement: Proposed presentation, Prof., 16
Pests, Electrical destruction of, 341
Phase displacers, Induction regulators as, 220
Physical Society of London, 249
Piano, Electromagnetic, 120
Pictures without photography, Moving, by G. B. Barham, 438
Platinum, 61
Ploughing, Electric, 508
Point Five Association: Discussion on electric cooking, 673
Point Five Association, The, 117
Poisoning, Lead, 567
Poland, 492
Poles, Ferro-concrete, 679
"Poochees," by C. S. Jeffrey, 383
Portuguese West Africa, 654
Powdered fuel, 624
Power plant testing, by W. M. Selvey, 803, 809, 842
Power stations, Cinder removal at New York 325
Premium wages system, The, 221
Presidential address, A review of the electrical industry: I.E.E., 609
Pressure-reducing motor-generator for high-pressure direct current, 289
Private arrangements, 251, 279, 339, 367, 432, 729, 752, 786, 847
Problems of industry, by "A Would-be Reformer," 475
PROCEEDINGS OF SOCIETIES AND INSTITUTIONS—
Aerials, The capacity of radio-telegraphic, by Prof. G. W. O. Howe 319
Aquitania, Electrical equipment of the, by J. Lowson, 735
Blast furnaces, Mechanical charging of, by N. Kapp, 458
Brass melting, Electric, by G. H. Clamer and Carl Hering, 573
British Association for the Advancement of Science, Australia, 1914, 317, 348, 359
Cables, by C. J. Beaver, 706, 738
Coal mining, The limiting conditions for the safe use of electricity in, by Prof. W. M. Thornton, 350
Economics of electric railway distribution, by Dr. H. F. Parshall 706
Electricity in mines, by G. J. Ralph, 811; by W. Maurice, 812
Electrolytic iron, by Dr. L. Guillet, 478
Faraday Society, The, 414
Ferro-manganese in the steel processes, The use of liquid, by Axel Sahlin, 543
Gaseous explosions, 360
Heat contained in slag, Utilisation of, by W. L. Johnson, 479
Heat engines, Temperature cycles in, by Prof. E. G. Coker and W. A. Scoble, 319
Hydro-electric power, Irrigation dams and, by E. K. Scott, 317, 348
Illuminating engineering in war time, 800
Imperial College of Science and Technology, 360
Incorporated Municipal Electrical Association Convention, 33, 76
Institution of Electrical Engineers: Inaugural address by Sir John Snell, 639
(Birmingham Local Section), Inaugural address by Dr. A. H. Railing, 801
(Manchester Local Section): Inaugural address by Mr. P. P. Wheelwright, 673
(Newcastle Local Section): Inaugural address by Mr. P. V. Hunter, 767
(Scottish Local Section): Inaugural address by Mr. J. Lowson, 735
(Yorkshire Local Section): Inaugural address by Mr. T. Roles, 672
PROCEEDINGS OF SOCIETIES AND INSTITUTIONS—*continued.*
Iron, Electrolytic, by Dr. L. Guillet, 478
Irrigation dams and hydro-electric power, by E. K. Scott, 317, 348
Irrigation works in Italy, by Prof. L. Luiggi, 319
Limiting conditions for the safe use of electricity in coal mining, The, by Prof. W. M. Thornton, 350
Locomotives, A transmission system suitable for heavy internal-combustion by H. J. Thomson, 605
Melting, Electric brass, by G. H. Clamer and Carl Hering, 573
Mines, Electricity in, by G. J. Ralph, 811; by W. Maurice, 812
Municipal Electrical Association Convention, 33, 76
Newcastle Corporation Tramways, by R. Mayne, 157
Physical Society of London, 249
Power plant testing, by W. M. Selvey, 803, 809, 842
Radio-telegraphic aerials, The capacity of, by Prof. G. W. O. Howe, 319
Radiotelegraphic investigations, 359
Rail joints, by R. Humphries, 196
Rails, Standard tramway, by F. Bland, 158
Railway distribution, Economics of electric, by Dr. H. F. Parshall, 706
Slag, Utilisation of heat contained in, by W. L. Johnson, 479
Standardisation of tariffs, by J. H. Bowden, 33
Standard tramway rails, by F. Bland, 158
Steel processes, The use of liquid ferro-manganese in the, by Axel Sahlin, 543
Temperature cycles in heat engines, by Prof. E. G. Coker and W. A. Scoble, 319
Testing, Power plant, by W. M. Selvey, 803, 809, 842
Town planning in relation to tramways, by J. A. Brodie, 197
Tramway Congress, 156, 196, 197
Tramways in Brazil, by H. M. Sayers, 158
Transmission system suitable for heavy internal-combustion locomotives, A, by H. J. Thomson, 605
Utilisation of heat contained in slag, by W. L. Johnson, 479
Vacuum in steam turbines, The effect of, by G. G. Stoney, 840
Wireless Society of London, 705
Promotion of the electrical trade, 843
PROSPECTUSES—
Barcelona Traction, Light & Power, 68
Derby Lamp Works, 827
Smith, S. & Sons (Motor Accessories), 147
Southern Brazil Electric Co., 108

Protective gear for high-tension circuits, Over-pressure, by K. Edgcumbe, 712, 744, 775, 807
Pumping at oilfields, Electric, 407

RACE removal, The influence of engineering on, 293
Radiations, New, 33
Radio-telegraphic Aerials, The capacity of, by Prof. G. W. O. Howe, 319
Radio-telegraphic investigations, 359
Radio-telephony systems, New, 429
Radium, 223, 436
Radium rays, Hard X-rays as a substitute for, 18
Rail joints, by R. Humphries, 196
Rail joints, Tramway, by H. M. Sayers, 163
Rails: British standard specification, Resistance of steel conductor, 300
Rails, Standard tramway, by F. Bland, 158

RAILWAY NOTES—
Accrington, 529
Argentina, 217, 253, 760
Australia, 281, 310, 494, 529, 720, 850
Austria, 217
Canada, 760
Chile, 100
Clayton-le-Moors, 720, 788
Colwyn Bay, 590
Continental, 12, 58, 218, 310, 760, 821
Dover, 58
Germany, 12, 310
Halwill, 369
Italy, 369, 821
Japan, 470, 690, 721
Lancashire, 133
Liverpool, 822
London, 58, 434, 500, 590
Manchester, 721
Melbourne, 310
Northampton, 590
Portugal, 760
Richmond (Yorks.), 690
South African railway electrification, 563
Spain, 58
Torrington, 369
United States, 58, 253, 310, 529, 658
Weston-super-Mare, 822
York, 500

Railway distribution, Economics of electric, by Dr. H. F. Parshall, 706
Railway electrification, 679
Railway electrification and engine drivers, 235
Railway electrification contracts, London, 53
Railways, Electric signalling on French, 192
Railways, Electrifying the Belgian State, 38
Railway, The Berlin Elevated & Underground, 21
Rainstorm, The horse-power of a, 160
Ram's report on electrical accidents, Mr. G. Scott, 84, 91, 154
Range-finder wanted, 630, 666
Rating of bare copper conductors, The, by W. A. Coates, 411
Rays, Ultra-violet, 480, 503
Reconnoitring, War and trade, 513
Records of progress and completion of manufacturing orders, 279
Rectifier for large outputs, The development of the mercury, 210
Red Cross Society, French, 592
Refining, Electrolytic, by G. B. Barham, 282
Regulators as phase displacers, Induction, 220
Relay for heavy work, A differential, by H. E. Dey, 206
Rennerfelt furnace, The latest type of, 112
Repenting at leisure, War: 356, 419
Research, Scientific, 159
Resistance by Lorenz's method, Absolute measurement of electrical, by F. E Smith, 164
Resistance of steel conductor rails: British standard specification, 300

REVIEWS—
Advertising and Progress, by E. S. Hole and J. Hart, 490
Applications of Electricity, by A. Ogilvie, 230
British Industry and the War, 587
Calculus for Engineering Students, by J. Graham, 457
Continuous and Alternating-current Machinery, by J. H. Morecroft, 348
Electrical engineering, A first year course, by F. Shaw, 687
Electrical Engineering Problems, by F. C. Caldwell, 195
Electrical Photometry and Illumination, by Herman Bohle, 229
Electric Car Maintenance, by W. Jackson, 358
Electric Light Accounts and their Significance, by H. M. Edwards, 551
Electric Power Transmission by Aluminium Conductors, 688
Electric Traction, by L. Calisch, 621
Electro-Thermal Methods of Iron and Steel Production, by J. B. C. Kershaw, 456
Elementary Graphic Statics, by J. T. Wight, 430
Elementary Magnetism and Electricity, by C. M. Janstey, 289
Elementary Principles of Wireless Telegraphy, by R. D. Bangay, 686
Elements of Electricity, by Lieut.-Col. Wirt Robinson, 491
Every Briton's War Book, 467
Factory Administration and Accounts, by E. T. Elbourne, 686
Handbook of Wireless Telegraphy, by Dr. J. Erskine Murray, 230
Incandescent Electric Lamps, by D. H. Ogley, 123
Inventor's Adviser and Manufacturer's Handbook to Patents, Advisers and Trademarks, by R. Haddan, 124
Inventors' and Patentees' Year Book for 1914, by W. H. Taylor, 431
Laboratory Manual: Direct and Alternating Current, by C. E. Clewell, 491
Le Théorie du Rayonnement et les Quanta, 289
Manual of Electrical Undertakings and Directory of Officials, by E. Garcke, 54
Mechanical Design and Construction of Generators, by R. Livingstone, 622
Mechanical Engineer's Pocket Book, 1914, by D. K. Clark and H. H. P. Powles, 259
Mechanical World Pocket Diary and Year-Book for 1915, 688
Modern Workshop Practice, by E. Pull, 490
Motoring: An Introduction to the Car and the Art of Driving it, by A. E. Berriman, 430
Photo-Electricity, by Dr. A. L. Hughes, 455
Picture Play Photography, by H. M. Lomas, 550
Practical Illumination, by J. Eck, 195
Practical Iron Founding, by J. G. Horner, 357
Practical Uses of the Wave Meter in Wireless Telegraphy, by J. O. Mauborgne, 288
Principles of Automatic Telephony, The, by W. Atkins, 347
Problems in Alternating-current Machinery, by W. V. Lyon, 123
Questions and Answers about Electrical Apparatus, by J. W. Craig and W. P. Woodward, 622
Questions and Solutions in Magnetism and Electricity, by W. J. White, 230
Questions and Solutions in Telegraphy and Telephony, by H. P. Few, 688
Ragged Staff Rhymes, by A. Sedgwick Barnard, 96
REVIEWS—*continued.*
Researches on Irritability of Plants, by Jagadis Chunder Bose, 357
Slide Rule Notes, by H. C. Dunlop and C. S. Jackson, 230
Steam Pipes: Their Construction and Maintenance, 456
Text-book of Physics: Electricity and Magnetism, Parts I. and II. Static Electricity and Magnetism, by Prof. J. H. Poynting and Sir J. J. Thomson, 258
Universal Directory of Railway Officials, 131
Water Turbines, by I. J. Hallinger, 456
What Every Private Soldier Ought to Know, 467
X-Rays, by Dr. G. W. C. Kaye, 347
Year Book of Wireless Telegraphy and Telephony, 1914, 551

Rifle league, Electricity supply, 61
Risk," "We can't take the, by R.S.T.V., 639
Road maintenance, 122
Rolling-mill motors, Simpler control for, 592
Rolling mills, Application of electrical driving to existing, by L. Rothera, 510
Royal Engineers Old Comrades' Association, 567
Rubber, 2, 238, 322, 419, 515, 611, 711, 806
Rubber and Allied Trades' Exhibition International, 37
Rubber market, The, 122
Rules for the operation of electrical equipment and lines, U.S.A. safety, 580, 635
Russia, 718
Russia as a field for British electrical trade, by G. W. de Tunzelmann, 680
Russia, Electrical material in, 62
Russian Far East, 214
Russia, Trade with, 610

SAFETY lamps, Miners', 805
Safety rules for the operation of electrical equipment and lines, U.S.A., 580, 635
St. Paul's Cathedral, Fire protection of, 730
Schrage patent three-phase commutator motor with shunt regulation by brush displacement, 445
Science and the State, 137
Science, War and the neutrality of, 449
Scientific research, 159
Searchlights, Electric, 436
Self-synchronising motor, The decline of the, by E. P. Hollis, 357
Senghenydd disaster, Electric signalling and the, 191
Separation, Electrostatic ore, 622
Shop-window lighting, 588
Siemens resignation, A, 341
Sign, A large "Motograph," 630
Signalling and the Senghenydd disaster, Electric, 191
Signalling on French railways, Electric, 92
Signals, Malicious damage to railway, 408
Slag, Utilisation of heat contained in, by W. L. Johnson, 479
Smelting furnaces, Large electrical, 378
Snell, Complimentary dinner to Sir John, 61
South Africa, Import duty on catalogues for, 377
South Africa, The British trade position in, 711
South Africa, Trade of, 735
South American trade, War:, 578
Southend-on-Sea, Coal-handling plant at, 52
Sparking distances in electrical installations, 222
Special constable, The, 482, 646
Specifications and new patents, Published, 40, 80, 120, 160, 200, 236, 264, 292, 320, 352, 384, 416, 448, 480, 544, 576, 608, 644, 676, 708, 740, 772, 804, 836, 868
Standardisation of electrical fittings on petrol motor-cars, 16
Standardisation of electrical installations on motor-cars, 374
Standardisation of tariffs, J. H. Bowden, 33
Standardisation, Tariff, 36
Standardisation, U.S. electrical vehicle, 854
Standards Committee, Engineering, 77
Starter for motor-cars, The Brolt electric engine, 517
Steamship, A new cable-repairing, 401
Steel processes, The use of liquid ferro-manganese in the, by Axel Sahlin, 543
Steel production, Electric furnaces and electric, 351
Steel tubes, Incorrodible, 687
Sterilisation of water, 180
Straits Settlements, British trade with the, 631
Street lamps at Chicago, Half-watt, 504
Strength of flat plates, The, 544
Strength of tungsten lamps, 857
Strike, American Westinghouse, 137
Strikes, 131, 175
Strike, The coal, 138
Surgery, Electromagnets for war, 593

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Suspension of creditors' remedies, 387
Sweden, 214, 638, 655
Sweden, Electrical exports from, 655, 786
Swedish water power, 8
Swiss or German? 839
Switchgear, Concerning, by S. Lees, 3
Switching examination, Electric light, 257
Switzerland, 785
Switzerland, The trade situation in, 857
Switzerland, Trade statistics of, 114, 834

TANTALUM and Wotan lamps, The manufacture of, 421
Tariff matters, Australian, 433
Tariffs on electrical goods, Foreign and Colonial, 159, 235, 319, 416, 448, 512, 772
Tariffs: South Africa, 480
Tariff standardisation, 36
Task setting and efficiency, 387

TELEGRAPH NOTES—
Alien's wireless installation, 629, 658, 690, 789
Argentina, 218, 340
Atlantic cables cut, 218
Australasia, All-British cable to, 13
Australia, 370
Automobile wireless telegraph stations, 218
Baltic cables, 760
Cable cutting, 470, 529, 721
Cable profits, 590
Cable repaired, 470
Cable tariffs, 13, 134, 405, 434, 470, 500
Canada, 340, 658, 850
Canadian Marconi stations, 310
Censorship of cable telegrams, 529
China, 58, 134, 180, 306
Continental, 218
Cut telegraph wires, 281, 760
Denmark, 370
Dutch cables, New, 281
Experimental wireless stations, 218
Farmers and wireless telegraphy, 281
Fire alarms, 100
Foreign telegrams, 218
France, 760
German communications, 760
German pirates, 822
German wireless station destroyed, 246
Germany, 58, 254
Germany's isolation, 850
Greece, 100
Honolulu, 564
Imperial wireless chain, 13, 101, 134
India, 690
Italy, 101
Laboratory, An automobile, 690
Mail, Telegraph and telephone in Europe and the States, 213
Marconi shares, 629, 658, 721
Motor vehicles for telegraph service, 500
New cables, 850
New telegram rule, 760
New wireless receiver, 500
New York—Panama cable, 310
Norway, 101
Orders by wireless, 59
Pacific cable cut, 370, 405, 530
Pacific cable repaired, 658
Pacific cable returns, 658
Panama, 340
Postal service, The, 180
Post office telegraphs, 760, 789
Poulsen wireless system, 500
Radio-telegraphic research, International Commission for, 100
Russia, 470
Scheme, A dastardly, 590
Secret wireless stations, 369, 629, 690, 721, 760, 790, 822
Solar eclipse observations, 254
South America, 281, 790
Spain, 310
Submarine signalling apparatus, 761
Sweden, 310
Telegrams in code, 564, 590, 629, 658, 721, 822
Telegraphic delays, 500
Telegraphists at the front, 530
Telegraphs and telephones on the Continent, 218
Telegraph service, The, 134, 254
Telegraphy at the front, 790
Telephote, The, 101
Torpedo, Another wireless, 789
Turkey, 761
United States, 254, 340, 370, 434, 470, 850
U.S.A. wireless stations, 591
West Indies, 340
Wireless amateurs charged, 434
Wireless and the war, 340
Wireless apparatus, 564
Wireless apparatus seized, 564
Wireless charge, 564
Wireless in the Pacific, 500
Wireless in warfare, 218, 470, 658
Wireless on board ship, 59, 101, 134, 180
Wireless operators for the navy, 434
Wireless spy?, 500
Wireless spying, 564
Wireless station captured, 254, 405, 434
Wireless stations, 254
Wireless station wrecked, 281
Wireless telegraphy and the solar eclipse, 181
Wireless telegraphy, Long-distance, 180
Wireless telegraphy regulations, 218
Wreck of the *Buccaneer*, 470

TELEPHONE NOTES—
Alien telephone inspector, 629
Alien at the switchboard, An, 590
Argentina, 281
Australia, 434, 564, 789
Automatic telephones, 100
Bolton, 434
Canada, 134, 310
China, 180, 306, 310
Continental, 218
Corea, 405, 470
Cutting telephone wires, 500
Denmark, 180
Dublin, 13
Free telephone calls, 281
German telephones, 564
Japan, 310, 405
London ambulance service, 180
Manchester, 101
National revenue, 591
Norway, 530, 721
Panama, 342
Portsmouth, 134
Post office telegraph and telephone service, The, 281, 789
Rochford, 629
Sweden, 180
Telephone censorship, 254
Telephone directory, 721
Telephone poles, 101
Telephone service, The, 13, 59, 101, 134
Telephone spy, 530, 564
Underground telephone, An, 500
United States, 310
War tax on telephone and telegraph, 629
Wireless telephony, 58, 500

Telephone system, The Betulander relay automatic, 17, 44
Telephony in railway operation, Wireless, by H. A. Tinson, 244
Temperature cycles in heat engines, by Prof. E. G. Coker and W. A. Scoble, 319
Tendering, Natal contracts and public, 384
Terminals, Definition of consumer's, 698
Terms and definitions, Electrical, 72
Testing institution for the electrical industry, A proposed, 193
Testing, Power plant, by W. M. Selvey, 803, 809, 842
Tests, Turbo-generator, 407
Texas, Electric cooking of the U.S.S., 32
Theatre, The I.E.E., 838
Theft, 558
Thermophone, The, 774
Thermophone, The, by M. de Lange, 801
Three-phase commutation motor with shunt regulation by brush displacement, Schrage patent, 445
Three-phase repulsion motor, New, 209
Time switch approved, 588
Tow-boat, Electrical canal, 344
Tower wagons, Electrically-propelled, 288
Town planning, 162, 197
Toxicology, Electricity in, 566
Tractor, A new electric, 413
Trade: An appeal to the Government, War and, 545
Trade and the war, British overseas, 237
Trade and the war, The electrical, 242, 552, 582, 614
Trade disputes ended, 238
Trade expansion, 588
Trade expansion, Co-operation in, 418 451
Trade expansion, Co-operation in, by C. A. Baker, 539
Trade: How to ensure success, Capturing German, 519
Trade in Australia, British, 323, 350
Trade in Canada, British, 82, 155
Trade in June, Foreign, 62; July, 264; August, 373; September, 503; October, 664; November, 791
Trade, Italian, 718
Trade-mark and patent rules, War: The new, 355
Trade: Reconnoitring, War and, 513
Trade returns in war time, 372, 503
Trade situation in Switzerland, The, 857
Trade statistics of Egypt, 1913, 446
Trade statistics of Italy, 509
Trade statistics of Japan, 1913, 477
Trade statistics of Newfoundland, 608
Trade statistics of Switzerland, 114, 834
Trade, The Government and foreign, 848
Trade, The Position of the electrical, 834
Trade war, by "Ignotus," 444
Trade, War: South American, 578
Trade war, The, 547
Trade, War: The course of, 257
Trade with Russia, 610
Trading in Italy, by O. E. Allo, 483, 518, 548
Trading with the enemy, 391, 709, 730
Traffic, Fares and, 437
Training of engineers, The practical, 577, 636, 671
Trains in U.S.A., Electric lighting of, 834
Tramway Congress, The, 157, 196
Tramway deficit, The L.C.C., 3
Tramway Managers, Metropolitan Association of Electric, 568

TRAMWAY NOTES—
Aberdare, 590
Aberdeen, 133, 179, 309, 470, 628
Accrington, 57, 369

TRAMWAY NOTES—*continued.*
Argentina, 340, 590, 760
Astley, 405
Australia, 12, 434, 628, 690, 760, 788
Ayr, 434, 563
Baildon, 57, 217
Balearic Isles, 529
Barnes, 821
Barnsley, 760, 788, 850
Belfast, 253, 434
Belgium, 310
Bethnal Green, 470
Bingley, 529
Birkenhead, 217
Birmingham, 563
Blackpool, 57, 310, 470, 563, 720
Bolton, 590, 628
Bournemouth, 529
Bradford, 12, 58, 100, 281, 529, 690
Brighouse, 590
Brighton, 720
Bristol, 590, 788, 850
Burnley, 58, 529
Bury, 563, 620, 657
Canada, 690
Cardiff, 217
Chile, 760
Colne, 58, 494
Continental, 12, 100, 180, 253, 281, 310, 529, 628, 720
Coventry, 405, 470, 494
Croydon, 100, 180, 405, 470, 590, 760
Dartford, 100
Decreased tram receipts, 850
Denton (Lancs.), 100
Devonport, 760
Dewsbury, 180, 281, 788
Doncaster, 58, 180, 253, 369
Dover, 494
Dundee, 12, 133
Dunedin, 529
Ealing, 529
East Ham, 100, 217, 494, 720
East Kent, 721
Eccles, 657
Edinburgh, 58, 180, 217, 434, 494, 590, 628, 721, 760, 788, 821
Electric delivery vans, 690
Emley, 821
Erith, 760
Farnworth, 369
France, 529
Germany, 12, 100, 180
Germiston (Transvaal), 405
Glasgow, 12, 253, 563, 657, 690
Glossop, 850
Gloucester, 217
Golcar, 470
Greasbro', 821
Halifax, 12, 58, 133, 470, 494, 590, 657, 760, 850
Hammersmith, 721
Hindley, 821
Holland, 100, 628
Horbury, 100
Hove, 789
Huddersfield, 100, 500, 590
Hull, 721
Hurst, 850
Ilford, 563, 690, 821
India, 133
Ipswich, 58
Italy, 253
Keighley, 405
Kirkcaldy, 133
Lambeth, 822
Lanarkshire, 822
Leeds, 369, 500, 563
Leicester, 58
Leith, 180
Lepton, 690
Lincoln, 822
Liverpool, 628
Llandaff, 369
London, 12, 134, 180, 217, 369, 470, 529, 590, 628, 658, 690, 721, 822
London County Council, 12, 134, 217, 369, 658, 690, 822
Lowestoft, 657
Manchester, 217, 500, 563, 760, 789, 850
Marsden, 405
Mexborough, 100
Mexico, 529, 563, 721
Middlesex, 134
Neath, 721
Netherlands, 281
Newcastle-on-Tyne, 180, 369, 470, 760
New Zealand, 529, 563
Northampton, 58
Norwich, 434
Oldham, 13, 217, 405
Pontefract, 405
Poole, 529
Preston, 590
Radcliffe, 100
Rawtenstall, 134, 563
Rochdale, 58, 134, 310
Rotherham, 253, 500, 529, 628
Russia, 180
Saddleworth, 721
Salford, 217, 369
Sheffield, 58, 340, 500, 529, 658, 789
Shelf, 529
South Africa, 100, 180, 405
Southampton, 100, 470, 563, 629, 822
South Shields, 13, 218, 529, 658, 850
Spain, 628, 720
Stainland (Yorks.), 500
Stalybridge, 13, 100, 590
Stepney, 470
Stirling, 310, 470, 690
Stoke-on-Trent, 658
Stretford, 100
Sunderland, 13
Tramway receipts and war, 470
Tunis, 58
U.S.A., 340, 434, 470
U.S.A. Electric Vehicle Association, 629
Wakefield, 281
Wallasey, 470

TRAMWAY NOTES—*continued.*
Walsall, 281, 822
West Ham, 100, 590, 721
West Hartlepool, 100
Wolverhampton, 822
York, 789

Tramway rail joints, by H. M. Sayers, 163
Tramway rails, Standard, by F. Bland, 138
Tramways in Brazil, by H. M. Sayers, 158
Tramways breakdown, The L.C.C., 837, 856
Transformers for Japan, E.H.T., 110
Transmission completed, 400-mile, 498
Transmission system suitable for heavy internal-combustion locomotives, A., by H. J. Thomas, 605
Transport vehicles, Cable, 256
Transport, War: Sea, 256
Tripoli, Concessions in, 785
Trucks, 763
Tubes, Incorrodible steel, 687
Tubular light sources, 104
Tungsten extraction, 472
Tungsten lamps Strength of, 857
Turbine, A large steam, 37
Turbine plant at Liverpool, New, 851
Turbine set, The Manchester 15,000 kw., 19
Turbines, The effect of vacuum in steam, by G. G. Stoney, F.R.S., 840
Turbo-generator, A large, 603
Turbo-generator tests, 407
Turkey, 214
Tyneside scientists honoured, 103

ULTRA-VIOLET rays, 480, 503
Underwriters' code, The Chicago, 53
Underwriters' label service, 222
Unemployment insurance amendments, by J. J. H. Stansfield, 232
U.S.A. and the war, 420
U.S.A. safety rules for the operation of electrical equipment and lines, 580, 635
Utilisation of heat contained in slag, by W. L. Johnson, 479

VACUUM in steam turbines, The effect of, by G. G. Stoney, F.R.S., 840
Vamma water-power plant in Norway, The, 647
Vehicle Association, U.S.A. Electric, 316
Vehicle Committee, The Electric, 314, 447, 576, 763, 856
Vehicle Convention, American Electric, 160
Vehicle equipment of the London Fire Brigade, Some notes on the electric, 296, 324
Vehicle in France, The electric, 263
Vehicle manufacture at Ipswich, Electric, 816
Vehicle, New electric, 416
Vehicle operating cost, Electric, 666
Vehicles and the war, Electric, 284
Vehicles, Electric charging for commercial, 62
Vehicles, Electric motor, 159
Vehicles for electrical work, Motor, 777
Vehicles in Boston, U.S.A., Battery, 137
Vehicle standardisation, U.S. electrical, 854
Vehicle, The cost of the electric, 741
Vexatious inquiries, 83
Victoria, Brown coal in, 466
Voting by electricity, 18

WAGES in the Midlands, 16
Wages, London County Council, 533
Wages or dividends? War, 355
Wages, Particulars of work, 143
Wages system, The premium, 221
Walking contest, 595

WAR ITEMS—
Aberdeen tramwaymen, 685
Active service allowances, 276, 302, 329, 366, 397, 428, 467, 489, 556
After the war, 685
Alien control of companies, 331
"All-British" directory, An, 330
America and the war, 342
American and German trade, 751
American authorities are saying, What, 524
American message, An, 301
American trade and the war, 396
America's trade campaign, 813
Anchor Cable staff, 652
Appeals, 653, 685, 783, 845
Argentine contracts placed in England, 428
Army and Navy service vacancies, 223
Australia and manufacturing, 586
Australia and the metal trades, 814
Australia, Contract difficulties in, 488
Australia, Imports into, 525
Australian manufacturers and the trade position, 652
Australian tramwaymen on active
Australian trade, 751
Australian tramwaymen on active service, 489
Australia, War effects in, 488

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WAR ITEMS—*continued.*
Bath electric supply men with the colours, 814
Belgian industries, 685
Belgian iron and steel works, 329
Belgium.—An invitation to British firms, 524
Belgium. Engineering works in, 556
Birmingham Electrical Volunteer Force, 730
Birmingham electricity department employés, 619
Birmingham trade, 462
Board of Trade campaign and reports, 276, 301, 302, 303, 328, 329, 331, 332, 364, 365, 396, 397, 426, 427, 462, 486, 524, 556, 585, 619, 653, 685, 717, 750, 784
Bradford 5,000-kw. plant contract, 428
Brighton railway contract, The, 397
British Aluminium employés, 462
British bulbs for electric lamps, 364
British Electrical and Allied Manufacturers' Association and "The state of war," 424
British Electrical Federation Employés, 275, 685
British firms and German agents in China, 620
British-made telephones, 426
British Thomson-Houston Co., 330, 364
British Westinghouse staff war relief fund, 366
British Westinghouse works at Trafford Park, 329
Bruce Peebles and the war, 525
Burnley tramwaymen, 621, 751, 784
Cables in war time, 311
Canada and the war, 277, 428, 526
Canadian General Electric Engineers for the front, 556
"Capturing" German trade, 461
Carbon manufacture, 328
Carbons for electrical purposes, 586
Carbons for Melbourne, 556
Carels Frères, 366
Chloride recruits, 331, 397, 428
City and Guilds technological examinations, 331
City Corporation and German companies, 653
Civilian Electrical Force at Edinburgh, 524
Commandeered chassis, 331
Conquest of the international electrical market, 793
Constantinople telephones, 784, 814
Contraband of war, 428, 620
Contract prices, The war and, 489
Contracts, The war and, 631
Copper as contraband, 717
County Company's men, The, 467
Delayed contracts, 585
Eck and the Union Electric, Mr., 488
Electrical business openings abroad, 567
Electrical companies and the war, 256
Electrical men wanted, 717
Electrical news in German papers, 593
Electrical supplies scarce at Buenos Aires, 845
Electricity Supply employés and the war, 783
Electricity works insurance, 556
Electric vehicles and the war, 284
Engineering units of Royal Naval Division, 685
E.P.S. and the war, 365
Enemy factories, 426
Enemy patents, 472
Enemy's trade, The, 395
Engineers' Club Battalion, 366
Engineer Units of the Royal Naval Division, 472, 489
English electrical employés in Berlin, 331
Englishman, A compleat, 331, 364, 393, 488
Exhibition, All-British, 365
Exhibitions postponed, 277
Exporters and their debts abroad, 653
Exports from Denmark, 685
Extraordinary metal prices in Germany, 844
Flying Corps appeal for men, 256
Foreign trade debts, 717
France, Openings in, 489
French works, The war and, 487

WAR ITEMS—*continued.*
Fulham men with the forces, 784
General Electric Co. men with the colours, 332
German capital in the Russian electro-technical industry, 783
German contract re-let in England, 621
German contracts, 751
German electrical goods on offer, 526
German electrical industry, 631
German electro-technical works, 462
German exports, 525
German iron and steel exports, 489
German patents, 256
German trade and German vandalism, 427
German trade, To capture, 488
German trade with Canada, 813
German turbo-plant not re-ordered, 397
Germany and copper, 814
Germany, Business in, 631
Glassworkers with the forces, 784
Government assistance, 619
Hackney men with the forces, 717
Hart Accumulator men with the Forces, 783
Imperial Institute and trade, 555
Industrial disorganisation in Germany, 784
Inquiry bureau, An, 467
Institute of Commerce, 364
Institution of Electrical Engineers and National Service, 301
I.M.E.A. and foreign contracts, 585
I.C.S. warriors, 526
Iron and Steel Institute meeting cancelled, 331
Iron and steel trades, 751
Italy, The trade opportunity in, 462
Japan as an electrical manufacturer, 813
Lamp industry, The, 426
Lancashire Dynamo Works, 365
Laurence, Scott, at the front, 366, 428
Leyton electricity supply staff with the forces, 729
Limited companies and alien shareholders, 332
Liverpool and German contracts, 586
Liverpool City Council and its contracts, 620
Liverpool's objection to German firms, 526
Liverpool tramwaymen, 397
London, Brighton and South Coast Railway electrification, 426
London Electrical Engineers (T.F.), 717
L.C.C. tramway employés, 331
London electrical engineers to recruit, 489
London transport companies, 364
Magnetos, The War Office commandeers, 489
Manchester ball, 751
Manchester business man and German trade, 329
Manchester men with the forces, 845
Manchester students with the forces, 586
Manchester tramwaymen, 365, 428, 556
Manchester tramways and the war, 717
Marylebone men, 620
Metal trade, 685
Mining dispute, 814
Motor ambulances for the front, 653
Municipal employés and reduced remuneration, 489
Municipal Tramway Conference abandoned, 301
Nationality and naturalisation, 488, 526
National Relief Fund, 257
National Service for electrical engineers, 255, 277, 301
Naval disaster, The, 467
Northampton tramway managership, 489, 525, 556, 587, 621, 685, 751, 784, 814
Not a German firm, by J. Sax & Co., 330
Nothing German at Halifax, 685
Not paying at present, 365, 396
Oldham Corporation and its contracts, 619, 717, 783
Oldham E.C. and German contracts, 653
Oldham tramway contracts, 587

WAR ITEMS—*continued.*
Oldham tramway employés, 717
Ozone for recruiting purposes, 525
Patents and alien enemies, 492, 594
Payment for public contracts, 365
Personal, 467, 489, 526, 557, 587, 621, 653, 685, 717, 751, 785, 814, 845
Plea for the single man, A, 462
Port of London Authority contracts, 331
Pneumatic proposal, A, 845
Prisoners of war in Germany, 462
Professional classes and war relief, 731
Radium for Manchester, 488
Rights of alien enemies to sue, The, 407
Rochdale tramway employés, 717
Roll of honour, 489, 526, 587, 621, 653, 685, 717, 751, 784, 814, 845
Russia for damages to trade, Compensation in, 631
Russian supplies, 685
Russia, The future of, 428
Russia, Trade with, 620, 685, 717
Salford Corporation contracts, 397, 428
Salford tramwaymen and the war, 813
Scottish steel works reopened, 489
Seabrook's brother killed, Mr., 462
Sea transport, 256
Shift workmen, 365
Shorthand typists from Berlin, 632
Siemens and Government contracts, 397
Siemens and the Prince of Wales's Fund, 428
Siemens companies, The, 717
Siemens's employés at the front, 372
Skilled labour problem, The, 813
Soldiers at evening classes, 585
South America, Electrical trade outlook in, 461
Spain, Prices of electrical goods in, 489
Special constables, 366
Stepney men with the forces, 652
Street lighting, 331
Supplies for the Allied Governments, 784
Sydney cancels German order and places it at Rugby, 397
Sydney turbine contract, The, 487
Traders and Government orders, 653
Trade openings in Belgium, 813
Trade openings in Sweden, 462
Trade returns in war time, 372, 503
Trade, The course of, 257
Trade war and science, The, 653
Trade with Australia, 814
Trading with the enemy, 302, 467, 526, 652
Training for national service, 257
Tram cars and recruiting, 845
Turkey, Concessions in, 653
Turkey, Electrical goods in, 276
Turkish trade, The war and, 585
Unemployment, Lessening, 366
U.S. and South America, 784
U.S. electrical export trade, 556
U.S. electrical exports for September, 783
U.S. electrical imports and exports for August, 587
Vancouver engineer recruits, 487
Volunteer Force to protect electrical apparatus, 256
War and patents, 302
War and trade and industry, The, 242, 257, 265, 273, 276, 277, 295, 302, 303, 321, 353, 547, 552, 582, 620
War lighting, 544
Warrington contract, A, 396
War time, Contracts in, 427
West Ham and allowances to electrical employés, 653
West Ham Electricity Dept., 489
Westinghouse employés and the war, 784
What constitutes a British firm?, 361, 393, 424 (See also under "Correspondence")
"Who's who in the war," 301
Willans & Robinson, Ltd., 428
Wireless and the war, 340
Wireless men for the Navy, 257
X-Ray apparatus for, 283

War and industry, The, 265, 273, 299, 321
War and the neutrality of science, 449
War and the professional classes, 642
War and trade, 295
War and trade: An appeal to the Government, 545
War and Trade: Looking ahead, 353
War and trade: Reconnoitring, 513
War, British overseas trade and the, 237
War, Engineers and the, 202
Warfare, Electricity in, 483
War: Foreign supply works in belligerent countries, 807
War: In darkest London, 610
War, I.E.E. and the, 238, 436
Warning device, A useful, 411
War: Our duty, 201
War: Patriotism or prejudice?, 385
War: Repenting at leisure, 356, 419
Warship, Electrically-propelled U.S., 685
War: South American trade, 578
War: The badge of essential industry, 749
War: The City and the Crisis, 203
War, The electrical trades and the, 242, 552, 582, 614
War, The miner and, 266
War: The new trade-mark and patent rules, 355
War, The other, 581
War, The trade, 547
War, The U.S.A. and the, 420
War time, British-made carbons in, 307
War time Cables in, 311
War time, Contracts in, 427
War time, Illuminating engineering in, 800
War, Trade, by "Ignotus," 444
War: Trading with the enemy, 391
War: Wages or dividends?, 355
Water-power Congress, 70
Water-power in Finland, 233
Water-power plant in Norway, The Vamma, 647
Water-power, Swedish, 8
Wayleave rentals, 284
"We can't take the risk," by R.S.T.V., 839
Welding, Electro percussive, 666
Well boring, Rotary, 728
West Indies and cables, 323
Westinghouse strike, American, 137
White memorial, The William, 592
Williams fire-damp indicator, The, 15
Wills, 63, 105, 138, 668, 699, 731, 793, 824
Winding gear, Colliery, 532
Winding plant at Burley Colliery, Electric, 442
Wireless operators wanted, 408
Wireless outfit, U.S. Army, 303
Wireless Society of London, 705
Wireless telegraph station, The Carnarvon, 315
Wireless telephony in railway operation, by H. A. Tinson, 244
Woking Technical Institute, 104
Wolverhampton, Electrical exhibition at, 131
Work and wages, Particulars of, 143
Workmen's compensation case, A curious 202
Works of Messrs. T. Harding Churton & Co., Ltd., Leeds, The, 399
Wreck, 257

X-RAY apparatus for war, 283
X-rays as a substitute for radium rays, Hard, 18
X-ray tube, The Coolidge high-power, 519

YORKSHIRE Electric Power Co.'s supply, 792

ZERO resistivity, 16
"Zig" Lightning and Surge Arrester, The, 241

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Vol. LXXV.] CONTENTS: July 3, 1914. [No. 1,910.

	Page
London's Electricity Supply	1
Rubber	2
The L.C.C. Tramway Deficit	3
Concerning Switchgear, by S. Lees	3
Correspondence—	
Electricity Supply in London	5
Lightning and Trees	5
Hanover Square School of Electrical Engineering	6
Timber Drying	6
Geissler Tubes	6
The Training of the Instrument Maker	6
Legal	6
Parliamentary	8
Business Notes	9
Notes	15
The Manchester 15,000-KW. Turbine Set (*illus.*)	19
The Berlin Elevated and Underground Railway (*illus.*)	21
New Dock at Hull (*illus.*)	22
City Notes	25
Stocks and Shares	30
Electric Tramway and Railway Traffic Returns	30
Share List of Electrical Companies	31
Metal Market—Fluctuations in June	33
The Municipal Electrical Convention	33
The Standardisation of Tariffs	33
International Rubber and Allied Trades Exhibition	37
Innocence at Saffron Hill	38
New Electrical Devices, Fittings and Plant (*illus.*)	38
New Patents Applied For, 1914	40
Abstracts of Published Specifications	40

Contractors' Column ... Advertisement pages xxii and xxiv

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LONDON'S ELECTRICITY SUPPLY.

IT is somewhat appropriate at the present time, when the question of the future of London's electricity supply is so prominently before the public, that attention should be directed to the position of the latter, as represented by the electricity consumer, under present and possible future conditions of supply.

We publish elsewhere a letter bearing on this matter which reflects, to some extent, the opinion held in certain quarters that the London consumer is well off in comparison with the electrical user in European cities.

It would seem that the writer, who represents the company interests, is satisfied with the present position of affairs, but it is only right to point out that the average figures which he gives benefit considerably from the inclusion of the lower priced units supplied by the municipal undertakings, as will be shown below.

The report of Messrs. Merz & McLellan to the L.C.C. should serve to remove a good deal of the obscurity which has surrounded the possible municipalisation of supply in the Metropolitan area.

It will be readily admitted that for it to achieve ultimate success, any scheme which aims directly or indirectly at the unification of electricity supply in London must inspire confidence in the consumer, and the latter may find some food for thought in the L.C.C. returns relating to London's electricity supply during 1911-12; and if past records afford any indication of future prospects, possibly some idea may be gained from them as to whether private or municipal control, or some form of control which combines the advantages of both without their disadvantages, would be the best solution of the problem.

These returns dealt with 15 municipal and 13 private undertakings in London, and 24 municipal and 15 private extra-London undertakings.

For the moment it is only necessary to consider electricity supply in the London area and to take the figures as they stand for 1911-12 in comparison with those of six years earlier. These are tabulated below:—

	1911-12.	Position as compared with 1905-6.
NET CAPITAL EXPENDITURE.		
Municipal	£6,581,198	+ 20 %
Private	£14,437,257	+ 13½ %
REVENUE.		
Municipal	£795,150	+ 53·7 %
Private	£1,731,907	+ 4 %
INTEREST AND DIVIDENDS.		
Municipal	£199,706	+ 22 %
Private	£732,577	− 2 %
PLANT CAPACITY.		
Municipal	80,603 KW.	+ 53 %
Private	153,479 KW.	+ 19·8 %
UNITS SOLD.		
Municipal	96 865,278	+ 125 %
Private	160,697,495	+ 34½ %

It will be seen that while the increase of municipal expenditure has exceeded the increase of private expenditure by some 6½ per cent. during the period under consideration,

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the increased revenue derived from this expenditure by the municipal undertakings has been nearly 50 per cent. in excess of that derived by the private undertakings—the output of the municipal concerns having increased by 125 per cent., as compared with an increase of only 34½ per cent. on the part of the private undertakings.

With or without good reason, these figures, as an indication of six years' progress, are not favourable to the private companies.

The municipal undertakings obtained a smaller average price for their output, the figures being as follows :—

Average prices obtained.	Municipal.	Private.
Street lighting	... 1·52d.	1·43d.
Private lighting	... 3·15d.	3·55d.
Power	... 1·03d.	1·25d.
Combined av., all purposes	... 1·97d.	2·58d.

From the consumer's point of view, this is an important feature of the returns, and especially so in view of its influence on the development of electricity supply, although we are free to admit that increased sales might be attributable equally as much to business organisation and salesmanship as to price in some instances.

Price and efficiency of service rendered are the dominating factors so far as the consumer is concerned, and it is not illogical to assume that the comparatively greater progress of the municipal undertakings is due to a lead in both these directions, the competition of gas being equally felt all over the metropolis by both company and municipality, thanks to the splendid organisation of the gas interests.

The return gives the combined average prices obtained by municipal and company suppliers as 1·97d. and 2·58d., and the difference of ·61d. per unit paid by company consumers on the 160 million units credited to private undertakings may be taken as a measure of the extra cost of unrestricted private control.

Neglecting Stoke Newington, a minor undertaking, the highest average in the municipal list is the 3·17d. of Marylebone, while half a dozen companies exceed this figure, the highest average price for a private concern being over 4½d. per unit.

The increasing cost of fuel and domestic labour point to the necessity of many households introducing electrical power devices and electric heating, if only as a means of getting through more work in a given time, and quite apart from the hygienic question.

Looking more closely into the question of the future, and of any great extension of electricity supply, it is obvious that the smaller consumer will play a much more important part than he does now, and to such the initial price of energy* is of far more moment than the average price, which, indeed, means absolutely nothing to a consumer who is likely to be of the short-hour class.

We speak of "smaller consumer" in a strictly comparative sense, for there are thousands of dwelling houses in the London area, of rentals round about £40 to £50, some even fully wired in anticipation of electric lighting, which, in the companies' areas, use gas simply because they cannot get electricity, except on prohibitive terms, and the "business instinct" which perpetuates this sort of thing is not wholly confined to the companies' undertakings.

Still, judged on the basis of tariff, the municipal suppliers can claim, as a whole, to have done something tangible for even the smallest consumer, including the much disliked short-hour consumer, who, after all, must find a place in any scheme of electricity supply which is to be compatible with modern tendencies and requirements.

The companies, of course, have had their own troubles; insecurity of tenure has, no doubt, crippled their enterprise in recent years, and both this and early pioneering expenditure have been urged in extenuation of the comparatively high prices charged by them, although it must be admitted that these factors are unlikely to console the consumer.

However their financial position may have been prejudiced, it cannot be denied that the London companies have had a lengthy tenure of districts offering golden opportunities for business-getting on the whole, given the requisite enterprise and due recognition of modern requirements and facilities. Actually the average age of the London municipal undertakings is about 16 years as against roughly 23 years for the companies, and as it is only within the last eight years that turbine plant has been generally adopted for generating purposes, it is evident that the onus of replacing obsolete plant has not fallen upon the companies alone.

But if, on the whole, the figures which we quote are favourable to municipal supply in London, it must be remembered that municipal control frequently gives good cause for distrust.

Both good and bad examples of municipal management can be cited, and it can be urged against the best of them that the method of control by a municipal committee selected without regard to business qualifications, and, in any case, under the thumb of an even less informed Council, is likely to be unsatisfactory, particularly in view of the huge developments which may be expected in the future. Municipal engineers themselves admit its shortcomings, and the fact that Councillor Neumann, at a municipal conference in 1912, should have thought it necessary to read a paper indicating remedies for the present state of affairs, is most suggestive, as coming from within the municipal ranks.

However, the official report on the strike of municipal employés at Leeds last year contains even more convincing evidence from within as to the inefficiency which may creep into what one would consider a well-ordered service under municipal control.

It was, for example, found that the gas works were greatly overstaffed, and that certain old retorts which were in use required the labour of 60 men for the same output of gas as can be obtained by 12 men using modern retorts. The strike, at all events, served the good purpose of directing attention to the deficiencies of this department, and as the result of reorganisation, the staff could be reduced by 500 men, representing an annual saving to the city of £36,000! While we should hesitate to suggest that this is a common state of affairs, it may be taken for granted that whatever the deficiencies of unadulterated private control, purely municipal control is hardly likely to commend itself for a huge undertaking such as will be involved in the unified electricity supply of London. Here, then, is a matter for serious reflection on the part of the consumer—whose only requirements are a cheap supply of electricity and every facility for obtaining it—and of the public, whose interests are nowadays so closely bound up with electrical progress.

* The 10 lowest municipal flat rates range from 3d. to 4d. per unit, as against the seven lowest company flat rates of 4½d. to 5½d., and other initial rates are proportionately higher in the latter case.

Rubber. The general market for rubber has within recent weeks displayed little in the way of new feature, but taken all round the trade has been moving along quietly, and in not unsatisfactory fashion, with consumers taking good deliveries of material, while the movements in prices have been very small and the tone has generally been pretty steady. Plantation rubber still stands at a considerable discount compared with fine hard Para, and the arrivals of the latter as advised from Brazil are now and have lately been small. It is just possible that with small supplies of Para descriptions coming forward, the plantation product may be stimulated to some extent, as demands are turned upon it, but industrially the world's position is not any too cheerful or encouraging just now, and the outlook indicates a continuance of relatively quiet times. There has been rather less coming forward from the East of late, the shipments advised for May by the Federated Malay States authorities being 1,309 tons, compared with 1,548 tons in April, making the total for the five months of the year 7,026 tons, compared with 4,001 tons in 1913, and 1,772 in 1912. The auctions in Mincing Lane have been less too, the total handled at the two sales in June being only about 2,000 tons, a figure which falls considerably below that of some recent months, and the reduced quantities to hand have naturally assisted the market. There has recently been a rather more spirited inquiry in the

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private market for far forward deliveries, even up to June of next year, business in which has been done at a considerable discount compared with the rates accepted for near deliveries. This implies but a slender faith in the future of the market, but on the face of it the price looks fairly cheap, and it may stimulate buying on this ground alone.

The cost of production is, however, certainly coming down in many directions, and this can only be of benefit to all concerned. Most estates have, of late, succeeded in materially reducing their working costs, and the process is capable of further and general application, so that on this score, apart from any question of over-production, there is room for a further shading of prices, and the lower they go the more is consumption likely to be stimulated.

In considering the question of costs of production, a correspondent of the *Times* has been working out results on what is termed a "normal" estate in Malaya, by which expression is meant an estate which has no exceptional or abnormal disadvantages, is provided with good transport, is near a port or railway station, is a self-contained economic unit as to size, and is carefully laid out as regards labour. Taking everything into consideration, the "all in" cost is given as 8·76d. a lb. on an output of 600,000 lb., and on the writer's calculations, such an estate, capitalised at £75,000, and with rubber selling at 1s. 2¾d. a lb., can pay a 20 per cent. dividend, while every additional 1d. a lb. on the selling price is equal to a further 3⅓ per cent. or so on the dividend.

In connection with the efforts made to extend the uses to which rubber is put, it may be mentioned that a lawn tennis court laid with rubber has been put down at the Agricultural Hall in connection with the Rubber Exhibition, to which court the public are admitted, and the innovation has proved a decided attraction, the ball playing off very truly. The court is, however, slower in play than asphalte.

The L.C.C. Tramway Deficit.

No tramway report at the present time is awaited with such critical interest as that relating to the year's working of the London County Council tramway system. Heavily capitalised as it is, with its resources seriously depleted by concessions which cannot be justified from a tramway point of view, handicapped in addition in its facilities for gathering traffic in London, and up against an ever-increasing 'bus competition, the result of the year's working—a deficit of £88,526—need not cause any surprise to those interested.

Much has been written on the burdens cast—many think unfairly—on the L.C.C. tramways, but for various reasons these remain substantially as before, and it has been left for the motor-'bus to demonstrate the weak places in L.C.C. tramway administration.

The Highways Committee's report will be read with interest by those who desire an explanation of the present position, and one short sentence explains a good deal. "The Council in framing its tramway policy has not looked at the matter solely from the point of view of the tramways undertaking." If it had, the present position would scarcely have arisen.

Criticism of the result, in view of the sentence which we quote, may be somewhat out of place; the only question is whether London is prepared to face a loss of £50,000 a year or more in the future for the privilege of possessing tramways which are admittedly not run on a self-supporting basis.

A considerable section of the report deals with motor-omnibus competition, pointing out the various directions in which the 'bus is more favourably situated than the tramway, and it cannot be denied that there is certainly something wrong in a system which levies rates on a tramway route, the paving of which is kept in order by the tramway, to be worn out by other traffic, but which levies no rates on an equal 'bus service along the same route, although the latter causes more wear for every mile run.

The "'bus track," equivalent to the tramway track, is the whole road, and for the continuous all-day-long use of the latter, it would appear to be only equitable that some rate should be levied on the 'bus as on the tram.

CONCERNING SWITCHGEAR.

By S. LEES.

With the advent of the new Home Office rules and regulations governing the use of electrical energy for industrial purposes, it seemed reasonable to look forward in the near future to some radical changes toward better designed switchgear. The lapse of time since the new conditions became operable has been, it must be admitted, ample for the production of some necessarily rather drastic, yet much needed improvements making for increased safety and facility of working in the operation of electrical apparatus.

Taking these facts into consideration, it seems surprising that to-day there is little, if indeed any, striking evidence of the results of the 1912 regulations. True, a considerable proportion of central-station switchboards are now grilled in at the back; strange to say, however, an accident recently occurred where an attendant was severely shocked and injured through falling off a travelling crane which was stationed temporarily above the rear passage of a main switchboard. Here, substantial locked doors had been fitted, but the top of the passage-way was, as is usual, open.

But it is not at the main controlling or distributing centres that improvement is called for so much as at the points of actual use; for it is here that we still find being installed types of switchgear (so-called) which whilst outwardly complying with the statutory regulations, are yet so badly constructed that failure may be expected at any time. Take a common example—the coupled pattern of multipole switch, iron-cased, of course. Almost invariably the insulating bar which couples the several contact members is made of some kind or other of fibre. Up to the size of 100 amperes capacity this bar may be anything from 3-16in. to ½in. (rarely the latter) square section. Now, quite a lot of drilling, etc., is necessary for the mounting thereon of the contact blades and other fittings, and it is by no means uncommon to find adjacent screws which pass at right angles touching on the way. The section of the insulating bar is thus seriously reduced, and it can hardly be a matter for surprise if the switch fails at an unexpected moment. Sometimes clips are used instead of screws for directly attaching contact blades, and a bar of thinner section is employed. What happens with this method of mounting is that, in order to ensure certain and reasonably good contact, the friction between blades and jaws is so great as to defy withdrawal by means of the handle or lever fixed to the insulating bar, the latter often being of such a pliable nature as to allow one blade to break contact whilst the other remains "hard on." This is typical of a small size of switch having 4 in. centres between blades, the fibre bar allowing a torsional twist of ¼-full turn. Wood, too, is largely employed for this purpose, a common method of mounting the usual U and V shape contact blades being by means of small nutted screws. Trouble with this class of switch is speedy and sure. A certain pattern of multipole switch still on the market is provided with a rather elaborate insulating partition disposed between the contact jaws, and the contact blades are coupled together by means of a wooden bar held in position by two metal screws, one to each blade, the ends of the said screws coming within a small fraction of an inch of touching each other *inside* the wood bar. A case of failure of a switch of this make was experienced by the writer, the operator receiving such serious injuries as necessitated his absence from work for nearly two months. Switch mountings inevitably work loose in operation and contact blades become detached, and short-circuit across jaws, or "earth" to case; the indiscriminate boxing-in of some types of switch-

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gear often only accentuates trouble, as, with an open type of switch, a visible fault is more likely to be detected before any serious harm is done.

A particular form of double-pole service switch beloved of supply authorities is still with us, very little changed except, perhaps, that it must have its interior economy hidden under a cast-iron cloak of pretentious proportions. Its naked predecessor used to be a useful business-like sort of switch, always dependable. The present-day type is turned out by lots of "nameless" makers, and varies very little in the inside electrical details in the different makes, one point, at any rate, being its somewhat striking consistency. There is the familiar fibre coupling-bar which shows a decided reluctance to keep company with its contact blades, and there remains the same kind of handle grip which runs the whole gamut from "off" to "on" and reverse, without useful effect, and the cover has to be removed to elucidate the tactics of the erring switch. And what matters it if the live parts are only asbestos-paper thickness distant from the outer earthed case, there is still a full two inches length of break between contacts!

Truly, this robust mechanical method of enclosing small switchgear allows unlimited latitude for the unscrupulous hiding of a multitude of electrical sins inside, and especially does this apply to fuse-boxes or, as they were originally called, "cut-outs." More than one decade ago the act of an over-enterprising individual in trying to replace paired fuses simultaneously gave rise to the birth of the interlocking cut-out. Nowadays, it is not perhaps often necessary to stand at the top of a rickety step-ladder and nervously thread bare fuse wire and hold bare pliers in the one hand, the other member being in commission to preserve one's balance, but the risk of shock and burn is little if at all minimised, as the fuse holder is liable to be shattered, if the iron-clad, what-not-proof, switch happens to have an indefinite leak on a faulty pole. And, somehow, one cannot help feeling *afterwards* that short circuits, and once lightly considered "earths," possess grave potentialities for harm, especially when one sees such splendid shock-proof porcelain brought down just like so much candle grease.

Strangely discordant with electrical progress, the past year or so has witnessed the foisting on the market of a multitude of small switchgear bearing unmistakable evidence of inefficiency and yet presenting a prepossessing exterior. Commercial considerations would seem to be the principal operating cause of the demand for this admittedly cheap, but undesirable, line. Highly porous stone-ware insulation, pierced with screw-threaded holes, ungetatable and flimsy one-turn-thread terminals; fuse holders which require handling with one's handkerchief, and in which when inserted or withdrawn the porcelain bridge parts company with its contact clips —these are examples of this kind of accessory. One common pattern of fuse holder of which there are thousands in use, consists of a pot-ware tube having a frontal aperture and is described as a "safety" fuse holder. Again, a trough or channel-shaped piece of china ware, in which the fuse, *exposed*, reposes lengthwise is similarly labelled. Such devices are absolutely of no use, either utilitarian or aesthetic, and it would seem that the only reason for the existence of such freaks is an inexhaustible faith in cure-all porcelain.

The absurd idea of threading fuses through sinuous tunnelled paths, more or less contracted, while the terminals remain bare and exposed, is still worked. At this day one might not unreasonably expect a better knowledge of these details. A short time back the writer had occasion to handle in service a new type of safety fuse-holder. This was of the indicating variety, and consisted of a length of fibre tube fitted with removable brass-capped terminals, binding posts being at the extreme ends. Inside the tube there was a perforated china bobbin through which the fuse wire passed, the normal position of the suspended bobbin with fuse intact being opposite a small sight hole located centrally at the front of the tube. When the fuse ruptured the bobbin was supposed to fall by virtue of its own weight to the bottom of the tube, thus uncovering the sight hole and indicating a blown fuse. Unfortunately, oftener than not, it happened that the fuse would part either above or below the bobbin, owing, probably, to the inevitable weakening of the fuse wire at the point of attachment to the binding screws, and so although holding a blown fuse the bobbin remained in position indicating "good." Excepting that it was well made this example was nothing but a freak; the bare terminal caps were flush with the fibre tube, and very careful handling was necessary to avoid making contact at top or bottom with the metal fuse box. The operation of re-fusing was quite a business as the terminal caps had to be taken off the holder, the indicating bobbin withdrawn, and the holes cleared of blown metal, before inserting fresh fuse wire.

A useful and proper accessory, the common portable type of hand lamp, has of late been the cause of quite a number of disquieting accidents. This fitting is made up in almost countless forms, all professing to conform to the new regulations. Some are weird in shape, of wire labyrinth defying any photometric conclusion thereon; others remind one of the appanage of the old town crier. The construction appears to be first and foremost to render abstraction of the lamp proper the despair of thieves, but this advantage is considerably off-set by the necessity of having to dissect practically the whole thing in order to replace a faulty lamp. The vital part in all remains the same—the conventional B.S. lamp-holder with its attendant weaknesses and disadvantages. One might say a good deal critically, too, about the means of communication between lamp and plug connection. The latter is oftener than not a most reprehensible kind of fitting; and one views with some alarm the increasing vogue of the common wood-cased B.S. lamp-top form of adapter for use on portable circuits. The application of this type of accessory to highly inductive circuits, heavy heating devices, and the like, cannot be too strongly condemned. Quite recently the writer came across a modern power supply station, newly wired, the portable circuits of which were fitted up with ordinary batten lamp-holders. In absurd irony a number of hand lamps were in use for boiler cleaning, the flexible runs thereto being of steel-armoured cable (almost heavy enough for house services), and a few inches from the lamp-holder and the adapter plug the armouring had been cut away to allow of entry of the conductors, thus exposing the very thin coating of rubber insulation. Near at hand a one-horse-power portable air compressor was at work, plugged to an ordinary lamp-holder, the leads in this case being twin lamp flexible wire of a very poor quality, and as bearing evidence to its misbehaviour, every foot run or so wore a self-accusing bandage of tape. The adapter plug in this case was not itself visible, owing to a very complete encasement of insulating tape, which had been applied as a precautionary measure against the ill-effects of short circuits, of which experience was obviously not wanting.

Of recent years the tendency has been for an ever-increasing use of the bar blade or knife form of switch, and at the present time we find that this type, or some modification thereof, is generally accepted as a sort of standard for hand non-automatic gear. Otherwise possessing the qualities that go towards a simple and efficient design of switch, it is the exception to find an example fitted with a really safe hand shield or guard, notwithstanding that, in the Home Office rules and regulations it is provided that:—

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Clause 3.—Every switch, switch-fuse, circuit breaker and isolating link, shall be: (a) so constructed, placed, or protected, as to prevent danger; (b) so constructed, and adjusted, as accurately to make and maintain good contact; (c) *provided with an efficient handle, or other means of working, insulated from the system, and so arranged that the hand cannot inadvertently touch live metal;* (d) so constructed or arranged that it cannot accidentally fall or move into contact when left out of contact.

The closing of such a type of switch, with unprotected handle, on, say, a faulty heavy power circuit, would in all probability have (in fact, has had) disastrous results on the hand, at least, of the unfortunate operator. The provision of an efficient shield or guard, not merely to prevent contact with adjacent "live" metal, but effectually to protect the operator's person from injury at times of abnormal occurrences should be made compulsory. And with what ludicrous inconsistency one finds, too often, really splendid examples of first-class plant controlled by safety (save the mark!) switch gear, fool-proof, etc., etc., which wrecks itself when a fuse ruptures. The writer has had experience of more than one instance of plant ruined through failure of insufficient switch gear at a critical moment.

For one reason, owing to its superior mechanical qualities, at least as regards its ease of handling in manufacturing processes, the employment of fibre in its many guises appeals to makers of electrical apparatus, particularly switchgear. But fibre is very uncertain in its behaviour, and under work-a-day conditions warping or twisting sooner or later sets in, causing distortion of switch mountings. The necessary care is not always paid to proper selection of samples in assembly, due regard to "grain" or "run" being commonly neglected. Experience has proved, time and again, the unsuitability of this substance for electrical work; therefore, the discontinuance of the use of fibre for insulating electrical apparatus cannot be too sternly insisted upon.

The writer is far from condemning wholesale the employment of vulcanised fibre, as it has undeniably, many useful applications in electrical practice for which it is peculiarly suitable, being both cheap and easily fashioned. For insulating metal hand rails, and similar protective fencing for electric power supply stations, fibre tubing forms a safe and convenient covering; and for shields or guards for hand-operated switchgear, sheet or moulded fibre may be introduced where the presence of wood or other easily fired material would be quite inadmissible.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electricity Supply in London.

The following comparative figures will be cold comfort to those who find so much to abuse in everything connected with the supply of electricity in London.

In the London County Council analysis of accounts of companies and local authorities for the year ending December 31st, 1911 (or March 31st, 1912) the average prices are given as :—

Private lighting	3·43d.	per unit.
Street lighting	1·50d.	,,
Power and heat...	1·17d.	,,
Bulk supply	·97d.	,,
Traction supply	·73d.	,,

By applying these figures to units sold for different purposes in Continental towns for the same period, we obtain the average price which would have been received had London rates been charged. A comparison with the rates actually charged shows that in every case except one the consumers would have been grateful if they could have obtained their supply at London rates.

Town.	Average price at London rates, 1911-12.	Average price received, 1911-12.	Above or below London rates, 1911-12.
Amsterdam ...	1·614d.	1·412d.	− 12·5 %
Buda-Pesth ...	3·129d.	4·632d.	+ 48·0 %
Breslau ...	1·645d.	2·443d.	+ 48·5 %
Copenhagen ...	1·849d.	2·865d.	+ 54·9 %
Dresden ...	1·158d.	1·968d.	+ 70·0 %
Hamburg ...	1·274d.	2·951d.	+131·6 %
Leipsic ...	2·543d.	3·120d.	+ 22·7 %
Munich ...	1·429d.	2·137d.	+ 49·5 %
Vienna ...	1·575d.	2·544d.	+ 61·5 %

The usual fashion is to compare the average price received in the last completed year in some American city doing a big business in bulk or traction supply with the average price in London two or three years back. It all helps the argument that London suffers from high prices, but it is scarcely cricket. If anyone will add to the list given above, I hope they will see that the London rates they use are for the same year as that for which they have the figures for the other town, and also see that they have the units properly divided into their respective classes. "Lighting" often includes street lighting, "Power" frequently includes high-tension bulk supply and sometimes traction.

I am quite satisfied that London has nothing to fear from any such comparison with foreign towns, and the larger this list can be made, the better.

L. H. Hordern, *Manager,*
Westminster Electric Supply Corporation, Ltd.

London, S.W., *June 26th*, 1914.

Lightning and Trees.

Your article in the Review on June 26th contains much interesting information, but I cannot quite agree as to the immunity of the beech tree, or that it would be safe to shelter under this or any tree. I think that the comparative resistance of the wood has little if anything to do with its selection by a flash; if rain is falling, one or more streams of water run down the sides of the tree, forming a conductor, which is insufficient at the time of the discharge to carry off all the electricity, and, therefore, it becomes so suddenly converted into steam as to blow out the bark along the line; in this case the lightning passes outside and also along the boughs; but it may also enter the tree at the junction of some main branch with the stem, and partly descend by the sap, and in this case the trunk is splintered; generally these trees, which are found shattered, have been struck before the rain fell.

That discharge takes place from twigs and leaves is, I think, shown by sheep being killed which have been lying some distance from the trunk; after a storm in Stirlingshire I found that, out of a number killed, one sheep was lying almost outside the shelter area of the branches of a large tree. It, therefore, appears to be dangerous to shelter under the boughs of any tree.

The extraordinary evidence of the Wandsworth Common keeper, "that it was not dangerous to stand under trees if there was plenty of earth near the base of the trunk," shows the ignorance of the public, who ought to know better; but the little children who were killed had no means of learning about the risk, and I think that warning notices should be exhibited in all country and parish schools during the summer months and their significance explained by the teachers. The Electrical Review has done good service by publishing "Suggestions for dealing with electric shock," and if you would draw up simple rules showing "How not to get struck by lightning," you would give schoolmasters and employers of labour an opportunity of making the danger more generally known. I will conclude by offering the suggestions published in my book, "Modern Lightning Conductors" (London: Crosby Lockwood & Son, 1910), under the heading, "Where to Seek Safety in a Storm," as a nucleus for rules, and also any additional help that I could give.

Killingworth Hedges, M.I.E.E.,
Hon. Sec., L.R.C. (1905 *Report*).

London, *June 29th*.

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Hanover Square School of Electrical Engineering.

It has recently come to the knowledge of the undersigned that there is a desire on the part of several electrical engineers who received their technical training at the Hanover Square School of Electrical Engineering, to have an annual *réunion* where old ties could be renewed.

Such annual *réunion*, to accord with the natural inclination of most Englishmen, would probably take the form of an annual dinner which might be held in different parts of the country in successive years.

In order to place the matter on a proper footing, it will be necessary to form a Committee, and we suggest that any gentlemen willing to serve on such a Committee should send their names to one of the undersigned.

Frank J. Moffett, B.A., M.I.E.E.,
Union Chambers,
Temple Row, Birmingham.
Lancelot W. Wild, M.I.E.E.,
York Mansion,
York Street, London, S.W.

June 29th, 1914.

Timber Drying.

According to the extract from the *Melbourne Age*, page 1041 of your issue of June 19th, Australian blackwood boards 1 ft. wide, take four to five years to dry in the open, with a loss of 25 per cent. through warping. After a preliminary application of an electric current for eight hours, the air drying is reduced to four or five months, and the loss through warping, &c., reduced to 10 per cent.

The losses from warping could, however, be entirely eliminated without any preliminary treatment or any re-handling, by drying the boards in a moist air timber dryer. The circulation of moist air prevents warping, case-hardening or other injury, while drying the wood in about a fortnight, at very small expense.

The modified Nodon process of applying a slight current of electricity to wet wood, described on page 1049 of the same issue, is evidently very similar. The wood is first piled between jute blankets saturated with water, and subjected for one or two days to an electrical current; then taken out and stacked for drying in a position exposed to strong winds.

A strong electric current would admittedly crack or split the wood; so the current is limited to 150 ampere-hours at, say, 60 volts per cubic metre, or, say, a quarter of a unit of electricity per cubic foot of wood. The heat in this electric current is so small as to have no appreciable drying effect, so it appears very misleading to claim that "the time necessary for *drying* wood by the Nodon process varies from one to two full days." This actually is the time that the surfaces of the wood are soaked by contact with wet blankets, preliminary to restacking for air drying.

The results claimed for the Nodon process plus the subsequent drying appear to be precisely those achieved by drying alone, viz., the oxidation of the resiniferous materials in the sap, a molecular transformation of the cellulose, and a supression of destructive germs.

Electricity could be used as a drying agent in a moist air dryer; but it is much more usual to heat the air by steam, thus utilising all the latent heat. When steam is used to generate electric current, all the latent heat is necessarily lost, and, therefore, the drying of timber by electricity would involve prohibitive cost. It would not, however, involve the additional handling of the wood that is incurred in the Nodon process of passing an electrical current to wood placed between wet blankets, prior to restacking for drying.

Erith's Engineering Co., Ltd.

London, *June 25th*, 1914.

Geissler Tubes.

I should be very much obliged if either you or any of your readers could give me some information regarding the life of the different gases and electrodes which are inside the ordinary Geissler tubes, *i.e.*, how many hours such a tube may be worked before the gas or electrode is destroyed; and, further, what exactly becomes of the gas?

I understand that in the Moore tube, nitrogen or CO_2 gas has to be continually fed in—here, again, I should be glad if anyone could tell me what becomes of it, and what would happen if the gas supply were stopped?

Medico.

The Training of the Instrument Maker.

With reference to the letter which appeared in your "Correspondence" columns of June 26th, in regard to the training of the instrument maker, I would like to suggest a few points which I am sure would benefit both employers and employés as regards becoming good workmen and producing good workmanship.

For instance, if there were the opportunity of overcoming all the difficulties mentioned in Mr. Paul's letter, which would come the best off, after taking all expenses involved on the apprentice's side, and the wage he has to have for all his theory and practical training as a skilled instrument maker?

I suggest that favouritism should be abandoned, which is a great hindrance in most shops, and that energetic apprentices should be advanced to a higher rank according to their abilities, which not only would encourage the apprentices, but satisfy their employers.

Again, as there is so much competition in instruments and the making of them, I think it would be very difficult for one to attend a trade school and learn every method different firms have in the manufacture of instruments, &c. If they learnt, for example, A's method, B's, perhaps, would be much the same instrument, but a totally different method of manufacturing, so it is a case of "No man can serve two masters." I should like others interested in the above letter to bring this matter forward, looking on the employés' side, in addition to the employers', therefore to benefit the latter.

N. Ingleby.

June 29th, 1914.

LEGAL.

SENGHENYDD PROSECUTIONS.

According to the *Birmingham Daily Post* the summonses brought by the Home Office against the owners of the Lewis Merthyr Consolidated Collieries, and Mr. Edward Shaw, manager of the Universal Colliery, Senghenydd, for alleged breach of the Mines Regulations, were heard at Caerphilly on June 17th. There are 21 summonses in all. Of these, four are against the company and 17 against the manager, all being taken at the instance of Dr. Atkinson, Chief Divisional Inspector of Mines, and as the result of the Home Office inquiry into the cause of the disaster at the Universal Colliery in October last, when over 400 lives were lost.

Mr. Ivor Bowen, K.C., in opening the case for the Public Prosecutor, said the explosion caused the loss of 439 lives. In May, 1901, there was a previous explosion, which caused the death of 81 lives. Two exhaustive inquiries had been held into the cause of the present disaster, but no definite conclusion could be arrived at. The Court would be concerned with an investigation of a very different character. They would have to consider whether during the month preceding the explosion the mine was managed in conformity with the statutory law. The first summons was against Edward Shaw for neglecting to appoint in writing a person to examine the safety lamps. The defence was that the lampman was appointed 17 years ago, and was a competent person. He received a note stating the nature of the duties, but this had been lost.

The Bench decided to hear all the cases before giving their decision, and the hearing of the other summonses was deferred until July 14th.

WORKMEN'S COMPENSATION.

On Friday, in the Marylebone County Court, Ethel May Faber, 18 years, of 3, Golborne Gardens, North Kensington, was awarded £9 damages and costs for personal injuries, the defendants being the International Electric Co., telephone manufacturers, of 85, Gracechurch Street, E.C. It appeared that the plaintiff was employed at the company's works at Salusbury Road, Kilburn, being engaged at 7s. a week on a power press machine, which continued to work when the treadle was not being touched by the operator. On April 14th last, while the plaintiff was attending the machine, her left thumb was severely crushed by the descending press. It was alleged that the accident was due to the absence of a guard, and that this constituted legal negligence.

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Kenna v. Dublin United Tramways Co., Ltd.

At Dublin last week, before Mr. Justice Kenny and a special jury, John Kenna, a provision merchant, claimed £2,500 from defendants, for personal injuries alleged to have been caused by the negligence of the defendants and their servants in the control and management of a tramcar on February 1st. Plaintiff was on top of a car which went off the rails and crashed down upon the pavement. He was pitched into a heap of broken glass. Evidence as to injuries having been given, a police witness said that the driver attributed the accident to the failure of the points to set automatically.

According to a report in the *Dublin Daily Express*, Serjeant Sullivan said the accident was due to an occurrence which could not have been foreseen. In many places the tramway points were manipulated by an electric contrivance. The system had been well tried in many places, and until this night in Merrion Square it had never been known to fail. When the electrical point system failed for the first time in its history the driver committed an error of judgment, when he found himself on the wrong line, by slapping on his brakes, and it was this that caused the car to overturn.

Mr. George W. Harris, electrical engineer to the Tramways Co., stated that the points where the accident occurred were designed to make a straight run to Dalkey. The driver of the Donnybrook tramcars had a means of setting the points to enable him to take the turn, but they resumed their position automatically. He examined the points an hour after the accident, and found them in good order, and no repairs had been found necessary since. An evilly-disposed person could move the points in the wrong direction. He thought the accident was caused by the sudden application of the track brake. It was a company rule that such points should not be approached at a greater speed than two miles an hour.

Evidence was given to show that the car was proceeding at a moderate rate of speed.

The jury found for the plaintiff, and assessed damages at £550. A stay of execution for 14 days was granted.

Marconi and Marconi's Wireless Telegraph Co., Ltd., v. Helsby Wireless Telegraph Co., Ltd.

As mentioned in our last issue, Mr. Justice Eve and an Assessor commenced the hearing in the Chancery Division on June 24th of this action, claiming damages in respect of alleged infringement of letters patent. The infringement was denied.

Mr. Walter, K.C. (for the plaintiffs), said the patent was No. 7,777 of 1900. It formed the subject of an action heard some time before by Lord Parker, then Mr. Justice Parker, and it had now expired by effluxion of time. The defendants had manufactured and supplied wireless installations to four ships belonging to the London and North-Western Railway Co., and that was the matter complained of in that action. The defendants attacked the validity of the patent, and as far as the Marconi experts could see, they attacked it upon the same grounds as before, while as regarded infringement, the plaintiffs' expert witnesses could not see any distinction between what had been done by the defendants and what was done in the case before Lord Parker. The defendants, besides denying the infringement, alleged that the invention was not new; that it had been published in this country before the date of the letters patent; that it was not useful; and that the specifications did not sufficiently describe and ascertain the nature of the alleged invention, or in what manner it was to be performed.

Under the last head the defendants alleged:—

(*a*) No sufficient directions were given to determine the self-induction or the capacity of the aerial for the purpose of calculating the product of the self-induction multiplied by the capacity of the circuit containing the aerial in the transmitter and receiver.

(*b*) No sufficient directions were given whereby with the data appearing in the examples, the product of the self-induction multiplied by the capacity could be the same in each circuit.

(*c*) The specification failed to state or indicate whether the time period of the two circuits of the transmitter was to be made the same when the two circuits were considered separately or when coupled together as in use. Further, no sufficient directions were given whereby it could be ascertained whether equality in the time periods of the two circuits when the transmitter was in use had been attained.

(*d*) No sufficient directions were given as to the degree of couplings desirable between the two circuits of either the transmitter or the receiver.

(*e*) If it was contended that in order to get selective signalling the two circuits of the transformer in the transmitter were to be both lightly coupled, and to be tuned so that the time period of the oscillations in the two circuits was the same, no sufficient directions were given how it was to be carried into effect.

(*f*) No sufficient directions were given as to the length and disposal of the leads constituting the closed oscillation circuits or whereby their capacity and inductance might be calculated.

(*g*) No sufficient directions were given as to how the circuits were to be arranged or adjusted if the oscillations were to be harmonics of each other.

(*h*) If upon the true construction of the specification the use of an "auto-transformer" was comprehended in the first or any claim no sufficient or any directions were given how to carry the invention into effect when using such a device.

Counsel proceeded to deal in detail with the development of wireless telegraphy up to the present time. The judgment of Mr. Justice Parker given at the previous action referred to was also read.

Prof. Bertram Hopkinson sat as assessor and counsel. Engaged in the case were Mr. Walter, K.C., and Mr. Hunter Gray, for the plaintiffs; Mr. Courtney Terrell and Mr. Arthur Jaffe for the defendants.

Evidence was then called.

Mr. James Swinburne, examined by Mr. Hunter Gray, for the plaintiffs, said he had read the judgment of Mr. Justice Parker in the previous case, and agreed that it was a complete and full statement of the art of wireless telegraphy.

Counsel: Would you, in a few words, tell my Lord what you conceive, from the electrical point of view, to be the step which Marconi took, over what was done before, by his 1900 patent?—The step was having one circuit with a condenser, which he could charge up with a great deal of energy, and which could oscillate without being stopped much, as far as the circuit itself went, passing the energy of that gradually over into another circuit, which was a specially good radiator, and get the energy over in small portions to keep that radiator circuit going till the energy was all dissipated.

The words of the specification on page 3, at line 11, are:—"This device enables more energy to be imparted to the radiator than heretofore, the approximately closed circuit of the primary being a good conserver, and the open circuit of the secondary a good radiator of wave energy"?—Yes.

Do you know what the effect of the improvement of the Marconi 1900 device was over the 1896 one?—It increased the distance enormously. You may almost say the modern development of wireless telegraphy is due to it. I do not mean to say that every modern system infringes it, but it gave a start to wireless telegraphy.

I think you have visited one of the ships, the *Cambria*. Would you explain what is the operation there?

Witness did so, and Counsel continued: Does this system work in accordance with Marconi's 1900 specification?—Yes.

Counsel: You saw this in operation?—Yes.

Did it operate so as to have a closed circuit which conserved the energy and gave it out in small quantities to an open circuit which radiated the energy?—Yes.

Was it a device which enabled "more energy to be imparted to the radiator than heretofore, the approximately closed circuit of the primary being a good conserver, and the open circuit of the secondary a good radiator of wave energy"?—Yes, I think so, certainly; but it must be remembered that this was an established installation, and the capacity of the aerial was larger than it would have been in the time contemplated by the 7,777.

His Lordship: Is there any transformer?

Mr. Hunter Gray: There is an auto-transformer. (To witness): When you saw that apparatus was it tuning?—Yes.

Do you find the invention the subject of the patents described in any of the documents specified in the pleadings?—No.

It is suggested that the invention is not useful?—It certainly is useful, I think.

It is pleaded that the specification does not sufficiently describe and ascertain the nature of the invention, or in what manner it is to be performed. What do you say with regard to that?—I think it describes all that is necessary for an engineer to carry it out.

Mr. Terrell then cross-examined: In the case of Marconi's specification, you say that you get your radiator continually radiating a train of waves. And you get your oscillator continually going on oscillating all the time and making up for the losses as they are lost by the radiator?—Yes.

Then you get a series of waves slowly diminishing for your primary, and underneath you will have another series of waves that will be not quite in the same phase with these which would be going on all the time from your radiator?—Yes, that is the idea of Marconi.

That is the essential feature of Marconi's invention?—Yes.

Counsel put to Witness a wave train that had been worked out.

Witness said: The whole point is that the theoretical wave would have to put just as much energy each vibration into the secondary as the secondary sends out. If there is a difference of a quarter of a period in lag right through as the amplitude gets less, I think the proportion of radiation would alter, and you would tend to get out of step. I do not know if it makes any difference.

Supposing the conditions do not exactly fulfil that state of affairs, supposing the energy transferred from the primary to the secondary is rather too much for the secondary to radiate, and the secondary puts some of it back into the primary, and that sort of exchange goes on. There are different periods of oscillation going on in the primary?—I follow it.

You will not get from the aerial all one wave length right throughout?—No.

But whatever may occur in Marconi's actual example, you are satisfied that is the kind of thing he tells the engineer he wants?—That is what he wanted to get at; but, as a matter of fact, that needs generally a weaker coupling than is actually in practice used by Marconi. The practice is to have the circuits more coupled than that, and you do get a double wave.

I am not saying that if, as a matter of fact, you get a double hump wave in Marconi, that, therefore, Marconi's ideas are all wrong.—No; they are substantially right, only I do not know whether he knew of that fact; very likely he did not. It is a disturbing influence in the Marconi system.

You say that Marconi means loose coupling.—Witness: The question of the looseness of the coupling will depend on the nature of the aerial, whether the aerial is one that radiates much in proportion to its oscillation.

Referring to the presence of two wave-lengths in the secondary circuit in a given case, Counsel said: The coupling is 10·6 per cent

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In that case you get two humps?—I think you always find the two humps.

I understand the distance between the two humps is a measure of the coupling?—Yes, the less the coupling the nearer they come together.

So that, in all these Marconi examples, in carrying out the invention according to Marconi, you do not get the natural wave of the aerial emitted?—No.

You do get a state of affairs such that when you are sending out messages on one wave length, anybody who is tuned to the other peak of the curve will also receive the message?—Yes.

And you do not get your energy concentrated on to the wave length which you are sending out?—No, you do not get it at all in one wave length.

Will you take Lodge's specification No. 11,575* of 1897? Did you regard that as of great importance?—Yes.

The first thing that Lodge did was instead of taking the old aerial that Marconi and other people had been using, a tall aerial with a spark gap in it, he put inductance into it?—Yes.

Instead of having a heavy wave, he says the effect is that you will not get it rapidly damping down, but it will steadily swing till it comes to rest, and the length of wave will be approximately an equal amount?—That is the fact.

The point of Lodge was to get his material oscillating, leave it alone, and let it slow down till it died out, when he would make it oscillate again?—Yes.

Lodge wants to cut off the source of electricity as soon as you can?—He does, but he does not want, to use a modern expression, to quench an oscillatory spark. Lodge says he is going to use the impulsive rush. That goes back to Lodge's ideas on the question of lightning, and he explained in his paper on lightning that you could get a discharge by what he calls the impulsive rush. He was not considering the impulsive rush as an oscillatory discharge at all, simply as a sudden discharge.

Will you compare Lodge, fig. 4, with fig. 6, which is alleged to be the infringement. Surely, is it not that in fig. 6 you have got an apparatus for tuning, and in the fig. 4 you have not got it shown?—No, not only an apparatus for tuning in fig. 6, but the whole idea is absent from fig. 4; and you have got an aerial inductance in fig. 6, which will make the difficulty still greater.

Do you know what would be the effect of shorting the gaps in the infringement, and also the gaps in fig. 4—the charging gaps; that means putting a wire across them? Would it make it more, or less, like Marconi's?—It seems to me it is pretty much the same as Marconi's whichever way you take it.

I am going to show you the wave train that was produced by calculating the decrement. We took the decrement from the resonance curve, and plotted the wave train following the decrement, and this was the result obtained?—It looks all right to me.

In the last case you said the energy passing between the primary circuit and the radiator of Marconi was like that of a miser supporting a spendthrift son? Also, in that case, when talking of the Marconi circuit, the primary circuit, you said: "When it does discharge it will oscillate for a long time without much waste of energy. He uses that oscillating circuit to excite the antenna. He arranges his antenna to be of the same frequency so that it can be excited in the best way possible by this primary circuit, and by that means, though his antenna circuit is a circuit which cannot hold much energy to begin with, he keeps supplying it with energy as it gets used up?"—That is right.

Mr. James Swinburne was recalled and re-examined by Mr. Walter with regard to the inspection of the *Cambria*.

Counsel: I think in your presence the wave length was actually determined, was it not?—The measurement was taken with the wave meter.

It was 500 metres?—Yes.

You were also told at the time by Mr. Chambers that the coupling was 5 per cent.?—Yes.

And you were also told, you examined it yourself also, that the primary and secondary were tuned?—Yes.

Mr. Courtney Terrell: We admit the coupling was somewhere in the order of 5 per cent.

Mr. Walter: Does quenching mean damping?—No, not properly. If you have a circuit which has resistance in it, it will damp, the resistance will use up energy very quickly, and the oscillations will die down very quickly. What you want to do in quenching is another thing altogether. You want to quench the instant when all the energy has been put out of the primary into the secondary, and disconnect the primary completely at that instant; that instant is when the secondary has got practically the maximum energy into it, and the primary has nothing.

How many complete swings will there be with a 5 per cent. coupling?—You want, roughly, about 20 complete swings before the whole of the energy of 5 per cent. is taken into the secondary.

Mr. John St. Vincent Pletts then gave evidence.

Mr. Hunter Gray (examining): For many years you have devoted yourself to electricity, and its application to wireless telegraphy?—Yes, 15 years with the plaintiff company.

I think you were responsible for the installation of some of the earliest of the practical Marconi stations?—Yes. I was engaged on the erection of the first chain of wireless commercial stations in the world in 1900.

Have you worked out the tunes in the specification in suit in this action?—Yes.

First of all, with regard to the couplings, because that seems to be the important matter, what were the couplings which were less than 3 per cent.?—The couplings derived from tunes Nos. 2 and 4 were both very small—something less than 3 per cent. It is very difficult to determine these couplings with any degree of accuracy, when they are very small, on account of the two humps coming close together, and merging into one another.

Mr. Hunter Gray: You went down with Mr. Swinburne and Mr. Dugald Clerk and made the measurements which you are speaking of now, at the defendants' station?—Yes.

I think you have also reproduced the circuits which you tested at Chelmsford at the plaintiffs' works?—Yes, I reproduced them from the data I took on the ships.

Perhaps you had better tell my Lord, in your own words, what you did?—We inspected the apparatus and noted the general arrangement of the circuits, the way that the common and the external inductance was arranged, and then we took the resonance curve from the aerial, actually from the earth wire and the aerial, so that we found the wave length which the station was emitting. We varied the common inductance in order to see that the two circuits were in tune, and we found that they were quite well tuned, because if they were thrown a little bit out of tune, the lamp which was placed in the aerial circuit did not glow brightly, showing that there was a very small current in the aerial, instead of a comparatively large current, which was obtained when they were properly tuned.

Will you tell my Lord what this resonance curve indicates to you as regards the nature of the installation?—This resonance curve is only consistent with two loosely-coupled circuits or with two tightly-coupled circuits and a quenched spark.

Is it consistent with two loosely-coupled circuits and a quenched spark?—No, certainly not.

It has been said that damping is an alternative position. Is it consistent with two loosely-coupled circuits and excessive damping?—With excessive damping the curve in itself might, perhaps, be, but the amount of energy which could be radiated from the aerial would be purely negligible if the damping were so large that there was no interaction between the two circuits.

Was there any special damping means employed?—No, certainly there was not. It was an ordinary circuit with ordinarily good conductors in it, and three or four spark gaps.

Mr. Hunter Gray: Would these three or four spark gaps, without special means, give such damping as would be consistent with this curve?—With or without any means that I know, they would not give any such damping.

You have reproduced the installation at Chelmsford and tested it?—Yes. To my mind the curve we obtained at Holyhead, as I think I have said before, is only consistent with tight coupling and quenching, or with very loose coupling, and no quenching.

(To be continued.)

PARLIAMENTARY.

North Metropolitan Electric Power Bill.

On June 25th a Select Committee of the House of Commons, under the chairmanship of Mr. Hugh Law, considered this Bill. Among other things, the Bill gives the company power to use land at St. Albans for the erection of a generating station, and to take electric current in bulk from the Metropolitan Railway Co. and the London and North-Western Railway Co. Further, the Bill gives the company power to promote electric lighting provisional orders and to raise £250,000 additional capital.

Mr. Fitzgerald, K.C., who appeared for the L.C.C. in opposition to the Bill, urged that the project was of a novel character which would establish a precedent which might have very far reaching effects. The L.C.C., he pointed out, was empowered to take over the whole of the electric supply of London in 1931, and if the Bill was passed the present situation, which was already greatly complicated, would become more so.

Opposition was also made by Mr. Freeman, K.C., representing the existing electricity undertakings in London.

After some evidence had been given, the Chairman stated that the Committee had decided to approve the preamble of the Bill, subject to the proviso that the Bill should be modified so as to limit the powers conferred upon the promoters to the area in which they were at present supplying electrical energy, excluding any portion of the administrative area of the L.C.C. not at present supplied.

Swedish Water Power.—It is stated that the High Court at Stockholm has now given a decision in the action which has been proceeding for several years between the State and the Krongede Water Power Co., in regard to ownership rights of the Krongede falls. The decision is in favour of the company, and will enable the Svenska Emissions Aktie-Bolaget, which has a share capital of £659,000, to utilise the falls, which represent a total of 90,000 H.P. The emission company holds the majority of the shares in the water power company. It is impossible to foresee whether the power available will be used for railway purposes, but adequate possibilities of disposing of the production already exist in the saw mills and mines which are located in the vicinity of the falls.

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BUSINESS NOTES.

Trade Announcements.—MR. HERBERT J. HAWKINS, M.I.E.E., has taken offices at 42, Cheapside, London, E.C. Manufacturers are invited to send him catalogues and other literature applicable to central station requirements.

The telephone number of the ELECTRICAL CONTRACTS AND MAINTENANCE CO., LTD., Sanctuary House, Westminster, is now "Victoria 6757."

MR. G. BRAULIK, of 8, Lambeth Hill, London, E.C., asks us to announce to the trade that his business has now been reconstructed and put on a sound footing, and that the rumour that the business has been discontinued is absolutely unfounded; in fact, the business is now being conducted on up-to-date lines, and a large and well-assorted stock of all saleable goods is being kept.

Co-operative Purchasing in Germany. — The Einkaufs Vereinigung for electrotechnical articles of Frankfort-on-Main, which has a working capital of £17,300, reached a surplus of £22,000 in 1913-14, as compared with £11,900 in the preceding year. The creditors represented £53,000, whilst the debts owing at the end of the year amounted to £84,000. During the year the number of members increased by 69 to 197.

Trade in Colombia.—In the course of a report on possible openings for trade in Colombia, the Canadian Trade Commissioner for the Latin-American Republics, says:—One thing that, perhaps, militates against the extensive use of calcium carbide is the fact that Latin-Americans favour electric light, and consequently where cheap power can be furnished, lighting plants are being established, even in some of the smaller towns. Both American and Scandinavian carbide are being imported into Colombia, the latter being purchased through London. The price is about £15 per ton c.i.f. Puerto Colombia. Electrical material is imported from the United Kingdom and the United States. This trade is likely to be an increasing one, owing to the expansion of the mining industry and to the increase in electric lighting plants. The statistics show that the increase in imports of this material in 1912 over the previous year was about £15,000.

Electric Clocks.—MESSRS. GENT & CO., LTD., Leicester, report considerable activity in their electric clock department. Their "Pulsynetic" system installed on the *Aquitania* behaved very satisfactorily on the maiden voyage of the great liner. Similar installations are in progress for two C.P.R. boats now building, and also for a new liner for Patrick Henderson & Co. The Allan Line offices at Montreal are also being equipped. Among many other installations in hand are the following:—

Delhi Station, East Indian Railway.
Dominion Bank, Toronto (50 dials, mostly in marble cases).
Henry Birks & Son, Vancouver, B.C.
Large striking and chiming turret clock for new Grey Institute, Port Elizabeth, S.A.
Turret clock and 50 dials for Australia.
Astronomical clock for Odessa Observatory.
St. Mary's Church, Northampton, four-dial turret clock.
Ardol, Ltd., Selby.
De Montfort Public Hall, Leicester, four-dial hanging clock
Children's Hospital, Leicester.
Watson Laidlaw, Glasgow, 20 dials and time bells.
Glasgow Corporation Tramways.
Aberdeen Station, N.B. & Caledonian Railways.
St. George's School, Glasgow, turret clock with chiming gear, &c.
Edinburgh Evening News, 17 dials.
Academical Club, Glasgow.
Newton Abbot Secondary Schools.
Oxford County Asylum.

Annual Outings and Sports.—MESSRS. SIEMENS'S Tantalum and Wotan Lamp Manufacturing Department (Dalston) held their annual outing on Saturday last, when over 400 employés travelled by special train to Hastings. The company left London Bridge about 7 a.m., and was favoured with glorious weather. As in previous years, the firm bore the cost of travelling, thus leaving the individual members of the party free to make their own arrangements as to catering and entertainment. Mr. A. M. Hicks, who acted as secretary, organised the event to the complete satisfaction of all concerned. Mr. Le Marechal, the genial works manager, accompanied the party, and in conjunction with the secretary, spared no effort to ensure for those present a most enjoyable day's outing.

We are pleased to learn that the annual athletic sports held in connection with the firm of MESSRS. CROMPTON & CO., LTD., on Saturday, June 20th, were an unqualified success. The excellent ground possessed by the club at Wood Street was in perfect condition, and it is looked upon as one of the best sports field belonging to any works in the Eastern Counties. In previous years the races had been confined to employés at the Arc Works, but this year the committee arranged three open events, and these received a large entry, and some well-known riders and runners competed. It was gratifying to the club, however, that their 100 yards champion, J. R. Tucker, won the 100 yards open event off the 6½ yards mark. The Silver Cup now becomes Tucker's absolute property, he having won the Championship for the past three years. The races were carried through without a hitch, and proved very interesting to the large number of people present, and the other most notable feature of the meeting was the defeat of Mr. E. H. Barnes, who had held the Mile Championship for the past five years. He was defeated by a very promising miler in Mr. R. H. Holboche. The Arc Works Silver Prize Band, which is proving a valuable asset to the club, enlivened the proceedings by playing some very fine selections under the conductorship of Mr. W. Hall. At the conclusion of the sports, the prizes were distributed by Mrs. Tufnell, wife of Mr. Carleton F. Tufnell, president to the club, and chairman of the company; others present were Mr. E. Reeves, managing director, with Mrs. Reeves, Mr. T. Britton, manager, Mr. and Mrs. H. Pensabene, Mr. and Mrs. H. J. Fell, Mr. P. Morgan, together with the chiefs of the departments at the works. A good party from the London office also attended, including Mr. A. E. Mohring. In the evening a fete was held, and a highly successful function was brought to a close by a grand display of fireworks. The arrangements were carried out by a most enthusiastic committee under the secretaryship of Mr. P. G. Cheverton.

On Saturday morning last, over 600 of the employés from the Witton Works of the GENERAL ELECTRIC CO., LTD., travelled by special train to Bournemouth on the occasion of the annual works outing. Favoured with beautiful weather, they spent an exceedingly enjoyable time, and did not return home until the early hours of Sunday. Owing to the difficulty of finding accommodation for lunching so large a party, the largest skating rink in the town was required. Lunch and tea were partaken of here under the chairmanship of Dr. Railing.

The seventh annual outing of ELECTRICAL INSTALLATIONS, LTD., took place on Saturday, June 20th, the party dividing themselves into two sections. About 30 left Cannon Street, E.C., by char-à-banc at 7.30 a.m., for Hastings, arriving just before one o'clock, and the remainder went by train to Southend-on-Sea. The weather was all that could be desired. The Southend party went for a brake ride round the country during the afternoon, and other pastimes, such as swimming and boating, were indulged in by both parties. The char-à-banc portion left for home about 5.30, arriving safely soon after 11.

Dissolutions and Liquidations.—THE UNIVERSAL BELTING CO., LTD.—This company is winding-up voluntarily, with Mr. J. A. Ashley, of 75, Currier Lane, Ashton-under-Lyne, as liquidator. A meeting of creditors is called for July 8th, at 8, St. James' Square, Manchester.

UITENHAGE ELECTRIC LIGHT AND POWER CO., LTD.—This company is winding-up voluntarily, with Mr. E. West, of 71A, Queen Victoria Street, E.C., as liquidator. A meeting of creditors is called for July 13th.

RUSHMORE LAMPS, LTD. (old company).—A meeting will be held at 27, Southampton Street, Strand, W.C., to hear an account of the winding-up from the liquidator, Mr. G. H. Cobley.

THE ROSSENDALE BELTING CO., LTD., Manchester.—Liquidator (Mr. E. D. Symond, Official Receiver) released June 12th.

GARRETT, HARTLEY & CO., LTD., electrical engineers, Morena Street Works, Morena Street, Catford, S.E.—Under a compulsory winding-up order made recently, the statutory first meetings of the creditors and shareholders were held on Monday, at the Carey Street offices of the Board of Trade, Lincoln's Inn, W.C. Proofs of debt were tendered as follows:—

John Russell & Co., Ltd.	£34
Sun Electrical Co.	100
Accles & Pollock, Ltd.	120
Watts, Fincham & Co.	21
Hartley, S.	345

The Chairman reported that the company was promoted only a year ago, with a nominal capital of £1,500, and Mr. Garrett had been carrying on the business of an electrical engineer for some little time; he had spent his capital in experiments, and on advertising for a partner, he was met by Mr. Hartley, who was willing to put £750 into the business. It was deemed best to convert the business into a limited company, which was to acquire the whole concern for £750, but the arrangement was entirely muddled, and Mr. Garrett was allotted 750 fully paid shares of £1 each, whilst Mr. Hartley received £350 in debentures and £400 in fully paid shares. He paid the money, or most of it, to Mr. Garrett; some question would doubtless arise as to the validity of his debenture holding, and if Mr. Hartley wished to evade responsibility for the bungling he would have to make an application for directions by the Court. It was stated that Mr. Hartley paid £500 cash to Mr. Garrett prior to the promotion, and £250 at the date of registration. Mr. Garrett had asserted that he spent the £500 in paying off the debts of the old business, and the £250 was used as working capital for the company. The gross turnover of the business appeared to have been just over £2,000 during the 11 months of its existence, and after charging £3 weekly for the vendors' salaries, a net profit of £193 was returned. The company's business consisted almost entirely of electric installation work for cinema theatres. Two contracts were running at the date of the winding-up order, but they had been terminated, and it was improbable that anything would be recovered therefrom for the benefit of the creditors and shareholders. The plant and machinery at the Catford works had been sold for £160, and book debts to the face value of £245 had to be collected. The liabilities were estimated at £616, exclusive of the debenture-holders' claims, which would in all probability absorb all the assets. By general consent the liquidation was left in the hands of the Official Receiver.

THE BRITISH POWER CO., LTD.—A meeting of creditors is called for July 9th, at 34, Coleman Street, E.C., by the liquidator, Mr. T. W. Holland.

Catalogues and Lists.—MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—Pamphlet No. 546 (12 pages) gives illustrated particulars and prices of electric fans, sewing machine motors, small motor-generators for accumulator charging, polishing and buffing motors, and centrifugal fans. The range of fans extends from 10 in. diameter desk fan up to fans with box blades 4 ft. in diameter.

MESSRS. ISENTHAL & CO., Denzil Works, Neasden, N.W.—12-page pamphlet containing a full description of their "Grid"

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type electrolytic rectifier for A.C. to C.C. This is the firm's latest form. Prices, dimensions, &c., are tabulated.

Messrs. Baxter & Caunter, Ltd., 219, Tottenham Court Road, London, W.C.—List of tabulated prices and other particulars of Aero table, desk and bracket ventilating fans for D.C. and A.C. also porthole type fans.

The British Thomson-Houston Co., Ltd., Rugby.—Price list No. 4,505 (12 pages) deals in the firm's usual illustrated and detailed manner with the B.T.H. aluminium lightning arresters for A.C. circuits. Price list No. 2,532 describes and gives prices, &c., of their pressed steel gear cases for tramway motors, which have been subjected to extensive tramway tests, and are now being placed on the market.

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, London, E.C.—Illustrated price list No. 384, for contractors' use, of electric lanterns for half-watt lamps, the designs being suitable for shop front, street and general outside lighting, and for large interiors.

Messrs. Edison Accumulators, Ltd., 2 and 3, Duke Street, Piccadilly, London.—New catalogue of 32 pages, giving illustrations as well as a great deal of information, including abridged specifications in tabular form, regarding their commercial electric vehicles, as supplied to various well-known stores and other business houses, also particulars relating to their operation and actual running costs. Edison accumulator industrial trucks are also included.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, London, E.—Section I Catalogue (No. 33), of 96 pages, containing a large amount of well-arranged and finely illustrated material describing a great variety of telegraph instruments—single needle instruments, sounders and pole changers, keys, relays, lightning protectors, galvanometers, detectors, resistances, condensers, vibrators, switches and commutators, Morse inking apparatus, Wheatstone apparatus and repeater and quadruplex sets. Prices are clearly shown.

Messrs. Boving & Co., Ltd., Union Court, Old Broad Street, London, E.C.—Small pamphlet of 32 pages containing descriptive and tabulated information relating to their standard low-lift Victoria turbo pumps up to 21-in. discharge. These pumps are now being used by the Indian, Egyptian and Soudanese Governments, the London County Council, and many Colonial and other municipalities.

Messrs. Alley & MacLellan, Ltd., Sentinel Works, Polmadie, Glasgow.—Well-bound catalogue of 160 pages, containing exhaustive particulars and excellent pictures of their "Sentinel" air compressors. It gives dimensions, weights, prices and full particulars, of air compressors of capacities from 25 to 25,000 ft. of free air per minute. In addition to this, it includes in the articles on air piping, air lift pumping, compressed air forge hammers, drying air, cooling air, &c., a large volume of practical data accumulated during the sale of over 2,000 "Sentinel" compressors. The firm have endeavoured in this catalogue to give practical, rather than theoretical data, making it more valuable to the practical man than the ordinary text books. Copies of the catalogue will be forwarded on application.

The Ostro Light Co., Ltd, 11, Queen Victoria Street, London, E.C.—Two illustrated lists: one, of 16 pages, gives prices and other information in table form respecting table, oscillating, cabin, ceiling, porthole and other types of electric fans; the other (No. 67) is a 24-page list of electric time and automatic switches and automatic switchgear.

Photography with Half-Watt Lamps. — The General Electric Co., Ltd., has sent us a copy of a booklet dealing with photography by Osram half-watt lamps, which explains in simple language how the best results can be obtained in portraiture. The half-watt lamp lends itself admirably to studio lighting, and it is found that quite short exposures suffice; the cost of energy is small, and the lamps need no attention. A great deal depends upon the proper arrangement of reflectors, and directions are given showing how these should be disposed; suitable G.E.C. reflector fittings are also illustrated. An important feature of the illumination is its similarity to daylight; this is emphasised in a letter to the *British Journal of Photography*, by a professional photographer, Mr. A. L. Jones, who finds the light very satisfactory in this respect; he points out also that while he did not care for the results obtained with direct illumination, completely indirect lighting proved more rapid than direct, and he has used this system constantly, for over 1,000 negatives. The 3,000-C.P. lamp is the best for the purpose. The light is also suitable for printing daylight papers. Excellent examples of portraiture with the Osram half-watt lamp are given in the booklet, which can be obtained by application to the company.

For Sale.—Leeds Electric Lighting Department have for disposal boilers, engines, alternator, pumps, pipes, &c., particulars of which are given in our advertisement pages to-day.

Bankruptcy Proceedings. — Mr. George Philip Malcolm Lee, electrical and marine engineer, 39, Victoria Street, Westminster, S.W.—The first meeting of creditors was held on Tuesday at the London Bankruptcy Court under a receiving order. Mr. F. C. Garton, Official Receiver, reported that it appeared from the debtor's statements that in October, 1910, he joined in partnership Mr. H. A. Harvey. They subsequently transferred their business to a company registered as H. A. Harvey & Co., Ltd., with a nominal capital of £60,000. As vendors they each received the Governor's share, 2,200 £1 preference and 12,000 1s. ordinary shares in the company. The debtor, in addition, was appointed chief engineer to the company at a salary of £550 per annum, which he enjoyed until the concern went into liquidation in May, 1913. He had also acted as director of other companies, and he attributed his failure to liabilities accepted in that capacity. The accounts showed liabilities £1,015, and assets consisting almost entirely of shares of uncertain value. In the absence of any offer, the case was left in the hands of the Official Receiver, to be wound up in the ordinary course of bankruptcy.

LIGHTING and POWER NOTES.

Aberdovey.—Proposed E.L.—The U.D.C. is communicating with the Charity Commissioners in connection with the use of water-power at Dolgach, for the purpose of supplying electricity to Aberdovey and Towyn.

Ardsley and Wombwell.—Lighting Scheme.—The Electrical Distribution of Yorkshire, Ltd., which has powers to supply electricity for lighting purposes in Ardsley and Wombwell, will be in a position to commence the supply about the beginning of August.

Argentina.—The Rosario City Council has authorised the municipality to draw up a specification and to call for tenders for public electric lighting. No restrictions are to be made in the present specification, as was the case in the last, which prevented several firms from tendering.

Concessions for electricity works have been granted to Messrs. Barberis Hermanos, at Sastre (Santa Fe), to Messrs. Orechia and Ratti, at Olivo (Cordoba), and to Messrs. Rufino Duque & Co., at Magdalena and Atalaya (Buenos Ayres).—*Review of the River Plate.*

Basingstoke.—E.L. Scheme.—Messrs. Johnson and Phillips, Ltd., have commenced laying mains in connection with the municipal E.L. scheme.

Belfast.—Year's Working.—There was a gross profit of £37,896 on the Corporation electricity undertaking for the year ended March 31st last, and a net balance of £12,798, compared with £13,175 in the previous year.

Blackpool.—Decorative Lighting.—The Electricity Committee has decided to illuminate the promenade and Princess Parade with vari-coloured electric lighting, including an electrically illuminated fountain, during the latter part of the summer season.

Owing to the bursting of the main steam valve at the electricity works on Monday last week, the supply of electricity was stopped for three-quarters of an hour.

Burnley.—Annual Report.—The report of the borough electrical engineer, Mr. James E. Starkie, on the past year's working of the Corporation electricity department states that the units sold totalled 5,399,113, including lighting, 1,090,678; power and heating, 600,673; and tramways, 3,707,672; against a total of 4,534,939 in the previous year. The net income amounted to £34,921, against £29,751, and working costs were £19,117, against £13,752. Of the net profit of £7,636, £5,550 was allocated to the relief of the rates, against £4,500 in the preceding year, and £2,087, against £3,426, to the reserve fund, which now stands at £25,026. The works costs per unit was 0·494d., and the gross cost, 1·212d. A H.T. alternating current supply is about to be introduced. Mr. Starkie states that the present station can only accommodate another 2,000-KW. set after the present extensions are completed, and is of opinion that a new station will be necessary in the near future.

Bury.—Annual Report.—In his report for the year ended March 31st, 1914, Mr. S. J. Watson, manager of the Corporation electricity department, states that the total output was 7,001,015 units, compared with 5,076,634 in the preceding year. The total includes power and lighting 4,096,041, against 2,936,804; tramways 1,604,603, against 1,370,266; and private lighting 622,239, against 548,181 units. Public lighting decreased from 77,976 units to 72,342. The average load factor was 25·9 per cent, against 22·4 per cent. There are 65 hired motors, equal to 648 H.P., and 641 privately-owned motors, equal to 4,337 H.P. connected. The total average price per unit was 0·95d., while the generating cost per unit was 0·47d. There was a gross profit on the year of £14,054, against £10,577. Interest and sinking fund absorbs £11,869, leaving a net profit of £2,185. During the year £7,182 was expended on new mains, services and transformers, and £1,593 on the Chamber Hall power station. The reserve fund now stands at £9,103.

Continental Notes.—Norway.—The Akershus County Council has decided to purchase the Raansasfos waterfall, on the Glommen. The total cost was £58,300, and the Council has been authorised to take up a loan of £63,000 for the payment of the same. A Commission has been appointed to consider the most profitable manner in which the electrical energy can be utilised and distributed.

Austria.—According to the *Financial News*, the Brunn Municipality has obtained a 4,300,000 crowns loan, with the object of acquiring the majority of the shares in the electric company in the town.

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Coventry.—The E.L. Committee has considered an application from the Daimler Motor Co. for a further supply of electricity in bulk, and has submitted terms.

Crook.—Proposed E.L.—The Ratepayers' Association has approached the Electric Distribution Co. in connection with an E.L. scheme, and the company has offered to lay a main through the town. Messrs. Pease & Partners have for some years electrically lighted certain districts and property by arrangement with the U.D.C.

Dundalk.—Loan Sanction.—The L.G.B. has sanctioned the application of the U.D.C. for a loan of £21,000 for the extension of the electricity works necessary to supply the locomotive sheds and premises of the Great Northern Railway Co. (I.). A 15 years' agreement has been sealed with the Railway Co., the estimated annual consumption being about 800,000 units. The extensions will be commenced at once.

Durham.—Colliery Electrification.—We understand that Messrs. Thomas Hedley & Bros., owners of the Craghead and South Moor Collieries, Chester-le-Street, have decided to electrify their group of collieries, and at the outset will install one, or probably two, 750-kw. mixed-pressure turbo-generators and underground pumps, together with electrical haulage. The scheme will be carried out to the designs of Mr. W. C. Mountain, who is also engaged upon a 750-kw. steam turbine plant at the Waleswood Colliery of Messrs. Skinner & Holford, Ltd. At this colliery a ventilating fan, large steam-driven air-compressors, and other machinery, are being installed. For the Sacriston Pit, Plawsworth, of the Charlaw and Sacriston Collieries Co., Mr. Mountain has an extension to the exhaust-steam turbine plant in hand.

Eastbourne.—L.G.B. Inquiry. — Mr. H. R. Hooper held an inquiry last week into the application of the T.C. for sanction to a loan of £4,656, for the extension of the electricity undertaking. During the inquiry the amount was reduced to £4,000, and the odd £656 is to be raised out of revenue.

Eye (Suffolk).—Prov. Order.—The U.D.C. has been officially informed that the application of the Gas and Electricity Co. for a prov. order for E.L. will not be proceeded with. The chairman and the clerk, on June 26th, visited the B. of T. offices and discussed the question of electricity supply for the town; a report will be presented in due course.

Finchley. — Annual Report. — The report of the borough electrical engineer on the past year's working of the electricity undertaking, states that it was a record in almost every respect. The income exceeded £20,000, and the working expenses decreased by about £500, compared with the previous year. The cost of production was 1·548d. per unit sold, against 1·577d. The units sold increased by 195,000, of which 60,000 were for power purposes. The gross profit was £12,033, and after paying interest charges, £3,642, and loan charges, £5,957, there was a net balance of £2,422, which, with £3,501 brought forward, was carried to the appropriation account. An oil engine set, costing £4,925, was installed during the year.

Frodsham.—Electrical Pumping.—The Joint Water Committee has decided to introduce electrical power for pumping water and to install the necessary plant as early as possible. It is estimated that the annual cost of pumping by electricity will be £40 cheaper than by gas.

Grimsby. — Workhouse Lighting. — The Lighting Committee has decided to extend the mains, at a cost of £60, in order to supply current to the workhouse.

Halifax.—New Charges.—The Tramways and Electricity Committee has extended the existing scale of charges for electricity for power purposes as follows:—In any quarter when the units consumed per H.P. demanded are 550 and under 750, ¾d. per unit; in any quarter when the units consumed per H.P. demanded are 750 and upwards at rates to be approved by the Committee.

Year's Working.—A profit of £10,698 was made on the working of the Corporation electricity undertaking for the year ended March 31st last.

Hoylake and West Kirby.—Year's Working.—The net profit on the U.D.C.'s undertaking for the year ended March 31st last was £360, and the available balance now amounts to £2,142.

Walsall.—Mr. E. M. Lacey has been retained by the T.C. to prepare the necessary plans and specifications in connection with the scheme for the extension of the electricity works.

Keighley.—Annual Report.—As last year, the report of Mr. Webber, the borough electrical engineer, contains much information in readable form relative to the rapid progress being made in electrical matters in his town. In particular a comparison is made between 1914 and 1910, it being during this period that electricity at cheap rates has been available in the town. In 1910 rather over a million units were sold, including 612,000 for motor driving; the average revenue obtained was 1·69d. per unit, and the total working and financial cost was 1·73d., thus showing a deficit on the year. In 1914 some 4,325,000 units were sold, including 3,664,000 power units; the average price fell to ·87d. per unit, but the "all in" cost fell to ·79d. per unit, thus showing a profit of £1,304 on the year, and vindicating the policy of the engineer and Committee in providing cheap units for the power requirements of the numerous works in the district. The load during the year was taken by the turbine plant in connection with which a water tower, holding 150,000 gallons, has been erected to safeguard the condensing plant. One 2,000-kw. and two 1,000-kw. turbines are installed, and Mr. Webber has advised that a further 4,000-kw. turbine unit should be installed for next winter, although the matter has been deferred by the T.C. Some 15 high-tension and 28 low-tension supplies are given to large power consumers on five or 10-year agreements, and exclusive of traction, some 4,060 H.P. of motors are connected to the mains. In addition to the local mill and traction requirements, the department is now supplying the neighbouring town of Bingley, and negotiations are on hand for supplying the outlying D.C.'s of Haworth, Oakworth and Oxenhope, for which districts E.L. provisional orders are being applied for.

London.—Bethnal Green.—The B.C. has, on the recommendation of Sir John Snell, appointed Mr. Harold W. Couzens, as consulting engineer in connection with its electricity scheme, at a fee of £5 per cent. on the capital cost, excluding the cost of land and buildings.

Southwark.—The B.C. has decided to take up at once a loan of £10,087 from the L.C.C. for electricity purposes, and also one of £1,200 for the acquisition of property for the extension of the Penrose Street generating station.

Marylebone.—The Finance Committee has recommended the L.C.C. to sanction the application of the St. Marylebone B.C. for a loan of £5,524 for electrical plant.

Margate.—The Entertainments Committee has decided to have the Queen's bandstand and grounds illuminated by electricity.

Newmarket.—Proposed Workhouse Lighting.—The B. of G. has referred to a committee a communication from Mr. F. A. Simpson, of the electricity works, asking for permission to submit an estimate for wiring the workhouse for E.L. The Board desires to obtain Mr. Simpson's terms.

Nelson.—Bulk Supply.—The T.C. has renewed the agreement with the Brierfield U.D.C., for a bulk supply of electricity to the latter for seven years, from July 1st, 1914.

Nuneaton.—Loan Sanction.—The T.C. has received sanction to borrow £7,000 for the purposes of the electricity undertaking, including £5,000 for plant, £1,500 for mains and services, and £500 for other extensions.

The Council last week considered the question of supplying current in the Stockingford district, and the matter was again deferred.

Port Glasgow.—Proposed New Station.—The Clyde Shipbuilding and Engineering Co. has decided to erect an electricity station, and plans have been approved by the local authority.

Redruth.—Street Lighting.—The Lighting Committee has recommended the U.D.C. to accept the terms of the E.S. Co. for public lighting, subject to new lamps being erected free at distances not exceeding 100 yards, in the extended residential area of the town, and maintained by the company at £2 4s. each per annum.

Salford.—New Rates.—The Electricity Committee has approved various new charges for electricity, to come into force in October next. For lighting it is proposed to charge flat rates of 3½d. per unit in Salford, and 4d. in Prestwich. For power a sliding scale ranging from 2d. to ·9d. per unit, according to quantity, and an alternative of £5 per kw. demand per annum, and ½d. per unit are proposed. New contract rates under 10-year agreements, provide for maximum demands between 25 and 200 kw., with charges varying from £4 10s. per kw. demand, plus ·3d. per unit, to £3 10s. plus ·25d. per unit. Special lighting rates to power consumers vary from 3d. to 1½d. per unit. Supplies in the Prestwich area are charged 12½ per cent. extra.

South Africa.—The Robertson (Cape Province) Municipal Council has been authorised to borrow £10,000 for an electricity installation.—*African World.*

Tasmania.—The Government has signed a contract for the purchase of the Hydro-Electric Co.'s works at Great Lake. The contract is to be submitted to shareholders of the company for approval, and will then have to be ratified by Parliament.

Torpoint.—Proposed E.L.—The E.L. question was again discussed by the U.D.C. on June 25th, when it rescinded the former resolution, which held that the E.L. Co. had withdrawn from the agreement, and desired to renew the contract with the company in its entirety, subject to a guarantee of £100 instead of £50, as formerly. A member gave notice that at the next meeting he should move that this resolution be rescinded!

Truro.—E.L. Scheme.—The T.C. having decided in favour of Dr. Purves's scheme for E.L. in the town, application is to be made to the L.G.B. for sanction to a loan of £10,000 for the undertaking, and tenders for plant, mains, &c., are to be invited.

Whitstable.—Sewage Pumping.—The U.D.C. has received the consent of the L.G.B. to an agreement with the E.L. Co. for electrical pumping at the sewage works.

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Willesden.—PROPOSED LOANS.—The Electricity Committee has received a letter from the L.G.B. suggesting that it would be preferable to meet expenditure on meters out of revenue, rather than by loans. The Committee concurs, and has paid out of revenue £2,574 for meters, but the undertaking is making such progress that it is deemed desirable to take up a loan, although for a short period only. The Committee accordingly recommends the U.D.C. to request the Board to sanction a loan of £2,000.

The Committee also recommends that application be made for sanction to a loan of £25,000, including building, £170; machinery, £1,000; mains, £15,000; services, £5,000; public lighting, £330; meters and indicators, £3,500. The electrical engineer is of opinion that it will soon be necessary to extend the mains in the Cricklewood district, involving an expenditure of about £6,000.

The B. of. G. has received a letter from the L.G.B. suggesting that it should terminate its agreement with the Council for the supply of electricity to the workhouse infirmary, on the ground that, having abandoned its own generating plant, the Guardians had lost the benefit of the exhaust steam therefrom, involving an additional expenditure of £400 per annum. The chairman of the Electricity Committee, together with the clerk and the electrical engineer, have interviewed the Guardians on the subject, and discussed the question of using the plant at the infirmary for a stand-by supply. The Committee has considered a report of the electrical engineer on the matter, but before taking further action, proposes that he should interview the Engineering Inspector of the L.G.B., with a view to a further inquiry being held by him, at which the Council may be represented.

The Electricity Committee recommends the substitution of new flame arc lamps for those of the open type in four roads.

TRAMWAY and RAILWAY NOTES.

Australia.—The South Melbourne (Vic.) Council has decided to construct an electric tramways system from Princes Bridge, through South Melbourne, to Middle Park, at a cost of £64,000.—*Australian Mining Standard.*

Bradford.—YEAR'S WORKING.—Compared with the preceding year, the profit of the Corporation's tramway department for the year ended April 30th last, decreased from £41,900 to £29,500. The total revenue was £305,700, an increase of £17,500, and the car-mileage was 6,206,000, against 5,930,000. Working expenses increased as follows:—Track renewals, £3,000; car renewals, £10 500; wages, £7,000. Energy cost £50,000, or just under 2d. per car-mile. Interest and sinking fund charges amounted £52,000, and £10,000 against £17,000 in the previous year, was allocated to rate relief. The reserve fund now stands at £73,000. The railless traction system at Dudley Hill showed a loss of £414, against £380, and the parcels department showed a profit of £850, against £1,060.

Continental Notes.—FRANCE.—A writer in the *Revue Industrielle* on the subject of the electrification of the railways in France, details the lines that have been converted, those that are in course of construction, and those that are under consideration, summing up the particulars with the remark that they show France to be only making slow progress with railway electrification.

So far as the French State Railways are concerned, the electric lines now in operation include:—Paris-Invalides to Perpigan, 10 km.; Paris to Auteuil, and Champs de Mars, 14 km.; Paris to Versailles, 26 km.; St. Cloud to Etang-la-Ville, 16 km.; Paris to St. Germain, 23 km.; and Asnieres to Argenteuil, 5 km.; a total of 94 km. (59 miles).

The Paris, Lyons and Mediterranean Co. has in operation a line between Le Fayet, Chamonix and Vallorcine, 36 km.; the Orleans Co., the Paris-Juvisy line, 23 km.; and the Midi Co., the Perpigan-Bourg Madam line, 103 km. and others from Montrejeau to Luchon, 36 km.; from Lannemezan to Arreau, 26 km.; from Tarbes to Bagnere-de-Bigorre, 22 km.; from Montrejeau to Pau, 112 km.; from Lourds to Pierrefitte, 21 km.; from Pau to Bedous, 60 km.; and from Buzy to Laruns, 19 km. It will be seen from the foregoing that the Midi Co. has shown the greatest enterprise in connection with railway electrification in France, for out of the 560 km. (350 miles) open, no less than 399 km. (249 miles) are on the Midi system.

At the present time, 155 km. of new electric railways are in course of construction, viz., Auch-Lannemezan, 38 km.; Castelnau-Magnoac-Tarbes, 52 km.; Arreau-St. Lary, 11 km.; and Hagetmau-Pau, 54 km. A further 128 km. (80 miles) of electric railways are awaiting Government sanction before the work of construction is taken in hand, viz, Quillan-Belesta, 26 km.; Villefranche-Vernet les Bains-Sahorre, 9 km.; Montlouis la Cabanasse-Quillan, 87 km.; and Bourg Madam to the Spanish frontier, 6 km.

GERMANY.—ELECTRIC VEHICLES.—According to the Census of Production lately issued by the German Government, 291 private, and 122 industrial, electrically-propelled motor vehicles were constructed in that country during the year 1912.

The authorisation certificate for the proposed underground and elevated electric railway between Gesundbrunnen and Neukolln, Berlin, has been granted to the A.E.G. According to the certificate, the railway is to be of the elevated type for a distance of '97 mile in the north, whilst the length to be built in tunnel is 4·8 miles, and is to be completed by September 30th, 1918, under a penalty of £10,000 for any delay. A penalty of up to £5,000 is also provided for in the event of the working of a line being interrupted or suspended without sufficient reason. The speed is not to exceed 31 miles an hour. The fares can be fixed by the company for five years after the opening of the railway, but after that period the supervising authorities will have the right of settling the maximum fares.

Dundee.—PROPOSED TRAMWAY PURCHASE.—A Special Committee of the T.C. has agreed to offer £8,500 for about a mile of the Dundee and Broughty Ferry Tramway Co.'s system, situated between the city boundary and Belsize Road. This includes track, overhead equipment, &c., and the company recently offered to sell it for £15,486.

Glasgow.—ANNUAL REPORT.—The report of the past year's working of the Corporation tramways department has just been issued, and contains the following figures in addition to those in our issue of June 5th. The income was £1,083,846, and the expenditure £676,277, against £1,011,543 and £619,346 in the previous year, while the net balance credited to the common good account was £53,892. Notwithstanding the increase in car-mileage and the greater number of cars now upon the routes, the earnings per car-mile were more than in any previous year. The department paid £73,858 in local rates during the year. The outstanding debt is 2¼ million pounds, including over 2 million pounds which had been borrowed from the depreciation fund, and the actual net debt had been reduced to about £400,000.

Halifax.—PROPOSED EXTENSIONS.—The Tramways Committee has appointed a sub-committee to consider the question of tramway extensions to Elland and Stainland.

India.—The Mysore Government Railway Board has decided to install E.L. in all carriages on the State-worked systems, the change being brought about gradually.

London.—L.C.C. ANNUAL REPORT.—The total income of the L.C.C. tramways department for the year ended March 31st, 1914, amounted to £2,268,668, and the working expenses to £1,615,456. After paying interest charges, £328,109, debt redemption £408,488, income-tax £28,197, and sundry charges, making a total of £776,881, from which £25 153 has to be deducted on account of tax deducted, rent, &c., there is a deficiency on the year's working of £88,526, which has been met out of the reserve fund. The renewals fund, which stood at £539,749, has not been added to. The total running expenses per car-mile were 6·5d., compared with 6·62d. in the previous year, and the receipts were 9·21d. per car-mile, against 10·04d., for electric traction, and 8·15d., against 8·73d. for horse traction. The total passengers carried numbered 522,952,640, and the car-miles run totalled 59,209,289. The total capital expenditure is now £13,028,120, of which £409,277 was incurred during the past year, and the net indebtedness of the undertaking is now £9,923,528. In its report to the Council, the Highways Committee states that many lines recently electrified are not of a highly remunerative character, and have been very costly to construct, but the Committee's policy was influenced by housing and other considerations. The tramways also suffered through being unable on many occasions to carry passengers to the required destination, and a comprehensive linking-up scheme is recommended. Referring to motor-omnibus competition, the report states that the Council last year paid £86,337 in rates on the permanent way, to which the 'buses are not subject, and estimates that the annual saving to the road authorities consequent on the obligation of the Council to maintain the paving along its routes, is £128,000. The extra cost of bituminous grouting necessitated by the damage from rubber-tired vehicles is estimated at £20,000 a year. In respect of street improvements, the undertaking has been debited with a total of £800,575, of which £148,259 remains to be charged. During the year £124,259 was charged in respect of rates on track and buildings, £104,801 for permanent way repair, and £31,168 for street widenings, and the rates were, therefore, relieved to the extent of £260,228. The total amount per vehicle paid annually to the public funds, including licences, rates, taxes, road maintenance, &c, is stated to be £37 4s. 6d. per 'bus, and £187 10s. per tramcar, or, on the basis of £100 of gross receipts, £2 6s. per 'bus and and £11 1s. per tramcar. 52,754,604 passengers were carried at workmen's fares. In conclusion, the report states that it is clearly impossible, under existing conditions, to do away with the tramways, and recommends that every possible step be taken to improve the position of the undertaking, particularly in the direction of linking-up the system.

L.C.C.—The estimates for 1914-15 include the following working expenses £1,803,520, including renewals fund, £160,250; passengers estimated at 600 millions; total working surplus, £706,530, from which is to be deducted debt charges, £736,091, and income-tax £17,121, leaving a net estimated deficiency of £16,682; and to be expended on capital account, £965,915.

During the discussion on the report at Tuesday's meeting of the Council, an amendment by Sir John Benn that the Highways Committee should prepare a scheme for linking-up the "dead ends" on the system, was defeated.

The B. of T. has appointed a court of arbitration to decide upon applications received by the Electrical Conciliation Board for the revision of the wages of certain sections of the employés of the L.C.C. tramways department.

The Highways Committee recommends the Council to remove the overhead equipment and reconstruct the tramways in part of Seven Sisters Road on the conduit system, by direct labour under the supervision of the Committee, at a cost of £16,450.

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In order to relieve the traffic at the southern end of Blackfriars Bridge, the Committee recommends that a third track be installed between the Bridge and Stamford Street, at a cost of £3,500, the trackwork, at a cost of £1,350, to be obtained from Messrs. Hadfield's.

It also recommends that a tramway lay-by be installed in High Street, Plumstead, at a cost of £1,115.

Oldham.—Expiring Tramway Lease.—The lease of the Oldham, Ashton, Hyde and Denton Electric Tramways Co. shortly expires, and the question of the local authorities acquiring the undertaking is under consideration. A meeting of the various authorities is to be held on July 8th to consider what action they shall take in the matter.

South Shields-Sunderland.—Proposed Linking-Up.—In connection with the proposal of the South Shields Tramways Committee to link up its tramway system with that of Sunderland T.C., a joint meeting of the Sunderland and South Shields Tramway Committees has decided that Mr. W. T. Robson and Mr. A. R. Dayson, managers of the respective undertakings, shall inspect and report on three suggested routes.

Stalybridge.—Proposed Extensions.—The Tramways and Electricity Board has decided that, in the event of further Parliamentary powers being applied for, the following provisions be included in the Bill:—Power to purchase, lease or inter-run with neighbouring tramways; to extend the system to Woolley Bridge and to Greenfield; to run omnibuses; and to make the Board a trust investment.

TELEGRAPH and TELEPHONE NOTES.

All-British Cable to Australasia.—At the sitting on Friday last of the Dominions Royal Commission, Mr. Stanley J. Goddard, European representative of the Western Union Telegraph Co., gave evidence concerning a suggestion which had been made, that it might be possible for his company to lease to the Governments concerned one of its existing Atlantic cables connecting Great Britain with the North American Continent, and to arrange to operate it by British subjects on British territory on behalf of the Governments. He said he had communicated the suggestion to Mr. Newcomb Carlton, president of the company, and that Mr. Carlton saw no insuperable objection to such a proceeding, as a general proposition, subject to the company's interest being properly protected. The "line" would be leased from London to Montreal, where it would connect with a line worked by the Pacific Cable Co. for Australasia. The line would be for "general purposes," and would ensure communication between England and Australasia being entirely on British territory and worked by British subjects.

Cable Tariffs.—The Indo-European Telegraph Co., Ltd., gives notice of reductions in the tariff for Press telegrams to all Eastern countries that are served by the "Indo" route, amounting to 50 per cent. or more.

Dublin.—By the terms of an agreement arrived at between the parties, legal proceedings have been stayed in an action in which the Postmaster-General sought to restrain the Dublin Corporation from interfering with the construction of certain underground telephone lines in the City of Dublin. The Corporation contended that it was entitled to the payment of wayleave by virtue of an agreement entered into with the National Telephone Co., but the Postmaster-General held that he was not bound by an agreement with a company which had ceased to exist.

The Imperial Chain.—In reply to questions in the House of Commons, Mr. Hobhouse stated that several of the masts of the home station had been erected, and a considerable quantity of material had been sent out to Egypt; material was also about to be dispatched to the stations in East Africa, India and Singapore. The Post Office was not in a position to undertake the work of erecting the second three stations; but the Government could cancel the contract with the Marconi Co. for those stations, and was prepared to consider the employment of other contractors, subject to the practical demonstration of the efficiency of their system. No such demonstration had yet been given. Sites for stations had been acquired in England and Egypt, but not elsewhere, though the Government knew approximately where the others would be.

The Telephone Service.—The Post Office is gradually closing the trunk exchanges, and transferring the operation of the trunk lines to the local exchanges, thus expediting the service. Underground cables are being laid between the large manufacturing centres of the North which lie close together, with many more wires than the existing overhead lines, and this also will improve the trunk service. By the end of the month it is hoped that underground communication between London and Liverpool *viâ* Birmingham will be available; this is the longest loaded line yet laid down in this country for telephonic purposes. The trunk service between Manchester and Liverpool is now so satisfactory that the Manchester Royal Exchange and the Liverpool Cotton Exchange, which had hitherto used private telephone wires direct from one to the other, have asked to be relieved of their agreement with the Post Office.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—August 31st. Sydney Harbour Trust. Four electrically-operated semi-portable travelling cranes. Forms of tender from Mr. H. F. Norrie, Secretary to the Trust, Sydney.

Perth.—August 12th. Cable, lead-covered and various, for Postmaster-General. See "Official Notices" to-day.

August 12th. Insulators, for Postmaster-General. See "Official Notices" June 12th.

August 19th. Electric lamps and fittings, for Postmaster-General. See "Official Notices" to-day.

August 19th. Telephone switchboards, galvanised iron and steel stranded wire, for Postmaster-General. See "Official Notices" to-day.

September 2nd. Telephone instruments and parts, glassware, battery material, chemicals for batteries, wire—cotton, silk or wool covered—telegraph and telephone insulators, for Postmaster-General. See "Official Notices" to-day.

October 7th. Victorian Railway Commissioners. Four motor-driven air compressors and electrical equipment (motors, &c.) for the new workshops at Ballarat and Bendigo. Specification may be seen at the Board of Trade Commercial Intelligence Department in London.

Aylesbury.—July 6th. U.D.C. Lighting and power switchboard with connections, battery of accumulators, underground mains, including house services, conversion of existing lamp standards, &c. See "Official Notices" June 12th.

Ballaghadereen.—July 6th. Hydraulic turbine and accessories, dynamo and reducer set, aerial line and switchgear, for the Electricity Committee. See "Official Notices" June 19th.

Belgium.—July 7th. The municipal authorities of Lokeren are inviting tenders for the concession for the supply of electrical energy for lighting and power purposes in the town.

Blackrock.—July 13th. U.D.C. Underground mains, overhead mains, feeder pillars and public lighting. See "Official Notices" June 26th.

Bolton.—July 19th. Corporation. Converting plant, sub-station E.H.T. and H.T. switchgear. See "Official Notices" June 12th.

Erith.—The U.D.C. has decided to invite fresh tenders for the supply of coal for the electricity works, owing to the fact that one firm tendering felt that they had been unfairly treated with regard to the publication of the figures of the tests applied to the samples.

France.—July 17th. The French State Railway authorities (Bureaux du Service Electrique, 3me Division) in Paris (72, Rue de Rome) are inviting tenders for the supply of 100 continuous-current motors for railway traction purposes. Particulars may be obtained from the address given.

Gillingham (Kent).—July 17th. B.C. 12 months' supply of coal for the Electricity Department. Specification from the Borough Electrical Engineer, Gillingham Road.

Lancaster.—July 13th. Coal and slack for 6, 9 and 12 months respectively for the Corporation Electricity Works. Mr. G. C. Milnes, Marton St. Works.

London.—L.C.C. July 13th. One, two or three electrically-driven chassis, for Fire Brigade. See "Official Notices" June 19th.

July 14th. Five rotary converters of 1,500 kw. each, 15 main static transformers, two starting static transformers, and re-erection, &c., of existing motor generators. See "Official Notices" June 19th.

July 30th. 10,000 or 5,000 driving and pony wheel tramcar tires, 300 axle forgings for tramcars. Chief Officer, Tramways Department, 62, Finsbury Pavement, E.C.

July 7th. Three years' supply of electrical accessories. See "Official Notices" June 19th.

The Highways Committee recommends that tenders be invited for four portable electrically-driven grinding and drilling machines for use on the permanent way in connection with the Council's tramways.

Hackney.—July 9th. B.C. 80,000 pairs open-type white arc lamp carbons, and 100,000 pairs yellow-flame arc lamp carbons. See "Official Notices" June 26th.

Madeira.—The General Council of Administration of the district of Funchal, on the Island of Madeira, are at present inviting proposals for the establishment of a central electricity generating station for the supply of the current required for the operation of a system of electric tramways in the town and district of Funchal.

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New Zealand. — Auckland. — August 6th. Three 750-kw. d.c. mixed-pressure turbo-generators; one 1,500-kw. three-phase turbo-generator, including auxiliary plant and sub-station equipment. See "Official Notices" May 22nd.

July 31st. Seventy three-phase a.c. motors, including four 150-b.h.p., one 100-b.h.p., and eight 75-b.h.p., for the Dominion Portland Cement Co. Specifications from E. W. Hunt, secretary, Johnston Street, Wellington, or S. I. Crookes, Consulting Engineer, Auckland. Particulars may be seen at the Commercial Intelligence Branch of the Board of Trade in London.

Paisley.—July 6th. Corporation. Coal for the Electricity Committee. Particulars from Mr. C. F. Parkinson, Engineer and Manager.

Pittington (Durham). — July 11th. Poles, lamps, cables, &c., for the Parish Council. Specification from Mr. T. Carson, Clerk.

Ramsey (Hunts).—July 6th. Public lighting, for the U.D.C.; Mr. R. F. Serjeant, Clerk.

Rotherham.—July 8th. Corporation. Tramway stores, coals, cables, meters, &c. See "Official Notices" June 19th.

Skegness.—July 6th. U.D.C. Repair and maintenance of private telephone to waterworks for five years. Forms of tender from the Clerk to the Council.

Thorne (Yorks.)—July 6th. Public lighting, for the P.C. Mr. C. Waller, Clerk.

Truro. — July 4th. Electrical contractors who are desirous of tendering for the proposed municipal electric light plant, particulars of which appear in our advertisement pages, are invited to communicate with the Town Clerk not later than to-morrow, July 4th. See "Official Notices" to-day.

Walsall.—July 14th. Corporation. Four water-tube boilers, superheaters, economisers, pumps, pipes, &c. See "Official Notices" June 19th.

July 14th. Corporation. Two 3,000-kw. turbo-alternators with surface condensers, motor generator. See "Official Notices" June 19th.

Warrington.—July 8th. Corporation. High and low-tension cable. See "Official Notices" June 26th.

West Ham.—July 20th. Lighting installation at Rosetta Road School, for Education Committee. See "Official Notices" June 26th.

Whitstable. — July 17th. U.D.C. Electric motors, switches, &c., at the sewage pumping station. Specifications from Messrs. Strachan & Weekes, 9, Victoria Street, S.W.

York.—July 13th. Corporation. 500-kw. rotary converter, with transformers and switchgear. See "Official Notices" to-day.

CLOSED.

Australia.—The following contracts have been placed:—

P.M.G.'s Department, South Australia:—

200 c.b. telephones, wall-pattern, £4 5s. 3d. each; 100 ditto, table-pattern, £4 2s. 8d.; 50 cable terminals, £2 15s. 9d. each.—Western Electric Co. (Aus.), Ltd.

880 yd. switchboard cable, £147; 440 yd. ditto, £47.—Australian Metal Co., Ltd.

Victorian Railways Department:—

One 125-k.v.a. three-phase alternator, £573.—British G.E. Co., Ltd.; Electrical apparatus for McBride's Tunnel, State Coal Mines.—Australian G.E. Co.

Victorian Public Works Department:—

Electric lighting plant, for Williamstown Shipyard, £317.—Gardner, Waern & Co.

N.S.W. Railways Department:—

30 miles trolley wire, £2,714.—Cameron & Co.

N.S.W. Public Works Department:—

Two electric passenger lifts, for Public Instruction Department's offices, £1,916 and £1,450.—Standard Waygood Hercules, Ltd.

Sydney Municipal Council:—

Outdoor transformers, 20-50 k.v.a. and 100 k.v.a., £2,593.—Standard Waygood Hercules, Ltd.

100 and 300 k.v.a. indoor transformers, £1,802.—Noyes Bros.

For Phillip Street Sub-station (Sydney):—

Storage battery, £32,948.—Australian Metal Co., Ltd.
Running machinery, £10,581.—N. Guthridge, Ltd.
Switchgear, £7,145.—Australian G.E. Co.

Shire of Gisburne:—

Power station equipment, £1,100.—I.R., G.P. and Telegraph Works Co., Ltd.

Commonwealth:—

Electric light installation at Jervis Bay Naval College, £1,422.—W. Cumming, Melbourne.

A.C. generator, for Canberra power station, £1,545. — Brush Electrical Engineering Co., Ltd.

—*Australian Mining Standard.*

Barking. — The U.D.C. Electricity Committee has accepted the tender of Messrs. Phillips & Co., for an annual supply of Geddling high hazel ½-in. slack, at 11s. per ton; also the tender of Messrs. Myers, Rose & Co., Ltd., for a similar supply of Griff, 1½-in. nutty slack, at 12s. 3d. per ton.

Belfast.—The T.C. has accepted the tender of the British Westinghouse Co., for a rotary converter, at £2,003.

Belgium.—Seven concerns—six German and one Belgian—submitted tenders last week to the Belgian Post and Telegraph authorities in Brussels for the supply of a quantity of telephone cables and accessories, the lowest (£6,160) being that of the Société A.E.G. Union Electrique, of Brussels.

Bristol.—The Electrical Committee has placed the following contracts for 1914-15:—

Oliver Arc Lamp, Ltd.—Orifiamme yellow flame arc lamp carbons, £315.
Sykes & Sugden, Ltd.—Joint boxes, £446.
W. Lucy & Co., Ltd.—Fuse boxes, £154.
British Westinghouse Co., Ltd.—Meters (alternating current), £1,847.
Sloan Electrical Co., Ltd.—Open type white arc lamp carbons, £389.

Canada.—The Toronto Board of Works has awarded to Messrs. A. & P. Steven, Glasgow, the contract for an electric passenger elevator for the City Hall, at a cost of $4,300.—*Canadian Engineer.*

Dover.—For the supply of electrical pumps in connection with the Pier scheme drainage works, the T.C. received the following tenders:—

Turbo Electrical Co., London.—Accepted (69 h.p.), £750.
British Thomson-Houston Co., Ltd.—58 h.p., £754; 60 h.p., £849; 56 h.p., £814; 56 h.p., £902.
Tangyes, Ltd.—60 h.p., £890.
Worthington Pump Co.—62 h.p., £806.
Pooley & Austin.—62 h.p., £816.
Boving & Co.—54 h.p., £826.
Stereophagus Pump Co.—75 h.p., £1,025.

Halifax.—Mr. J. T. Murray, of Halifax, has secured the contract for the E.L. installation at the new Congregational Church at Highroad Well.

Heston-Isleworth.—The following tenders have been accepted by the U.D.C. for annual supplies of coal to the electricity works:—

Albert Usher & Co.—500 tons Coleorton hard steam, 15s. 2d. per ton, at Brentford Docks, 16s. 2d. per ton at Hounslow Station.
Wm. Cory & Co.—500 tons Brynteg anthracite, 19s. 11d. per ton at the docks.
Charrington, Sells, Dale & Co.—60 tons Bestwood brights, house, 19s. 2d. per ton at the docks.
Albert Usher & Co.—2,100 tons Mapperley or Readings bituminous nutty slack, 12s. 2½d. per ton at the docks, 13s. 5d. at station, 14s. 3d. at the works.

Kingston-on-Thames. — The tender of Messrs. Wm. Cory & Son, Ltd., has been accepted by the Council for an annual supply of about 2,800 tons of either (or both) Maude rough, at 13s. per ton, and Lampton rough, at 14s. 4d. per ton. Twenty-four tenders were received.

London.—L.C.C.—The Highways Committee recommends that the special trackwork required in connection with the reconstruction on the conduit system of the Seven Sisters Road tramways and for the installation of a third tramway track between Stamford Street and Blackfriars Bridge, be obtained from Hadfields, Ltd., at costs of £945 and £1,350 respectively.

Metropolitan Asylums Board.—Installation of telephones and domestic bells, &c., at the Orchard Hospital:—

Electric Installations, Ltd. (accepted)	**£510**	Pinching & Walton	£680
Brit. Home & Office Telep. Co.	460	Alpha Manufacturing Co. ..	705
Turnham & Co.	548	Tyler Apparatus, Ltd.	777
Lund Bros. & Co.	514	G. Weston & Son, Ltd. ..	1,117
J. and F. May & Co.	589	(The engineer-in-chief's estimate was £535.)	
T. W. Vaughan & Co. (1914), Ltd.	610		

Southwark.—The B.C. is recommended to accept the tender of Sir W. G. Armstrong, Whitworth & Co., Ltd., at £625, to provide and fix a horizontal electrically-driven force pumping engine at the Manor Place depôt.

The London Education Committee has received the following tenders for installing electric lighting, bells and telephones at the Furzedown Training College and Hostels:—

Turnham & Co. (recommended)	**£1,050**	**Alpha Manufacturing Co.**	**£1,746**
Tyler Apparatus Co., Ltd. ..	1,284	Malcolm & Allan, Ltd. ..	1,761
Arthur Newman, Ltd.	1,499	Cox-Walkers, Ltd... ..	1,965
G. Weston & Sons, Ltd. ..	1,503	Buchanan & Curwen ..	2,065
Lund Bros. & Co.	1,539	C. H. Cathcart & Co. ..	2,425
Defries & Goldman	1,565	Frederick Hodgson & Co.	2,800
Tredegar & Co.	1,729		

The tender of the Anglo-Colonial Engineering Co, Ltd., for the supply of 13,000 carbon filament lamps, has been accepted by the Royal Mail Steam Packet Co.

Margate.—The T.C. received the following tenders for an electric sign for the Pavilion and Winter Gardens:—

A. F. Goodwin & Co. (accepted)	**£69**	Kingston & Co.	£109
Siemens Bros.	74	Franco-British Electrical Co. ..	110
Watlington & Co.	80	Tyler Apparatus Co.	£120 and 180
Philpott & Son	92		

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Rugby.—The U.D.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for a distribution panel, and that of W. T. Henley's Co., Ltd., for cable.

Salford.—The T.C. is recommended to accept the tenders of the British Westinghouse Co., at £14,137, for a 5,000-KW. turbo-alternator, and, at £770, for an auxiliary steam turbine, directly coupled to an air-pump and an extraction pump, together with accessories.

The following tenders have been accepted by the Electricity Committee for annual supplies:—

Doulton & Co.—Stoneware conduits, £289.
G. Hanchett Barratt & Co.—Lighting transformers, £200.
British Electric Transformer Co.—Lighting transformers, £68.
Baxendale & Co.—W.I. steam tubes and fittings, £37.
H. Green & Co.—Electric motors, £1,092.
General Electric Co.—Electric motors, £204.
Electrical Engineering and Equipment Co.—L.T. three-core cable, £500 (provisionally).
W. T. Glover & Co.—L.T. three-core cable, £500.
Johnson & Phillips.—Copper strip, £2.
Price & Co., Ltd.—Turbine oil, £56.
G. S. Morris & Sons.—Graphite cylinder oil and cylinder oil, £58 and £150 respectively.
Bell Bros.—Crank chamber oil, £450.

Stoke.—The following tenders have been received by the Guardians for wiring the children's hospital:—

J. Richards & Co.	£138
Howell & Co.	210
Barnett & Soans	141
Blackburn, Starling & Co.	160

The following tenders have also been received for the installation of internal telephones and bells:—

L. Vaughan	£209
E. M. Evans	317
J. Richards	187
Blackburn, Starling & Co.	299
Staffs. Telephone Co.	195
Barnett & Soans	213
Dargue, Griffiths & Co.	364
Howells & Co.	321
Baggaley & Son	260

The tender of J. Richards has been accepted in both cases.

Stretford.—Mr. Bertram Thomas, who secured the contract for the electric lighting at Trafford Park School, asked that the contract should be cancelled, as a serious mistake had been made in his tender. The Education Committee agreed.

The Committee has since accepted the tender of Mr. Charles Cooper, of Stretford, at £336.

Tunbridge Wells.—The tender of Messrs. Isaac Storey and Sons, at £216, for refitting the old condenser at the electricity works is recommended.

Wimbledon.—The Corporation Electric Lighting Committee recommends the acceptance of the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., for switchgear, for the new 1,500 KW. turbo-alternator at the Electricity Works, for £152.

For the supply of coal for 12 months, for the Electricity Works, 15 tenders were received. The Committee recommends the acceptance of the tender of Messrs. E. Foster & Co., for 5,000 tons of "Kingsbury Ryder" small nuts, at 16s. 9d. per ton, and 6,000 tons of Ibstock (deep seam) double-screened nuts, at 16s. 6d. per ton.

The Committee recommends the approval of the draft contract with Messrs. E. Bennis & Co., Ltd, for chain grate stokers for three boilers at the Electricity Works.

York.—The Corporation has placed with Messrs. Siemens Bros. Dynamo Works, Ltd., its annual contract for carbon-filament lamps, radiator lamps, tantalum lamps and tantalum traction lamps.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued:—

Headquarters will be opened daily for the transaction of regimental business from 10 a.m. till 4 p.m., except Saturdays, on which days the opening will be from 10 a.m. till 12 noon. Headquarters will be closed for all purposes on August 3rd and 4th, 1914.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

Improper Use of the Letters A.M.I.C.E.—At the Auckland (N.Z.) Police Court, John Rogers, engineer to the Mount Eden Borough Council, was charged with having publicly used in connection with his profession the letters A.M.I.C.E., whereas his name did not appear on the list of Associate Members of the Institution of Civil Engineers, having been removed in 1905. The defendant was fined £5 and costs.—*A.M.S.*

FORTHCOMING EVENTS.

Institution of Municipal Engineers.—Friday and Saturday, July 3rd and 4th. North-Western District meeting at Manchester.

Royal Institution of Great Britain.—Monday, July 6th. At 5 p.m. At Albemarle Street, W. General Meeting.

Institute of Naval Architects. Institution of Engineers and Shipbuilders in Scotland. North-East Coast Institution of Engineers and Shipbuilders.—July 7th to 10th. Joint Summer Meeting in Newcastle-upon-Tyne.

Salford Technical and Engineering Association.—Saturday, July 11th. Visit to Carborundum Co., Ltd., Trafford Park.

NOTES.

New Chairman of the B.E.A.M.A.—At a meeting of the Council of the British Electrical and Allied Manufacturers' Association, held at 36, Kingsway, W.C., on the 25th inst., Mr. F. R. Davenport, managing director of Messrs. Willans & Robinson, Ltd., was elected to the office of chairman of the Council, recently rendered vacant by the death of Mr. A Bruce Anderson.

The Williams Fire-Damp Indicator.—On Friday last a demonstration of a new fire-damp indicator or methanometer, the invention of Mr. Alfred Williams, was given at the Hotel Cecil. The apparatus was introduced by Prof. S. P. Thompson and Dr. Erskine Murray, while Mr. R. Smillie, M.P. (President of the Miners' Federation) and Mr. W. Brace, M.P., also testified to the need for and value of such an appliance.

The Williams indicator consists of a detector, containing a pair of differential thermo-electric junctions, coupled in series in the circuit of a sensitive galvanometer of the milli-voltmeter type, the needle of which moves over a graduated scale giving direct percentage readings of methane. Each thermal junction is embedded in a small bead of porous stoney material and one of the latter is impregnated with platinum black. In the presence of even a small percentage of methane, the impregnated terminal rises in temperature, due to the catalytic action on the platinum black, and a small thermo-electric current is generated, the extent of the latter being recorded on the indicating instrument. So long as the two thermal junctions remain at the same temperature their actions balance and no movement of the instrument occurs, so that local changes of temperature have no effect. To get over the insensitiveness of platinum black when cold, each of the small terminal beads is initially heated to the same extent by a minute platinum loop embedded in it, and in circuit with an auxiliary cell.

In the apparatus shown the detector head, protected by a metal cover and gauze, was fixed on a wooden handle and coupled by flexible to the indicating instrument, which with the cells was contained in a small portable box; the apparatus is, of course, in a preliminary stage, but owing to its electrical nature it is anticipated that an automatic continuous recorder on the surface, together with an audible warning of the danger point, would be a possible development, while portable sets in the hands of the firemen would render the inspection of crevices much more trustworthy than they can be with the ordinary safety lamp.

The Williams indicator in its present form cannot supersede the safety lamp in the hands of the worker in a fiery mine, as a personal safeguard, and the accuracy of its percentage readings—and the safety of those depending on them—appears from Prof. Thompson's report to rest entirely on the constancy of the heating current to the thermal couples *under all conditions*. A simple, practical means, suited to mining conditions, for obtaining this constant heating current, should undoubtedly have been demonstrated to the meeting as an essential part of the Williams apparatus; this feature is apparently lacking, although necessary to its successful use on a commercial scale.

The introduction of a reliable fire-damp indicator would hasten the more general use of miners' electric lamps and thus lead to improved illumination generally, lessening the numerous accidents attributable to poor lighting and the disease known as miners' nystagmus, due to the same cause.

A 1916 Exhibition.—The Machine Tool and Engineering Association, Ltd., which is organising the Second International Engineering and Machinery Exhibition to be held at Olympia in September and October, 1916, does not intend to let the trade remain in doubt as to the arrangements. Considerably more than two years and a quarter in advance of the event it has issued a very complete exhibitors' guide and plan of the Hall, so nobody can plead that he has not time to weigh the whole matter up long before the closing date for space applications. The regulations relating to construction of stands, electric wiring and dangerous exhibits, occupy a number of pages, and there are the necessary perforated forms for applications for space, electric light and power service, and so forth. Judging from the early publication of so full a guide, it is obviously the intention of the Association to secure a big success, and we recommend electrical firms who are interested in the matter to communicate with the secretary, Mr. H. G. Williams, at Queen Anne's Chambers, Tothill Street, Westminster, S.W., for copies of this publication.

Mr. A. E. Fellowes is the Exhibition manager, and Messrs. Albion T. Snell & Partners, are the consulting engineers.

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Street Improvements Electric Railway Company's Liability.—On Friday, June 26th, the Judicial Committee of the Privy Council delivered judgment in an appeal by the British Columbia Electric Railway Co., Ltd., against an order of the Supreme Court of Canada. The respondents were the Vancouver, Victoria and Eastern Railway and Navigation Co. and others.

The appeal was argued before Lords Moulton, Parker and Sumner and Sir George Farwell in May, and the question was whether the Board of Railway Commissioners had jurisdiction to direct the British Columbia Electric Railway Co. to pay part of the costs of bridges over certain streets in Vancouver.

Mr. Upjohn, K.C., Mr. Bodwill, K.C., and Mr. W. Gordon-Brown (instructed by Messrs. Linklater, Addison and Brown) appeared in support of the appeal; Mr. A. H. MacNeill, K.C., instructed by Messrs. Blake and Redden, represented the Vancouver Railway, while the other respondents were represented by Sir R. Finlay, K.C., Mr. J. S. Hay and Mr. Arthur Page, instructed by Messrs. Laurence Jones & Co.

LORD MOULTON, in delivering the judgment of the Board, said that the British Electric Railway Co., referred to as the Tramway Co. in the pleadings, were a company operating street railways in the city of Vancouver under powers conferred upon them by an Act of the Legislature of that Province. Their railways were local street railways wholly situated within the Province of British Columbia, and had not been declared to be for the general advantage of Canada, or for the advantage of two or more provinces, so that they had not passed into the domain of the legislation of the Dominion Parliament. The respondent railways undertaking, on the other hand, had been declared to be worked for the general advantage of Canada. Part of its track through Vancouver city ran along the bottom of a valley, which was crossed by four streets. The Corporation, in order to avoid the trouble to traffic caused by these streets crossing the track, owing to the gradient, applied to the Railway Board for powers to construct viaducts, and the application was granted and the costs apportioned among the various respondents to the application. The appellants contended before the Supreme Court of Canada that there was no jurisdiction to order them to pay the cost of the erection of the viaducts or any portion, but by a majority the appeal was dismissed. They then appealed to the Privy Council.

Their LORDSHIPS could find nothing in Secs. 227 and 229 of the Railway Act which gave the Railway Board jurisdiction to deal with matters which were simply matters of street improvements. No doubt, as the Railway Board put it: "It being a substantial benefit to them (the tramway company), we are of opinion that they should contribute to the costs of the two bridges they will use—that is, the bridges at Hastings and Harris Streets," was a cogent reason for their decision. But the fundamental error the Board made was in thinking that this gave them jurisdiction to order appellants to pay the costs or a portion of it. There was nothing in the Railway Act which gave any such jurisdiction. It followed that they would humbly advise His Majesty that the appeal should be allowed, with costs.

Prof. Perry's Retirement: Proposed Presentation.—Prof. Perry, F.R.S., has recently retired from the staff of the Imperial College of Science and Technology, and we are informed that a fund is being raised for the purpose of giving expression to the appreciation of his services to the teaching of mathematics and to engineering education. An appeal for subscriptions has been issued to his former students and colleagues at the Imperial College and at Finsbury Technical College, but there are doubtless many others who have benefited by his published works, and who will desire to subscribe to the testimonial fund. It is to be hoped that there will be a ready response, which will allow the Committee to commemorate his work in a fitting manner. Past and present students of the Imperial College should also note that another fund is being raised for a testimonial to Prof. J. Harrison. Subscriptions should be sent to the Hon. Treasurer, P. T. Wrigley, Esq., M.A., Royal College of Science, South Kensington, S.W.

London Electric Railways Parliamentary Deposits.—On the application of the London Electric Railway Co. and the United Electric Railway Co., Mr. Justice Joyce, on Tuesday, directed payment out of Court of Parliamentary deposits. Mr. Austen Cartmell, who made the application, said that the deposit in question was paid in by the Edgware and Hampstead Railway Co., in respect of part of their undertakings in 1902, 1905 and 1907. In the years 1912 and 1913 there was an agreement with the London Electric Railways, by which the latter took over all the liabilities of the former together with the assets. Sec. 61 of the London Electric Railways Act, of 1913, provided for transfer of the Hampstead deposits to a total amount of £20,000. Mr. Justice Joyce directed payment out to the applicants as asked.

The Standardisation of Electrical Fittings on Petrol Motor-Cars.—The Electrical Equipment Committee Division of the Standards Committee of the American Society of Automobile Engineers has decided to recommend to the latter body at its forthcoming annual meeting that all insulating material used in connection with plugs, sockets and similar devices for use on petrol cars shall be capable of withstanding for 30 min. a temperature of 300° Fahr., and also that the single-wire system with earthed return be the recommended practice in connection with electrical fittings on motor-cars.

For Sale.—Salford Electricity Committee has for disposal three 170-KW D.C. motor-alternators, with switchgear. Particulars are given in our advertisement pages.

The British Association in Australia and Havre.—We have received particulars of the arrangements, as far as it has been possible to make them, for this year's meetings of the B.A. The list of papers, &c., is subject to revision and amplification. The Sections will meet at Melbourne on August 14th, 18th and 19th, and at Sydney on August 21st, 25th and 26th.

In Section A, the presidential address of Prof. F. T. Trouton will be read by Prof. A. W. Porter, and the following are among the subjects down for consideration:—

Joint meeting with Section B on "The Structure of Atoms and Molecules," opened by Sir E. Rutherford. Speakers: Prof. H. E. Armstrong, Prof. W. M. Hicks, Prof. Orme Masson, Prof. W. J. Pope and others.
Prof. E. Goldstein, "On Salts coloured by Cathode Rays."
Prof. T. R. Lyle, "Demonstration of a Mechanical Analogue of Wireless Telegraphic Circuits."
Prof. T. R. Lyle, "Demonstration of a Wave-tracer."
Sir E. Rutherford, "The Origin and Nature of the γ Rays from Radium."
Prof. O. W. Vonwiller, "Photo-electric Effect in Selenium."
H. Moseley, "High-frequency Spectra."
Prof. W. G. Duffield, "The Pressure upon the Poles of a Carbon Arc."
Joint discussion with Section G on "Wireless Telegraphy," opened by Sir O. J. Lodge.
Prof. J. A. Pollock, "Some Measurements of the Wave-length in air of Electrical Vibrations associated with a thin, straight terminated rod."

In the Engineering Section ("G") the following are included in the proceedings:—

SECTION G.—ENGINEERING.
MELBOURNE AND SYDNEY.

Presidential Address by Prof. E. G. Coker on "Stress Distribution in Materials" (to be delivered at Sydney).
Joint Discussion with Section A on "Wireless Telegraphy" (Sydney).
Mr. E. K. Scott, "Irrigation Dams and Hydro-Electric Power."
Mr. J. J. C. Bradfield, "Proposed Metropolitan Electric Railways."
Profs. E. G. Coker and L. N. G. Filon, "The Stress-Distribution in Short Compression Members."
Prof. E. G. Coker and Mr. W. A. Scoble, "Temperature Cycles in Heat-Engines."
Prof. W. E. Dalby, "Imperial College of Science and Technology; the New Engineering Laboratories of the City and Guilds of London Engineering College."
Prof. W. E. Dalby, "Railways and Motive Power."
Prof. W. E. Dalby, "The Testing of Materials."
Prof. G. W. O. Howe, "The Capacity of Radio-Telegraphic Aerials."
Dr. W. Rosenhain, "The Behaviour of Metals under Strain."
Dr. W. Rosenhain, "The Distribution of Phosphorus in Steel."
Prof. W. M. Thornton, "The Limiting Conditions for the Safe Use of Electricity in Coal Mining."
Prof. W. M. Thornton, "The Lost Pressure in Gaseous Explosions."
Reports of Committees on:—(a) "Gaseous Explosions" (b) "Stress Distributions in Engineering Materials."

A number of members of the Association left this country for Australia on June 22nd; others will leave on July 3rd.

The Havre meeting will be held from Monday, July 27th, to Sunday, August 2nd. A provisional programme has been issued, and full information of visits, discourses, &c., can be obtained from Dr. A. Loir, Comité Local de l'Association Française, Bureau d'Hygiène, Hotel de Ville, Le Havre.

The Liverpool Strike.—There are no prospects of an early settlement of the strike of electrical workers at Liverpool. The employers are apparently determined not to accede to the demands put forward on behalf of the men, and are content to adopt a waiting policy. There is a scarcity of big contract jobs at present. A printed statement has been issued, in which the men allege that attempts have been made to induce them to leave the Union by an offer of a penny an hour advance, which, it is stated, they refused. The officials of the Electrical Masters' Association deny that any such offer was made to the men. The policy that they have adopted meets with the unanimous approval of the members of the Association who are holding firmly together. The employers claim that several of the men on strike are dissatisfied with the policy of the Union.

Zero Resistivity.—In a communication to the French Academy of Sciences on Monday last, Prof. D'Arsonval described experiments made by Prof. Kamerlingh Onnes, of Leyden, who found that mercury cooled to a temperature of 4·19° absolute, tin to 3·8°, or lead to 6°, offered no resistance to the passage of an electric current. A bobbin wound with 1,000 turns of fine lead wire had a resistance at the ordinary temperature of 736 ohms, but when it was immersed in a bath of liquid helium the resistance became almost zero, and a current set up in the bobbin by induction persisted for several hours without perceptible diminution. It is suggested that the observation will open a new path of research into the continuity of matter.

The daily Press treats the matter as a remarkable discovery; it is a remarkable experimental feat to demonstrate the fact, but the phenomenon has been predicted for half a century, being clearly indicated by the variation of resistance of metals with temperature.

Shock Claim in Canada.—Judgment for $1,200 and costs in favour of Arthur E. Rayner, a painter, of Niagara Falls, against the Toronto Power Co., Ltd., has been given at Osgoode Hall by Chief Justice Falconbridge. Rayner was painting a transmission line tower belonging to the company and had been assured that there were no live wires on it. While pulling his brush out of the paint pot, which was hanging on one of the supposed dead wires, he received an electric shock, which caused him to fall 7 or 8 ft. to a plank walk. A thumb, one finger, and several toes were burned off. He entered action through his mother, as he was not of age, to recover $10,000.

Wages in the Midlands.—We read in the *Times* that the Birmingham and District Engineering Employers' Federation have received notice from the Engineering and Allied Trades Federation for an increase in wages of 5s. a week for all employés over 23 years of age. The number of men concerned is about 40,000. At present men in the engineering trades over 23 years of age are receiving 38s. a week and the hours range from 48 to 53.

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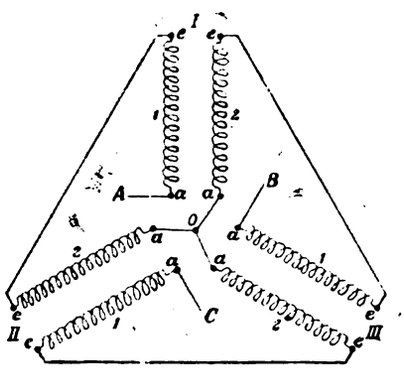
Alternator Connections Eliminating Triple-Frequency Harmonics.—Star-connected alternators, with earthed neutral point, frequently cause disturbance in neighbouring telephone systems, due to the presence of triple-frequency harmonics in the alternator pressure wave. During the time interval corresponding to the phase difference between the main alternator E.M.F.'s, there occur n complete periods of the $(3n)$th harmonics, which are thus in phase in all three generator phases. When the alternator supplies a cable network, it supplies single-phase triple-frequency currents to the condenser formed by the three cable cores and earth. In their passage through the earth, these vagabond currents cause more or less serious disturbance in neighbouring telephone circuits. Among the means which have been suggested to avoid such disturbance is the provision in the power cable of a metal sheathing, insulated from the cores and from earth, and connected to the neutral point of the alternator, to form a return path for the triple-frequency currents. Alternatively, the alternator neutral may be connected to an over-voltage safety device not earthing the neutral normally, but earthing it automatically in case of relatively small over-voltage. Yet another method is to damp out the dangerous harmonics by a current resonance circuit connected between the neutral point and earth, but the most rational procedure is to eliminate the offending harmonics from the voltage wave of the alternator.

With this end in view, R. J. Jensen (Copenhagen) has devised the zig-zag alternator connections shown in fig. 1, from the *Elektrotechnische Zeitschrift*. An even number of slots being used per pole per phase, each phase winding I, II, III, is



divided into equal parts 1, 2. The points 2 a are connected to a neutral point 0; the points 2 e are connected to the points 1 e of the following phases; and A, B, C constitute the terminals of the machine. Thus arranged, the phase voltage equals the difference between the pressures III, I, &c., *i.e.*, it is $\sqrt{3}\times$ the pressure per half-phase, instead of 2 × half-phase pressure, as in ordinary star-connected alternators. The length of armature bars must, therefore, be $2/\sqrt{3} = 1{\cdot}15$ times normal for a given terminal p.d. The end connections remain of normal length, hence the extra weight of copper is about 6 per cent.

In such an alternator pressure harmonics of triple frequencies are in phase in all windings taken from a to e in each phase but, each phase circuit comprising a 2 and a 1 coil connected in opposition, the triple-frequency harmonics are neutralised completely. The resultant armature reaction is of the same magnitude as in an ordinary alternator of equal output, but the ohmic and inductive pressure drops are each 6 per cent. and the iron loss 15 per cent. greater in the zig-zag wound machine.

Zig-zag connections have already been used in three-phase transformers to compensate for unbalanced loading. Such a transformer, with one ordinary and one zig-zag connected winding, blocks currents of triple frequency, hence its neutral point can be earthed without fear of causing telephone disturbances.

The Betulander Relay Automatic Telephone System.—In our issue of May 16th last year, it will be remembered, we published a description of the Betulander automatic telephone system, which had been taken up by the Marconi Co., and of which we had formed a very favourable opinion; in fact, it appeared to us that by confining the movements of the mechanical selectors to a straight-line motion, a new departure had been made which would probably "out in two," as our American friends would say, the difficulties and expense of the automatic exchange. Since then our readers may have wondered why nothing more was heard of this remarkable new system—certainly we have done so—but now we understand, and fully appreciate the reasons which have held it in abeyance. By the courtesy of Mr. C. B. Clay, manager of the Betulander Automatic Telephone Co., Ltd., we were on Tuesday last enabled to inspect a still newer system, devised by Messrs. Betulander and Palmgren, which was brought out before the former system had fairly got under way, and which upsets all preconceived ideas about automatic telephony. It was the development of this system which led the owners of the rights in the Betulander patents (outside Sweden) to hold their hand, and there can be no doubt as to their wisdom.

In the new system there are no travelling switches at all; the whole of the complicated operations involved in finding free junctions, selecting lines, and completing the connections, besides providing the necessary automatic guards, giving busy signals, calling subscribers, cutting off, &c., are accomplished entirely with relays of the simplest type—relays such as are working in hundreds of thousands in our manual exchanges, where their reliability has been proved to demonstration. We should hardly have thought it possible; but we have seen the apparatus at work, and working with precision and celerity; we have timed calls for such a number as 9999, involving the maximum number of relay operations in a four-figure exchange, and got through repeatedly in less than four seconds from the moment of lifting the receiver (after setting the number levers) to the moment when the bell began to ring. The operation of the apparatus is invisible, except for the flickering of signal lamps which show the passage of the call through the various banks of relays, while the clicking of the latter sounds, say, like a rapidly-operated typewriter.

The performance was unique in our experience, and the system a marvel of mechanical and electrical ingenuity. It is impossible to enter into details in the present issue, but next week we hope to publish a description of the principal features of what, we are not afraid to say, constitutes an epoch-making advance in automatic telephony.

Electrical Accidents in German Mines.—The annual report of the *Zeitschrift für Berg-Hutten und Salinenwesen* presents interesting data concerning electrical accidents in Prussian mines during 1912. A striking feature is the number of casualties which can only be classified as easily preventable. The number of accidents scheduled was 69 (including 7 carried forward from 1911); of these 40 were fatal, and the remainder involved more or less serious burns. From an analytical table in the original report the following summary is prepared:—

	Above ground.	In-by.	Total, including unclassified.
Fatal.—Due to low-pressure current (127-250 volts)	3	14	17
Due to high-pressure current ...	16	5	23
Not fatal.—Due to low-pressure current (220-250 volts)	4	4	8
Due to high-pressure current ...	12	3	21
Total	38	28	69

The large number of fatal accidents in-by due to low-pressure current should especially be noted; there is no doubt that under the humid conditions prevailing in-by, even 100 volts may be dangerous to life. Three-phase current is used very extensively in mining work; indeed, direct current is practically confined to main-shaft winding motors, haulage locomotives and arc lamps.

An analysis of the circumstances attending the accidents reported shows that the matters requiring attention most urgently are reduction of risk to men engaged on repairs or alterations; improved design of motor control switchgear; and safer arrangement of locomotive supply circuits. Verbal warnings and instructions are easily misunderstood or forgotten, and danger signs of whatever type soon lose their appeal. The only safe practice appears to be complete enclosure or isolation of all live parts and the provision of such electrical or mechanical interlocking devices as will ensure that any conductor is made dead before it is made accessible. The importance of employing only experienced and reliable men in electrical work in mines cannot be overrated.

No fewer than 11 cases of serious burning were (in 1912) due to arcs penetrating through switch covers. Standard enclosed switchgear, as used in mining work in this country, could not give rise to such accidents as the above; and now the German rules prohibit open slots in all cases.

In seven cases the primary cause of violent arcing was neglect to return the starter of slip-ring induction motors to the off position, or neglect to open the rotor short-circuiting device or lower the brushes before starting up. Suitable interlocking or automatic gear is the obvious remedy for this risk.

Of nine accidents caused by touching haulage loco. trolley wires in-by, seven were fatal, though in five fatal accidents the line voltage was only 220-250 volts.

Institution Notes.—ASSOCIATION OF CONSULTING ENGINEERS (INCORPORATED).—The report of the Committee for the 16 months ended April 30th, 1914, submitted to the second ordinary general meeting of the Association on May 25th, has just reached us. It states that the number of members at June 1st, 1914, was 70. On November 13th, 1913, a certificate of incorporation was signed by the Board of Trade, after due inquiry, and on December 1st, at the first meeting of the Committee of the Incorporated Association, Mr. A. H. Dykes and Mr. S. R. Lowcock were elected as hon. secretary and hon. treasurer respectively, Mr. G. M. Taylor being appointed chairman of the Committee. The first general meeting was held on February 2nd, 1914, and confirmed the acts of the Committee. At an extraordinary general meeting on July 20th, 1913, membership of the Institution of Civil Engineers of Ireland was accepted as sufficient qualification for membership of the Association. In November last the Committee took action in respect of the electrical department of a certain County Borough, which offered the services of its officers to mill owners as consulting engineers at a fee of 5 per cent., offering also to purchase plant for its clients on better terms than the latter could obtain. The Committee considered this practice unfair and detrimental to the public interest, and believes that the authority in question has discontinued it. On February 2nd the inaugural dinner of the Association was held at the Whitehall Club. An International Congress of Associations of Consulting Engineers was held at

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Ghent in July last, and it was proposed that an International Association of Consulting Engineers should be formed, but the Committee has postponed the question of joining it until the Association has consolidated its position in this country. A system of classification of members has been adopted, so that anyone requiring the services of a consulting engineer can see from the list of members the class of work in which any individual member chiefly specialises. The Committee commends to the members a suggestion of one of them, that in drafting arbitration clauses in agreements, the choice of an umpire should be left to the Committee.

Institution of Electrical Engineers.—On Thursday last week the annual Conversazione of the Institution was held at the Natural History Museum, South Kensington; the guests were received by Mr. W. Duddell, President, and Mrs. John Smithers, and members of the Council. Music was provided by the String Band of the Royal Engineers, and by the Royal Windsor Glee Singers, and a pleasant evening was spent by the members and their friends, though the attendance appeared to be much smaller than in former years.

Amongst those present were Sir F. A. Bosanquet, Col. R. E. B. Crompton, Sir William Crookes, Sir J. M. Davidson, Col. R. C. Hellard, Col. Sir T. H. Holdich, Vice-Admiral Sir H. B. Jackson, Major J. N. C. Kennedy, Major-Gen. Beresford Lovett, Lt.-Col. the Hon. Sir N. J. Moore, Sir Henry Norman, Dr. F. G. Ogilvie, Major W. A. J. O'Meara, C.M.G., Baron de Ropp, Major-Gen. R. M. Ruck, and Sir John Snell.

Hard X-Rays as a Substitute for Radium Rays.—Attempts have been made for some time to replace the expensive radium and mesothorium products by the use of X-ray bulbs, recent experience having shown the excellent results to be obtained with hard and homogeneous Röntgen-rays.

In a recent memoir,* F. Dessauer, of Frankfort-on-Main, gives an interesting account of his own work in this connection. The therapeutic effects of X-rays are due to differences in sensitiveness of the various kinds of cells composing our tissues, soft rays being in this connection comparable to a heavy hammer, whereas the harder, more penetrating radiations may be likened to a delicate scalpel. While the hammer is in itself more efficacious, it obviously risks destroying the sound, as well as the morbid tissues; the scalpel, on the other hand, allows the latter to be cut out carefully. With regard to the violent action of soft rays, any differences in sensitiveness exhibited by the cells become negligible, the more so as this action cannot well be accurately localised. Whereas hard rays will act uniformly on limited regions, soft rays will attack the upper tissue layers with enormous violence, thus becoming unable to act on those lying beneath. Hard rays afford a means of producing the dose just required over a wide range, without any risk of destruction to sound tissues, while in the case of soft radiations the available limits of useful effects are rather narrow.

It has become possible to generate X-rays which, in part at least, are of a hardness approaching that of gamma rays, comparative tests having shown their hardness to be as high as one-quarter to one-third of that of the latter. While the greater part of the initial radiation has, in this case, been absorbed by filtration, the remainder is still much stronger than the rays of even the strongest radium product. It may thus be hoped that whenever morbid tissues can be irradiated from outside, radium may be replaced completely by X-rays.

As regards the treatment of internal cavaties, which could hitherto be effected only with radium rays, Dessauer, in conjunction with Sellheim and Meyer, has devised an X-ray bulb working in the interior of the body, and which, at the same time, provides for an efficacious filtration of the rays. The cathode of this bulb projects its rays, not on an inclined platinum disk, but into the interior of a metal cone, the inside of which is coated with platinum. The cathode is so designed that the focus does not form a point, thus spreading the cathode rays on the whole inside surface of the cone. Part of the X-rays thus produced will enter the interior of the bulb, this part being left unused. Another part issues through the metal wall, while undergoing a filtration which allows only the hard rays to pass. This metal cone, surrounded by a water cooler, is introduced into the cavities to be treated.

Messrs. Veifa-Werke, of Frankfurt-on-Main, on a system devised by Mr. Amrhein, have recently constructed an X-ray bulb which, in a minimum of time, allows quite unprecedented amounts of hard X-rays (up to ten times more than with ordinary bulbs) to be generated and projected into the tissues of the body. This remarkable result is mainly due to the adoption of a new cooling principle, based on the utilisation of the heat of vaporisation. Water is drawn in from a vessel and pulverised so as to produce a spray as fine as possible, which, by means of the air current, is thrown with extreme violence against the rear wall of the hollow anti-cathode. The amount of heat thus carried away is enormous; the bulb may be charged very strongly without any appreciable heating of the anti-cathode.

Fatalities.—A correspondent writes: "Joseph Roddy, of Leighton Lane, Leeds, a linesman in the employ of the Post Office, fell from a 45-ft. telegraph pole whilst working on the Wakefield Road at Lofthouse on Monday afternoon. He was taken to the Leeds Infirmary, where he died. He was engaged in taking measurements of the wires at the time, and it is believed he had got a severe shock through accidental conduct through some power wires. He was seen to fall by a little girl, who noticed a big flash at the moment he fell. He had sustained extensive burns."

* *Die Umschau*, No. 17, 1914.

Educational Notes.—The "School of Oriental Studies" is the outcome of a movement towards the provision of facilities for the study of Oriental languages in London, which are at present very restricted; the site and buildings of the London Institution, Finsbury Circus, have been secured for the purpose by Act of Parliament, and are about to be adapted and extended, and about half the annual expenditure (£14,000) will be provided by the British Government, the Government of India, and the London County Council. An appeal is being made for the balance, and it is stated that an endowment fund of not less than £100,000 should be raised. The British Empire embraces a population of nearly 400 millions of Eastern peoples, and is closely related with as many more, while our Eastern and African imports and exports amount to more than £210,000,000 per annum. The necessity of such a school is therefore manifest. It will be attached to the University of London. Donations should be sent to Sir Montagu Turner, 38, Bishopsgate, E.C.

Copper in Russia.—Practically the whole copper industry of Russia is controlled by a single large company, the "Medj," and out of the total production of copper in 1912, 93·8 per cent. was produced by this company, and other concerns working in connection with it. In 1913 this percentage had risen to 95·7 per cent., and there were thus only 7·3 per cent. produced by "outsiders." The total output of copper amounted in 1913 to 32,784 tons, as compared with 33,000 tons in 1912, and 25,024 tons in 1911, of which the bulk was raised in the Ural district, which was responsible for 52·5, 50·2 and 47·4 per cent. of the above-mentioned three years' production. Next to the Ural comes the Caucasian district, where 30·2 per cent. of the total production was raised in 1913. The third copper-producing district is Siberia, with a percentage of 16·9 per cent. for 1913. The output of copper from the chemical works amounted to 4·2 per cent. of the total production. For the present year this is estimated to be raised considerably, viz. to 39,520 tons.

Voting by Electricity.—A time-saving electric vote-recording arrangement is about to be installed in the American House of Representatives in Washington, at an estimated cost of £4,000. There are at present 435 members of the House, the recording of whose votes on a division is stated to occupy 45 minutes. By means of the projected electrical device, it is expected that it will be possible to record the voting on a division in from five to ten minutes.

Veritas Sports.—The sixth annual sports of the Veritas Athletic and Social Club (Messrs. Falk, Stadelmann & Co., Ltd.) are to take place to-morrow, Saturday, at the "King's Oak" track, High Beech, commencing at 11 a.m. Mr. F. S. Prior is again acting as hon. secretary.

Appointments Vacant.—L.C.C.—Whole-time electrical engineering mechanic at Hackney Institute, Dalston, N.E. (42s.); shift engineer, for Lancashire Electric Power Co.; mains and assistant electrical engineer (£104 +), for Londonderry Corporation; instructor of telegraphy and telephony (12s. 6d. per evening), for East Ham Technical College evening classes; superintendent of meter and electrical testing department (£150), Salford Electricity Works; assistant electrical engineer (£140), for Redditch U.D.C. Particulars are given in our advertisement pages.

Efficiency Investigations on the Half-Watt Lamp.—Photometric, spectrophotometric and bolometric investigations carried out by Dr. Lux, and described in the *E.T.Z.*, indicate that though the half-watt tungsten lamp offers great advantages over the ordinary tungten lamp, it does not represent a radical advance in the efficiency of light production. Using Wien's equation, the author concludes that the filament temperature of a 1,000-c.p., 110-volt "Nitra" half-watt lamp is 2,850° C. absolute, as compared with 2,450° C. absolute, the filament temperature of a 200-c.p., 110-volt Osram lamp.

In respect of spherical candle-power per watt the ordinary tungsten lamp is superior to the half-watt type; at 2,400° C., for instance, the former yields 0·76 spherical hefner per watt and the latter only 0·64 spherical hefner per watt, *i.e.*, 18·75 per cent. less light for a given power input. Thanks to its nitrogen filling, the half-watt lamp reaches an efficiency which is high, but lower than that obtainable were it possible to run the filament of an evacuated lamp at the same temperature. Winding a 0·5-mm. wire to form a 2-mm. spiral reduces the heat loss due to convection from 6 per cent. to 1 per cent., but about 17 per cent. of the total light is lost inside the closely wound spiral. Comparative radiation data for half-watt and ordinary tungsten lamps are as follows:—

	Input watts.	Total radiation watts.	Luminous ÷ total radiation.	Luminous radiation ÷ input.	Heat radiated per 100 hefner watts.
Half-watt lamp.	237	155	2·01%	1·32%	133
	265	171	3·19	2·06	93
	392	242	5·02	3·11	49
	525	316	8·04	4·82	32
Ordinary tungsten.	95	83	3·76	3·32	125
	102	90	4·41	3·70	103

Under normal full-load conditions in the half-watt lamp, some 8 per cent. of the total radiated energy, but only 4·8 per cent. of the energy supplied, is available as light, the discrepancy being due to the considerable loss of energy by conduction and the loss of light within the tightly wound spiral itself. Loss by conduction is considerably greater than in evacuated lamps. No considerable further improvement can be anticipated in the efficiency of tungsten lamps, the efficiency being 0·3 watt per spherical hefner when the filament temperature reaches the melting point (3,200° C. absolute) of tungsten.

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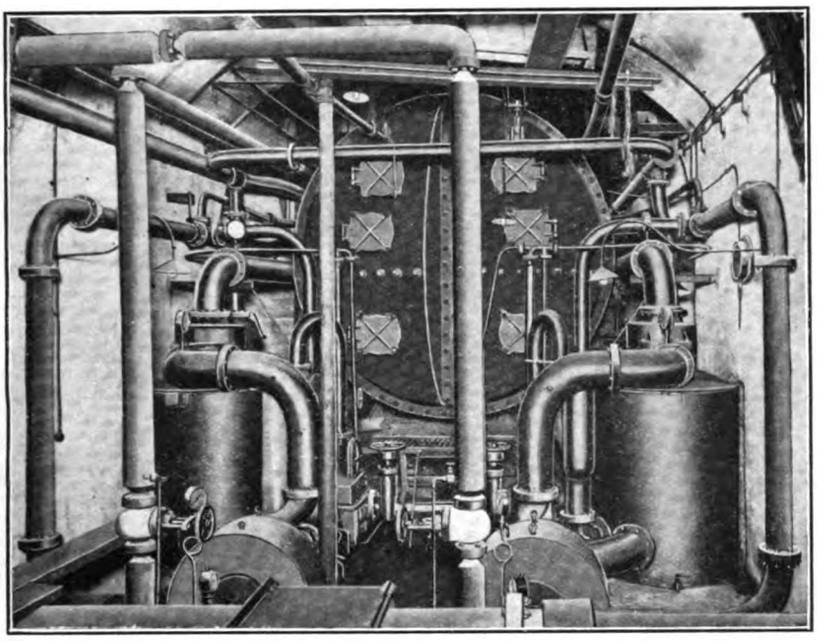
THE MANCHESTER 15,000-KW. TURBINE SET.

One of the most interesting turbine plants, and the largest so far installed in this country, has just been started up at the Stuart Street generating station of the Manchester Corporation electricity department.

This is a Howden-Siemens unit, with a normal output of 15,000 kw., and an overload rating of 19,000 kw. The speed is 1,000 r.p.m. The turbine is of the Zoelly impulse type with 14 wheels; the largest overall diameter is roughly 9 ft., and the smallest 8 ft.

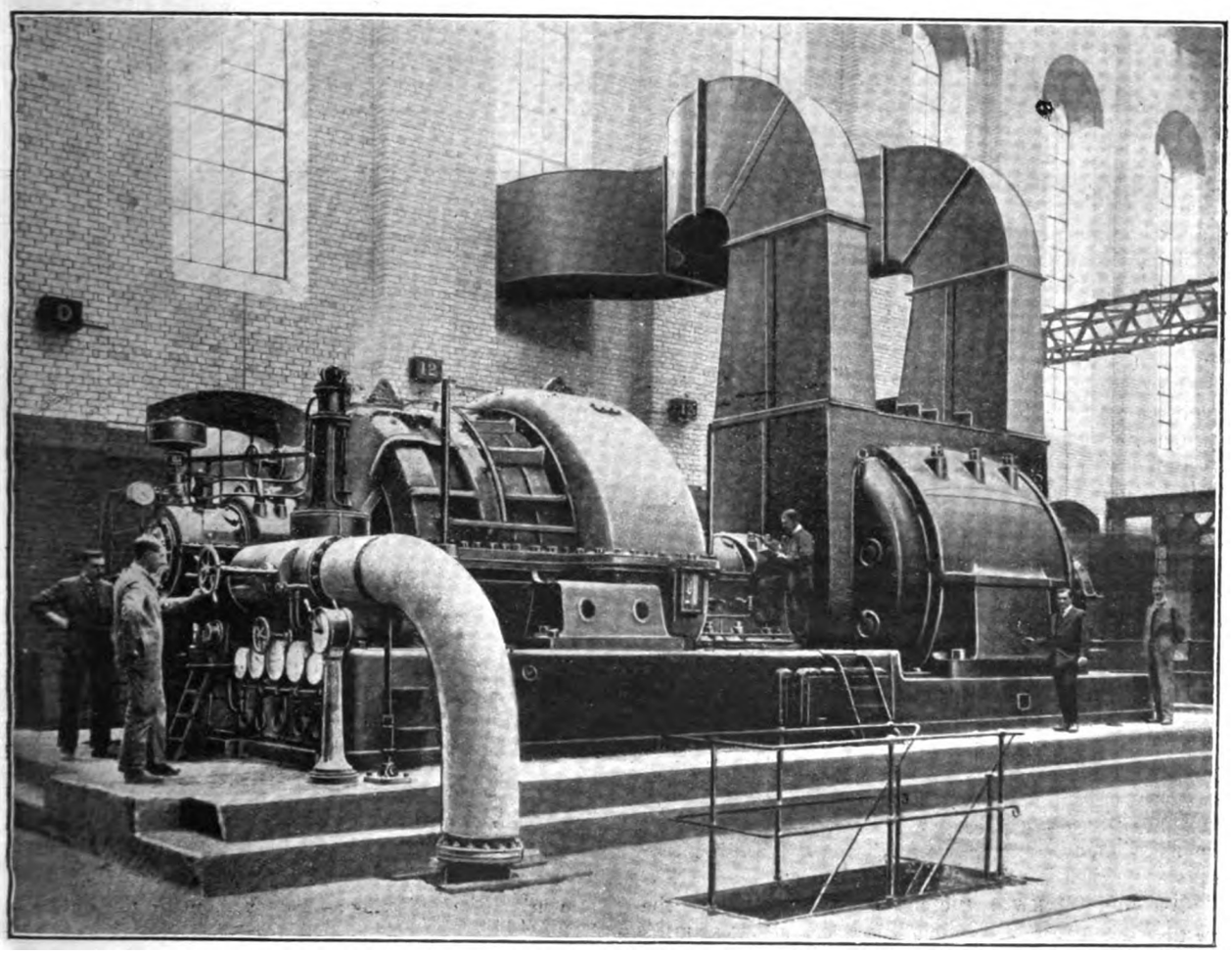
The turbine runs on steam at 190 lb. pressure and 600° F. temperature; and exhausts into a vacuum of 27½ in.

The condensing plant is of the surface type, by Messrs. Richardsons, Westgarth & Co. The condenser itself is cylindrical in shape, 11 ft. in diameter, and 16 ft. long between tube plates, and is built up of ¾-in. mild steel plates. It contains 6,550 ⅞-in. diameter tubes, giving a total cooling surface of 24,000 sq. ft. Following recent practice at Manchester, no main exhaust valve is installed between the turbine and condenser, but arrangements have been made for flooding the steam space of the condenser when the set is exhausting to atmosphere. The air and water extracting pumps are of the kinetic type supplied by the Pulsometer Co., and consist of two units, each equal to 60 per cent. of the capacity of the plant, and each driven by a 100-h.p. impulse turbine at 3,000 r.p.m.; the turbine exhausts are utilised in the kinetic air ejectors and direct-contact feed-water heaters.



Condenser Plant, 15,000-kw. Turbine Set, Manchester.

The same arrangement has been followed in the case of the circulating water pumps, which are also divided into two units, each equal to 60 per cent. of the capacity of the plant. Each unit consists of a Rateau multi-cellular centrifugal pump coupled to a 600-b.h.p. impulse turbine running at 3,000 r.p.m. These turbines exhaust into the main condenser; all the auxiliary turbines were made by Messrs. Richardsons, Westgarth & Co., Ltd.



View of 15,000-kw. Howden-Siemens Turbo-Alternator at Stuart Street Generating Station, Manchester.

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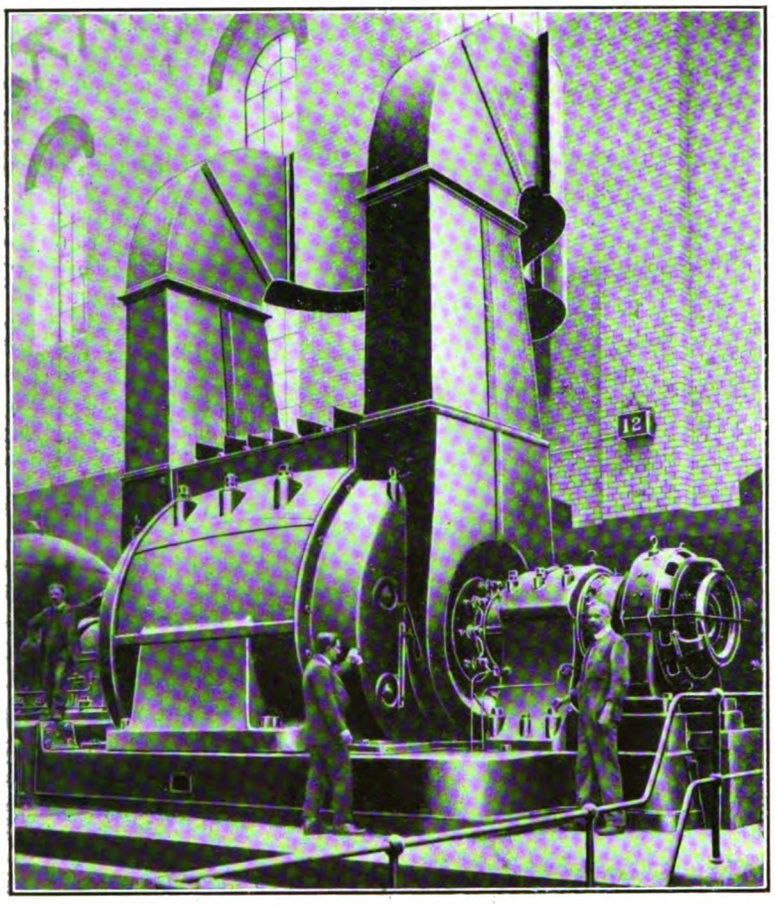
The alternator, which is rigidly coupled to the turbine, is a three-phase machine generating at 6,600 volts pressure and 50 cycles; the stator is totally enclosed and bar wound with one mica insulated bar per slot.



15,000-KW. TURBO-ALTERNATOR, WITH EXCITER, ALSO SHOWING VENTILATING TRUNKS.

Fans are fitted on the rotor for axial ventilation, and an external fan capable of delivering 53,000 cubic feet of air per minute is also installed. This fan is driven by a 120-B.H.P. motor running at 670 revolutions per minute. The rotor is of the cylindrical type, about 67 in. in diameter, and weighs some 53 tons. It was stipulated that the temperature rise in the alternator after a six hours' full load run should not exceed 60° F. on any part of the machine.

Energy for excitation is provided by a 220-volt shunt-wound dynamo coupled to the end of the main shaft; current for this purpose can also be supplied from the station bus-bars.

The cooling air for the machine is passed through a Sturtevant wet-air filter, which works in parallel with the original installation of dry cloth air filters.

The guaranteed steam consumptions per unit, with steam at 190 lb. pressure and at a total temperature of 530° F., with a 27½-in. vacuum, and power factor of ·95, are as follows:—

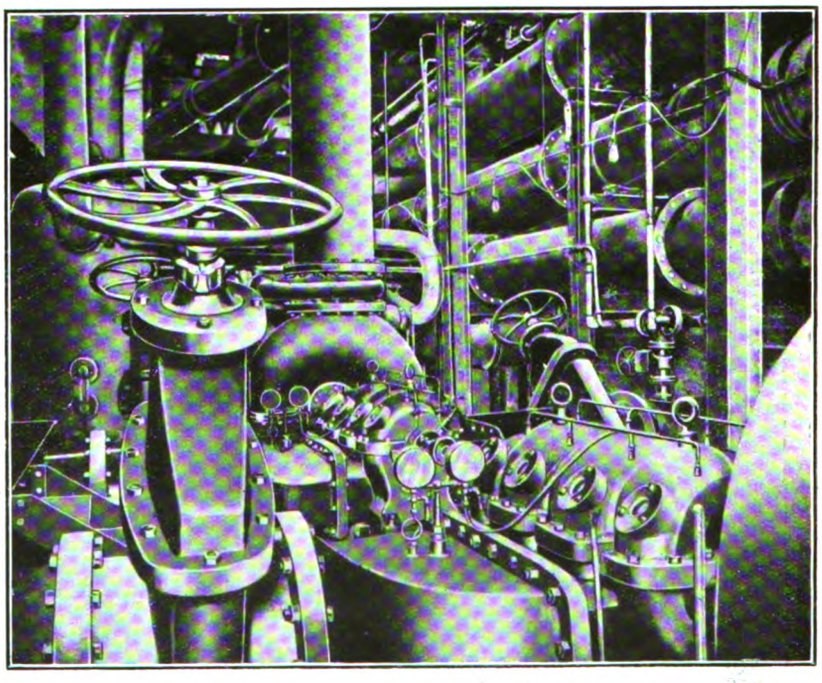
¼ load	16·95 lb.
½ „	14·92 lb.
¾ „	14·12 lb.
Full „	13·65 lb.
1¼ „	14·25 lb.

The Stuart Street plant works in conjunction with cooling towers and high vacuums are not obtainable.

The addition of this machine to Stuart Street station has increased its output capacity to 55,500 KW.; the maximum demand on the station last year was 36,120 KW., and the output in units generated 123,388,190.

The station is practically full up, but arrangements have been made up for replacing one of the original 1,500-KW. Yates & Thom-A.E.G. vertical slow-speed sets by a 6,000-KW. turbo-alternator running at 3,000 R.P.M., and this represents the utmost extension possible of the present station. The Manchester electricity undertaking continues to expand at an increasing rate. Last year 154,760,000 units were generated at all the stations, and nearly 118,000,000 units were sold, these figures comparing with 136,820,000 and 104,347,000 units approximately in the previous year. As the output for traction and public lighting remained nearly stationary over the two years, the increased total output may be traced to the power consumers. We are indebted to Mr. S. L. Pearce, the chief electrical engineer, for the information which we are able to give in regard to the new plant.

The Largest Cable-Making Machine in in the World.—MESSRS. JOHNSON & PHILLIPS, LTD., of Charlton, Kent, have just finished a cable-armouring machine for a cable factory in Vienna, which is of record size, because it will armour cables up to 6 in. in diameter, weighs over 70 tons, and is about 160 ft. long. The main shaft, which is hollow, is 13 in. in diameter, and carries six cast-iron disk wheels 12 ft. in diameter, each weighing 2½ tons. The general design follows the usual pattern as made for many years by Messrs. Johnson & Phillips, but, of course, there are many up-to-date improvements in detail. For example, the disks run on roller bearings; the end of the main shaft is fitted with a special swivelling thrust washer to take the pull of the armouring wires, which may amount to as much as 12 tons; and two of the disks are fitted with brake straps, which work iron to iron. The take-up stand will accommodate a drum of cable weighing 20 tons, and this also is a record in the way of size. The draw-drum is of the grooved type, 8½ ft. in diameter, and has four grooves, each 7 in. wide. The cable goes over one groove, then over a flat drum, over the next groove, and so on. The nominal speed of the machine is 12 to 16 R.P.M., and it is driven by a 75-H.P. two-phase motor through steel gearing having machined teeth. The bobbins are carried in forged mild steel frames, and each bobbin will carry half a ton of steel wire. The machine has the special attachments required for laying lock-coil armouring, and is also adapted for sheathing with steel tapes. It can be arranged for serving and armouring the following:—Compound, paper tapes, jute, compound, 48 wires or two steel tapes, compound, jute, jute, compound thick whiting and thin whiting.



TURBINE-DRIVEN CIRCULATING PUMPS, STUART STREET STATION, MANCHESTER.

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THE BERLIN ELEVATED AND UNDERGROUND RAILWAY.

[BY OUR BERLIN CORRESPONDENT.]

The electrical energy for operating the Berlin Elevated and Underground Railway is generated in two power stations, partly as continuous and partly as three-phase current; the former is supplied directly to the feeding points of the contact rail, whereas the three-phase current feeds two sub-stations for conversion into direct current.

The Trebbiner-Strasse power house contains two 1,100-KW. and two 800-KW. compound engine sets, with Siemens-Schuckert D.C. 780-volt generators; also eight water-tube boilers, constructed for 165 lb. pressure, and fitted with superheaters.

The alternating plant includes four Siemens-Schuckert turbo-generators, each of 1,200 KW. capacity (at 780 volts and 1,000 R.P.M.), driven by two 3,600-H.P. Zoelly steam turbines; these are supplied with steam by eight water-tube boilers, with a steam pressure of 210 lb. (absol.) and a steam temperature of 350° C. in the superheaters.

Preheaters and economisers have been provided, and a mechanical coaling plant conveys the coal from barges in the Spree Canal and railway wagons into the boiler house.

The power house contains a buffer battery of the Tudor type, with a capacity of 1,470 ampere-hours, which works with a reversible booster on the Pirani system.

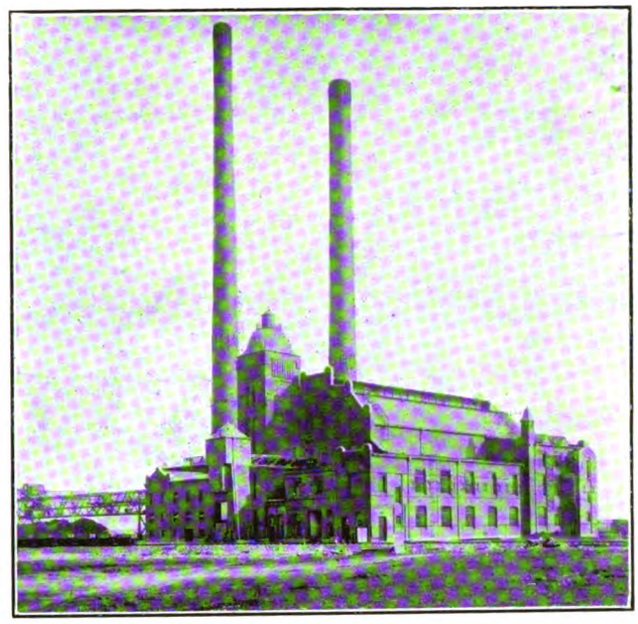
The Unterspree power house contains three Siemens-Schuckert three-phase turbo-generators, each of 4,000 K.V.A. output, at 2,650 volts and 40 cycles; these are driven by Zoelly turbines, and the generator pressure is stepped up to 10,000 volts.

Seven water-tube boilers supply steam at 240 lb. pressure, superheated to 375° C.

The boiler feed is passed through economisers. A coaling plant comprising a grab, slewing crane, travelling bridge, electric telpher and conveyor, has been provided to transfer the coal from Spree barges to the storage ground or boiler house.

The Bismarckstrasse sub-station comprises four Siemens-Schuckert rotary converters, each rated at 730 KW., at 480 R.P.M., and transformers for converting 10,000-volt three-phase current into 780-volt continuous current, also a buffer battery of 888 ampere-hours capacity, at one hour's discharge, with a reversible booster on the Pirani system. Another booster has been provided to serve as a standby.

The Senefelderplatz sub-station contains three cascade converters each of 1,500 KW. output at 300 R.P.M., for converting three-phase current at 9,600 volts pressure into continuous current at 780 volts, and one buffer battery of 1,850 ampere-hours capacity, at one hour's discharge, working in series with a reversible booster. Another booster of the same kind serves as a standby.



THE UNTERSPREE POWER STATION, BERLIN ELEVATED AND UNDERGROUND RAILWAY.

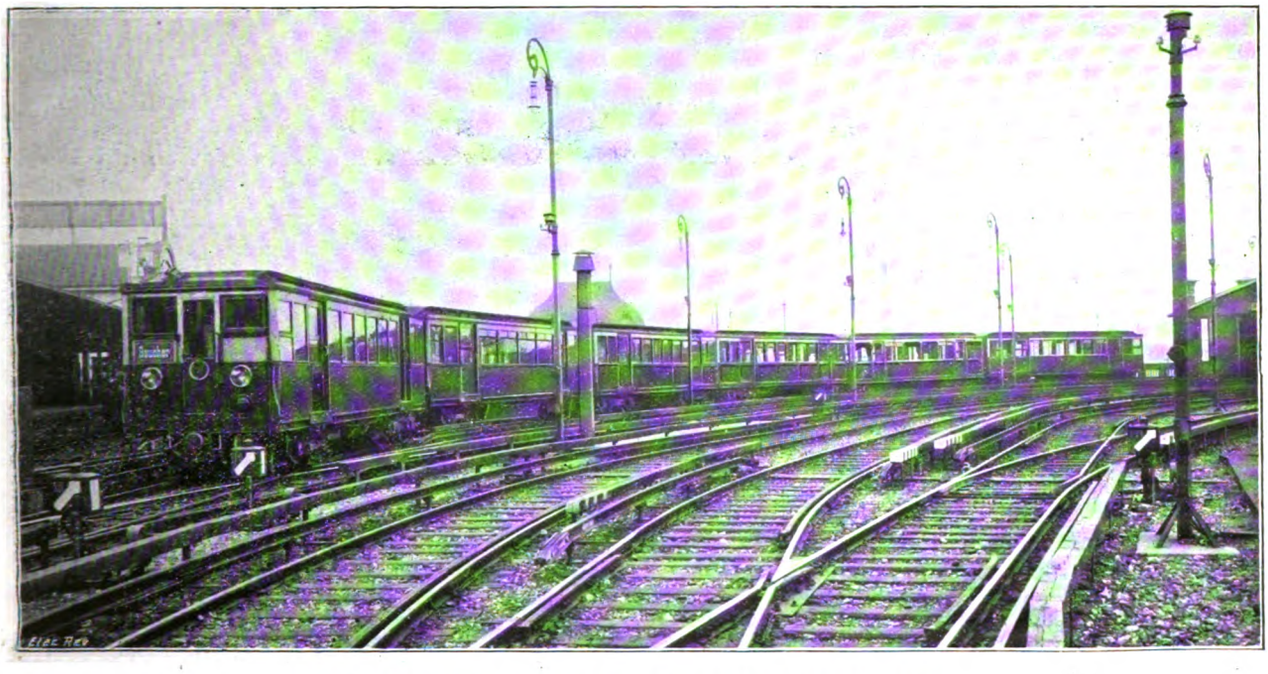
The power houses are connected with one another and with the sub-stations by armoured triple cables, which are mostly laid directly on the permanent way. Excess voltage cut-outs are inserted in the cables at given intervals.

As regards the feeder system, the various lines are divided into feeding districts; the east lines of the Elevated and Underground Railway comprise three, the West lines six, and the City lines five feeding districts.

Insulated feeder cables of from 1,500 to 3,500 sq. mm. cross-section, have been provided to connect the power houses or sub-stations with each of the feeding districts—1,000 or 500 sq. mm. cables being used.

The 780-volt direct current is supplied to the cars by an insulated and laminated soft iron rail, about 3,600 sq. mm. in cross-section, arranged alongside the track.

The contact rails on the lines passing through tunnels are situated at a higher level than on the other lines, thus inserting at the same time the electric lighting circuit, as soon as the trains enter the tunnel.



SIX-CAR ELECTRIC TRAIN ON THE BERLIN ELEVATED RAILWAY

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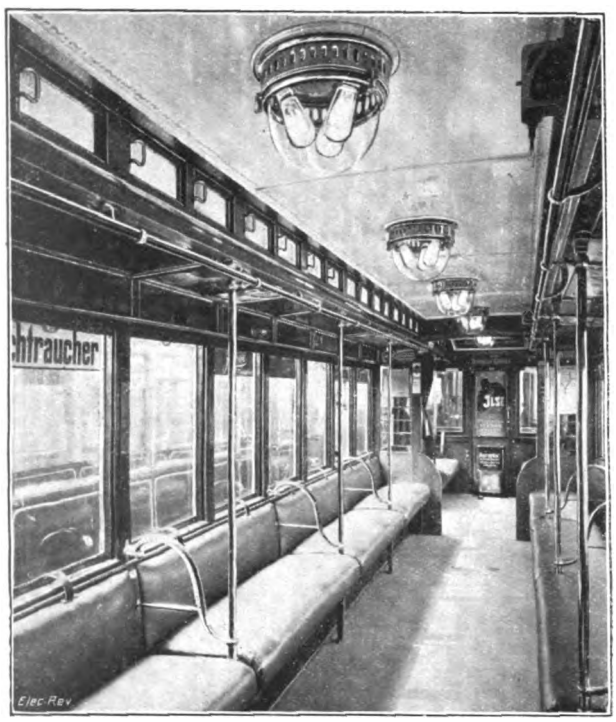
Current returns through the running rails, which are, of course, bonded and supplemented where required by bare copper cables laid beside the rails and connected to the



Interior of Second-Class Car, Berlin Elevated Railway.

latter every 50 m. Cable cross-sections of up to 4,000 sq. mm. are laid out in the neighbourhood of the power houses and sub-stations, reducing to 1,000 or 500 sq. mm.

Trains are made up of from 2 to 6 cars, with 1, 2 or 3 motor-cars respectively; the provision of 8-car trains is being considered.

The motor-cars are third-class, or mixed second and third-class cars, and the trailers second-class, or second and third-class cars; they each have a capacity of about 100 passengers, of whom one-third find seating accommodation. Each motor-car empty, with its four motors, weighs about 24 tons, and each trailer about 15·5 tons.

The motor-cars are generally provided with a driver's cab, but some have two and others none at all; they are equipped with four 70-75-h.p. motors, but on the two-car trains running between Bismarckstrasse and Reichskanzler-platz only two motors of the same output are fitted. This allows a maximum travelling speed of 50 km. an hour to be reached; the average speed on the various lines is 25-30 km. an hour.

The signalling is arranged with block sections on the Siemens & Halske four-field system, individual sections reaching from one station to the other and being calculated for 2½ minutes headway, at an average speed of 27 km. an hour.

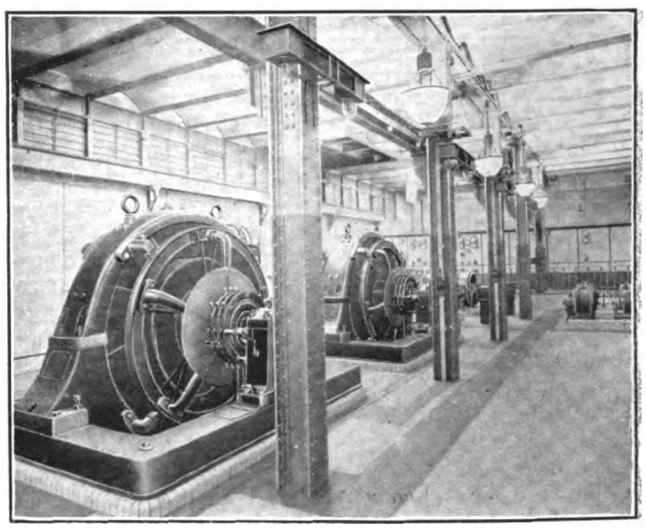
All stations are equipped with home and starting signals. Optical signals actuated from the stations are used exclusively, those in tunnels being light signals and those on the Elevated Railway sections semaphore signals, rendered visible in the dark by multicoloured lights. Any irregularities in the adjustment of points or the signals are signalled automatically.

The block instruments at the stations are interconnected, and when operated for a train to pass, the following one is locked until a rail contact situated at a train's length behind the starting signal has been passed through. Automatic train locking has been provided on the Spittelmarkt-Schönhauser Allee line, and is expected to allow of running at even shorter train intervals.

Electric clocks connected up to the master clock in Köthener Strasse and actuated and regulated every ½ minute are installed in all stations and offices, and complete inter-telephonic communication is provided.

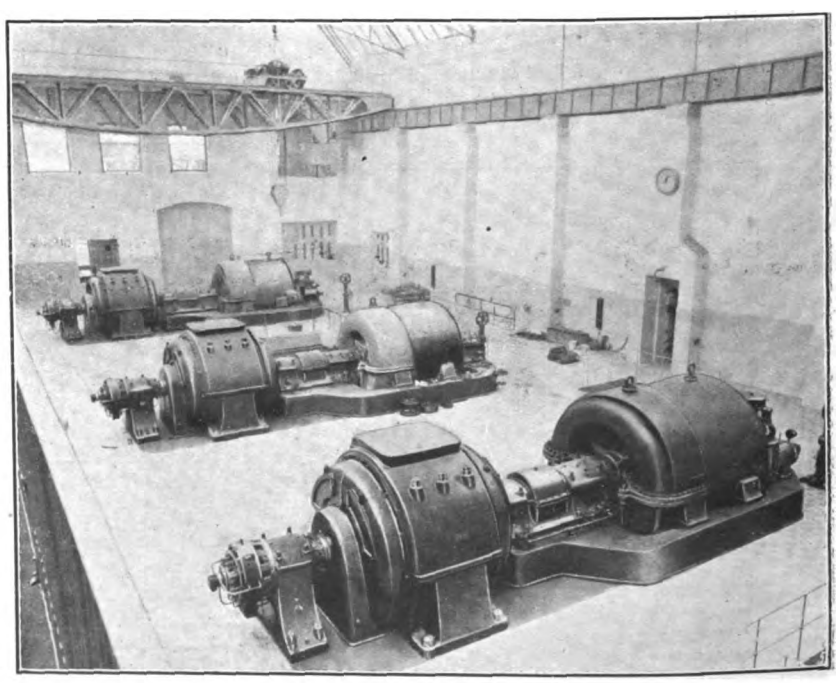
THE NEW DOCK AT HULL.

On Friday last, by the courtesy of the Hull Joint Dock Committee, we were present at the opening, by the King, of the new dock which has been built by the North-Eastern Railway Co., in conjunction with the Hull and Barnsley Railway Co., to cope with the constantly increasing trade of Hull, the third port of the United Kingdom. The dock is the largest on the North-East coast, having a water



Underground Sub-station, Berlin Railways.

area of 53 acres, which can be extended to 85 acres; and the main basin measures 1,050 × 1,000 ft., so that the largest vessels can be turned in it. The entrance lock is 750 ft. long × 85 ft. wide; the length of quays is 8,162 ft.,



Turbo-Generating Plant at the Unterspree Railway Power Station, Berlin.

and there are to be two graving docks, coaling appliances, 53 cranes, huge warehouses and a grain silo. The equipment is at present incomplete, the grain silo and many of the

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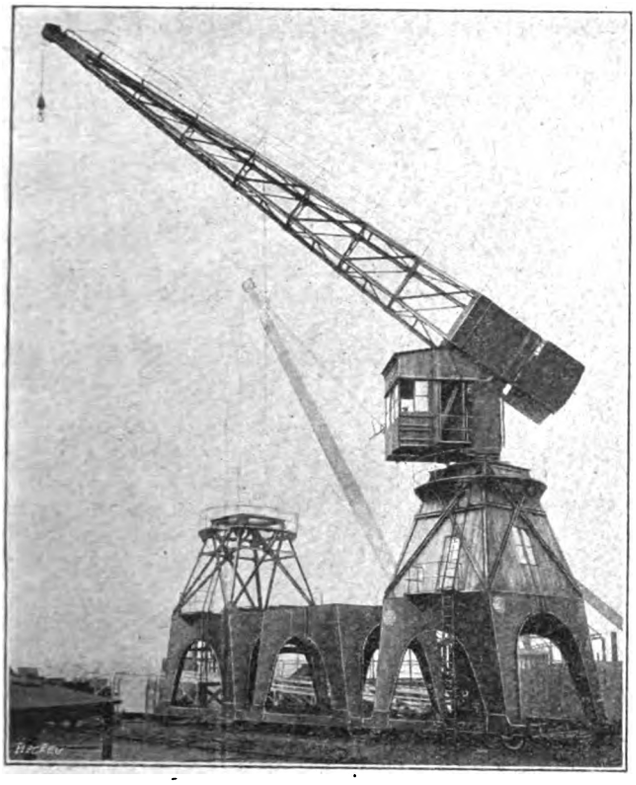
cranes, conveyers, &c., not having been erected yet, so it is not possible to enter upon details with advantage at present; but we may state that the whole of the power used on the dock will be provided through a 4,000-KW. sub-station at 440 volts D.C. by the Corporation of Hull, for which Mr.



Travelling Portal Crane by Messrs. Royce, Ltd.

Herbert Bell is chief electrical engineer, and as the first "all-electric" dock in the kingdom it is of exceptional interest to our readers.

The commanding situation occupied by the port, which has railway access to about 400 collieries and annually ships 7,000,000 tons of coal, and is close to an industrial area inhabited by 11 million people, has enabled it to grow in size and importance to an extent not generally realised, so that it now challenges even London and Liverpool, and is gradually drawing traffic which has hitherto used those ports. While the new dock will very greatly extend the facilities for dealing with traffic, it should not be overlooked that the 10 previously existing docks at Hull are of great extent, amounting in the aggregate to more than 158 acres, in addition to two riverside quays, with over 100 cranes and 34 coaling appliances, and 51 warehouses.

The new Joint Dock will be provided with five electric belt coal conveyers, as well as one fixed and one movable hoist occupying the same berth; these will serve six berths arranged in echelon, so that each ship, of the largest class, can be loaded and moved without interfering with its neighbours, and the total coaling capacity will be 5,000 tons per hour. Of the 53 cranes, one will be an 80-ton floating crane, 43 will be movable electric cranes of three to 10 tons capacity, and nine will be 1½-ton cranes travelling on the roofs of the warehouses. The grain silo, which will have a capacity of 40,000 tons, and four discharging berths, will be equipped with eight underground electric belt conveyers, six portable elevators with weighers, and other modern appliances for handling grain.

We give an illustration of the north side of No. 3 Quay, showing the ferro-concrete warehouses, and on the left hand some of the quay cranes. Another view shows one of the latter complete; and some of the travelling cranes on the roofs of the warehouse appear in the former view. All the cranes have luffing jibs giving a horizontal movement to the load when luffing. The coal tips and the lock gates are operated by hydraulic power, but this is produced by electrically-driven pumps.

The whole of the work has been carried out under the direct supervision of the engineers of the two railway companies—Mr. T. M. Newell and Mr. R. Pawley. Mr. W. Ebdon acted as resident engineer, and Mr. T. L. Norfolk superintended the construction of the equipment. The general contractors for the dock were Messrs. S. Pearson and Son, Ltd., of Westminster; the contractors who supplied the electrical equipment are named below:—

Royce, Ltd.	Electric cranes.
Sir W. G. Armstrong, Whitworth & Co, Ltd.	Electric capstans and coal hoists.
Craven Bros., Ltd.	Electric cranes.
W. H. Allen, Son & Co., Ltd.	Centrifugal pumping plant.
Henry Simon, Ltd.	Grain-handling plant.
Head, Wrightson & Co., Ltd.	Coal conveyers.
Callender's Cable and Construction Co., Ltd.	Electric cables.
Herbert Morris, Ltd.	Overhead travelling cranes.
British Westinghouse Electric and Manufacturing Co., Ltd.	Switchgear.
Crompton & Co., Ltd.	Arc lighting.
Robson & Coleman	Electric lighting.
Falconer, Cross & Co.	" "
W. Taylor & Co.	" "
King & Co., Ltd.	" "
Cox-Walkers, Ltd.	Lamp standards.
Chamberlain & Hookham, Ltd.	Electricity meters.

The quay crane here illustrated is one of 25 cranes made by Messrs. Royce, Ltd., Manchester, of the travelling gantry or portal type, each of 3-ton capacity. The cranes are fitted with the Musker-Davidson patent balanced luffing gear, and all the motions are electrically driven. The maximum radius of the jib is 50 ft., minimum 20 ft., and the luffing speed at the hook is 150 ft. per minute. The hoisting speed with 3 tons is 150 ft. per minute, with 1½ tons 250 ft. per minute; slewing speed at hook 400 ft. per minute, travelling speed 30 ft. per minute. The height from the

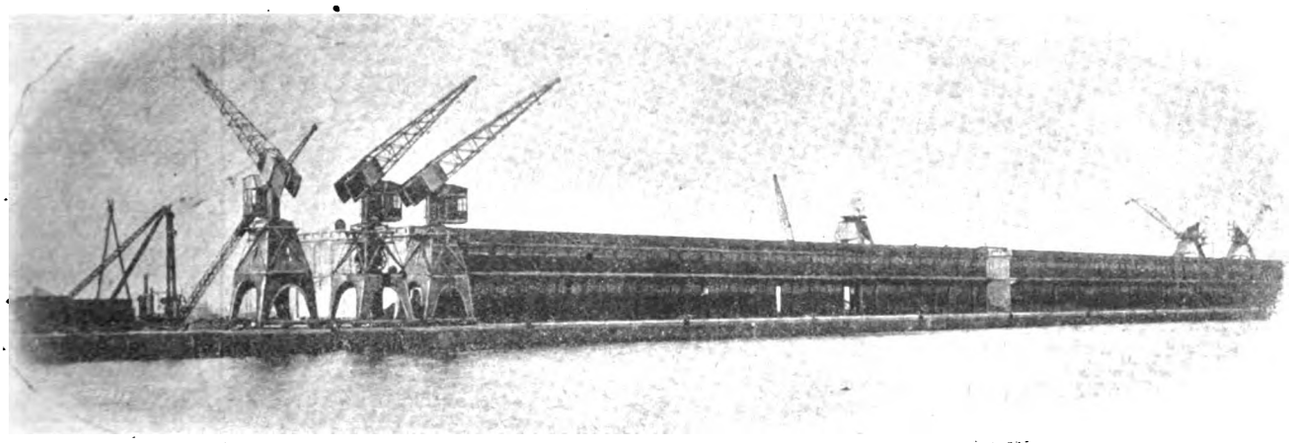


Photo by [*Photochrom Co., Ltd.*

Hull Joint Dock. Ferro concrete Warehouses and Cranes, No. 3 Quay.

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crane rails to the point of the jib at maximum radius is 80 ft. The hoisting motor is of 45 B.H.P., slewing 5 B.H.P., luffing and travelling each 8 B H.P. The electrical gear is of "Royce" manufacture throughout. The motors are of the totally-enclosed type, six hours' rating; the controllers are of the tramway type, of exceptionally robust construction to stand heavy usage. The travelling rail centres are 15 ft., and the wheel base 19 ft.

For a test of stability the cranes were subjected to a load of 6 tons on the hook at the extreme radius in any position of the jib, without any support from jacks or rail clips, and withstood the test successfully, there being no indication of the slightest lift on the structure or wheels.

Each crane is supported on four cast-steel travelling wheels with single flanges on the inside. The travelling motion only is fitted with hand gear. Automatic electrical safeguards against over-running in either direction are provided for the hoisting and luffing motions. All the toothed gears on the crane (except motor pinions, which are of raw hide) are of cast-steel, machine-cut throughout. Each motion is fitted with an electrical brake, and in the case of the hoisting motion a powerful foot-brake is also provided on the barrel shaft, and is used for quick lowering without current. In such circumstances the electrical brake is held off by a hand release device. The gear for the motions of hoisting, slewing and luffing is carried on a central revolving mast, which is pivoted and supported at the foot in a cast-steel footstep bearing, and at about the centre of its length by a roller path. The jib is carried at the top end of the mast by a heavy fixed shaft, and is balanced by c.i. weights fixed at the tail end of the jib structure.

The special advantages of the luffing arrangements are that the load during luffing is not lifted as in the ordinary jib crane, but moves in a horizontal line, and, consequently, a great saving of power is effected, and a small motor only is required. In addition, a quick luffing speed is permissible.

The position of the crane driver enables him to command in his view the whole of the movements of the hook and loads.

Current is conveyed to the cranes through heavily armoured cable from plug-boxes fixed at intervals along the quays, and each crane is provided for this purpose with a revolving cable-drum on one of the bottom carriages.

(To be continued.)

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. A. B. EALES, technical assistant and testing engineer at the Stoke-on-Trent Electricity Works, has resigned, and is returning to Johannesburg. His successor is MR. N. H. BARKER, of Fulham, appointed at a salary of £140 a year.

The Manchester Electricity Committee has appointed MR. W. DUNDAS, a member of the staff, as resident engineer at the Dickinson Street and Bloom Street electricity stations, to succeed Mr. F. H. Whysall, who has taken up the position of chief electrical engineer at Greenock. Out of 74 applicants for two positions as shift engineers at the generating stations at Manchester, MR. E. ATKINSON and MR. J. H. NIVEN were appointed.

After considerable discussion the T.C. has raised the salary of MR. J. W. HODFIELD, electrical engineer, Barnstaple, to £225 from £200, which has been the salary since the inception of the undertaking 12 years ago.

At the Keighley T.C. meeting last week, the Electricity Committee recommended that the salary of the borough engineer (MR. H. WEBBER) be increased from £300 to £400 per annum. An amendment was moved that the increase be only £25, and this was carried after a suggestion had been made that rather than increase the engineer's salary, an assistant should be appointed at £100 a year. A further amendment was also moved that the increase be £50, but this was defeated by one vote.

The Wimbledon Corporation Electricity Committee recommends that the salary of MR. R. W. KLITZ chief assistant electrical engineer, be increased from £225 to £250 per annum.

General.—Among the new magistrates appointed for Lancashire, MR. THOS. WILKINSON, founder and managing director of Thomas Wilkinson, Ltd., electrical engineers, of Arnside, is included.

The marriage took place last week at Boroughbridge (Yorks.) of MR. C. F. DAWSON, assistant electrical engineer at New Bromsgrove, under the Worcestershire County Council, and Miss S. Langley.

The directors of the Metropolitan Railway Co. have elected SIR CLARENDON GOLDING HYDE, deputy-chairman of the company.

The Council of the Institution of Electrical Engineers has elected MR. H. C. LEVIS to be an Ordinary Member of Council in the place of the late Mr. A. B. Anderson.

MR. W. C. MOUNTAIN, consulting engineer, Newcastle-on-Tyne, announces that to meet the requirements of his increasing practice, he has opened an office at 66, Victoria Street, Westminster, S.W. Mr. M. B. Mountain, who will be associated with him in the conduct of the London business, is resident in London.

MR. GILBERT, late director of the Gilbert Arc Lamp Co., Ltd., and of Engineering and Arc Lamps, Ltd., has disposed of his entire interests in these concerns, and can be consulted on arc lamps and engineering matters generally at 9, Birchington Road, West Hampstead.

We regret to learn that MR. BARRALET, who was present with Mrs. Barralet at the I.M.E.A. Convention at Birmingham, was suddenly taken ill last week, and he has since undergone an operation for appendicitis. His illness has, unfortunately, prevented him from keeping a number of appointments and from advising his friends of the reason. We are requested by Mrs. Barralet to publish this information, and we would add our wishes for Mr. Barralet's speedy recovery.

On June 18th, at Chinley Chapel, Derbyshire, MR. T. TALLENT-BATEMAN, A.M.I.E.E, was married to Jane Catherine, daughter of Mr. Hugh T. Hughes, M.S.M. and C.E., of Chapel, surveyor to the Derbyshire County Roads. In commemoration of his marriage, Mr. Bateman was presented with a massive grandfather clock by his friends at the British Westinghouse Co, where he is chief switchgear engineer.

Obituary.—The death, at the age of 41, of ENGINEER ARTURO FELIPE BONO, director-general of the Compania Italo-Argentina de Eléctricidad, occurred last month. Senor Bono was at one time Professor of Electricity in the Argentine Naval Gunnery School, and afterwards engineer to the Compania Alemana Trans-Atlantica de Eléctricidad, subsequently attaining the position of vice-director. He retired from that company in 1912, and, on the formation of the Italo-Argentina Co., was offered and accepted the position of managing director.—*Review of the River Plate.*

MRS. G. WESTINGHOUSE.—We are informed that news has just come to hand by cable from New York of the death of Mrs. George Westinghouse, who therefore survived her husband by only two months.

NEW COMPANIES REGISTERED.

Direct Copper Production Syndicate, Ltd. (136,536).—This company was registered on June 20th, with a capital of £10,000 in 6,000 "A" and 4,000 "B" shares of £1 each, to take over certain inventions relating to processes and apparatus for the direct production of copper cathode plates, sheets tubes or wire from copper ores, or from crude copper, and to adopt an agreement with Sherard Cowper-Coles. The subscribers (with one share each) are:—E. M. Fox, 6, Charles Street, Berkeley Square, W., gentleman; Sherard Cowper-Coles, 1-2, Old Tye Street, Westminster, electro-metallurgist. Private company. The number of directors is not to be less than two or more than five; the first are Sherard O. Cowper-Coles, J. J. G. Gordon, T. Bolton, E. M. Fox and the Right Hon. Sir T. Vesey Strong, P.C., K.C.B.; Sherard O. Cowper-Coles may retain office for life, and may, while holding 2,000 shares nominate one director (or, if he resigns, two directors); qualification, £100. Solicitors, Edgar Smith & Co., 22, Francis Street, W.C.

South Wales Wireless Training Colleges, Ltd. (136,585).—This company was registered on June 23rd, with a capital of £1,500 in £1 shares (1,498 "A" and 2 "B"), to carry on the business of a college or school for instructing pupils in wireless telegraphy or telephony, &c., and to adopt an agreement with J. B. Schofield. The subscribers (with five shares each) are:—W. L. Yorath, Strathlyn, Lake Road, E. Cardiff; H. B. Taylor, Cleethorpes, Stanwell Road, Penarth, manufacturer's agent. Private company. The number of directors is not to be less than two or more than five; the first are W. L. Yorath and H. B. Taylor, each of whom may retain office for life; qualification, £75; remuneration as fixed by the company. Registered office, Market Buildings, St. Mary Street, Cardiff.

Electro Motor-Hiring, Ltd. (136,627).—This company was registered on June 25th, with a capital of £10 000 in £1 shares, to sell, let on hire, repair, construct, and connect cables, wires, lines, dynamos, accumulators, motors, meters, galvanometers, ammeters, voltmeters, telephones, fans, carbons, switches, cut-outs, generators and distributors of electricity, fittings, brackets, cinema and other lanterns, X-ray apparatus, lamps, globes, films, &c. The subscribers (with one share each) are:—C. Crossley, the Grange, Hindhead, Surrey, gentleman; E. N. Whitley, Hadlow, Halifax, solicitor. Private company. The number of directors is not to be less than two or more than five, the subscribers are to appoint the first three; qualification, £100. Solicitors, Hirst, Whitley & Akeroyd, Halifax and Bradford.

J. Whitehouse, Ltd. (136,569).—This company was registered on June 23rd, with a capital of £3 000 in £1 shares, to take over the business of an electrical engineer, and contractor and decorator, and dealer in electrical goods and materials, carried on at 15, The Parade, Golder's Green. The subscribers (with one share each) are:—J. R. Whitehouse, 15, The Parade, Golder's Green, N.W., electrical engineer; Mrs. F. M Whitehouse, 43, St. Andrew's Road, Golder's Green, N.W. Private company. J. Whitehouse is permanent managing director

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Duncan's Electricity Supply, Ltd. (9,173).—This company was registered in Edinburgh on June 24th, with capital of £95,000 in £1 shares, to carry on the business of an electrical supply company, and to acquire from J. Duncan rights in connection with the supply of light to Aboyne, Ballater and Ellon. The subscribers (with one share each) are:—J. Duncan, Tillycorthie, Aberdeenshire, landed proprietor; R. Watt, 469, Great Western Road, Aberdeen, banker; J. H. Edwards, 1, Golden Square, Aberdeen, advocate. Private company. The number of directors is not to be more than five; the first are J. Duncan, R. Watt and J. H. Edwards; qualification, 500 shares. Registered office, 1, Golden Square, Aberdeen.

CITY NOTES.

Aron Electricity Meter, Ltd.

THE annual meeting was held at Winchester House, E.C., on Tuesday, Mr. H. Hirst presiding.

The CHAIRMAN, in proposing the adoption of the report (ELECTRICAL REVIEW, page 1084), said they had every reason to be satisfied with the result of the year's work, although the net profits attained were about £4,000 less than last year. They had done a larger business in Germany, with corresponding better results, and they had to record a similar agreeable experience in England and France. In Austria-Hungary they had suffered from severe stagnation of business, from causes not their fault. Those who knew the conditions that had obtained in that country during the Balkan War must realise that all building operations, all contracting work, and practically all construction work were stopped, with a consequent decrease of turnover and loss of profits to them, and the result that the contribution to the balance-sheet from that country was adversely affected to the extent of £8,000. It was very encouraging to note that during the first three months of this financial year business in Austria-Hungary had resumed a condition which was more normal, and their sales, and he hoped their profits, in the present year ought to be considerably better. The conditions in Austria and Hungary made it necessary that they should establish there suitable factories and establishments, and the additional capital expenditure of £24,000 last year had been principally in connection with this item. For the carrying on of the business in Hungary they had recently formed a Hungarian company, in which they had the assistance of influential gentlemen of that country, and he hoped that their business there would be considerably augmented by this enterprise. In reply to various letters which he had received, he would like to take that opportunity of explaining that although they found it proper and necessary to carry on their business in the various territories where they operated under the title of companies formed according to the laws of the different countries, companies which were capitalised in a manner suitable for the trade they were doing in those countries, the Aron Co. was the sole owner of those different foreign companies. It was merely a matter of expediency and helpful to business, in fact under other conditions it might be impossible to do business at all in some of the highly protected countries of the Continent. He was frequently asked on those occasions why they still put together under one heading, amounting to over £200,000, such different items as goodwill and patents, land, buildings, machinery, tools, and the like. Shareholders liked to compare one balance-sheet with another, and they did not like to make any change in the form unless there was some specific reason for doing so. He held out the hope last year that the board might decide during the year just closed to have the assets of the company valued and thus it might be opportune to split up those various items under different headings; the shareholders would thus be able to see what were their assets and what amount still stood in the books as the value of goodwill and patents. It had been impossible to make this valuation during the past 12 months, but the matter was now actually in hand, and when they met again the directors hoped to be able to place a report before the shareholders, according to which it might be their pleasure to consent to a different rendering of the accounts in future. With regard to the other items in the balance-sheet, the depreciation had increased by about £2,000 because for the first time they had to include the new Vienna factory, and though this was quite new they had thought it wise to depreciate it already by some £1,660. The business of the first three months of this year showed an increase over the corresponding period of last year all through the company, but the general outlook of industrial affairs in this, and all other European countries, was at present not over bright. He could only hope that the clouds might pass away, so that they might have a year of undisturbed work before them. The most important event during the past year, however, was not a matter of trade or finance, it was the death of their managing director and the founder of the company, Prof. Aron. It was a great loss to the company, but a much greater loss to those who had had the good luck to work with him, and who had had the opportunity to appreciate his great qualities. He (Mr. Hirst) felt confident that now that the business had emerged from the evolutionary and inventive stage, and had entered the ranks of mere industrial undertakings, they would be able to hold their own with the assistance of the staff on the designing, manufacturing and commercial sides. It was very difficult to find for the position of managing director an absolute successor to Prof. Aron. He hoped the shareholders would approve of the action the board had taken, for which he took full responsibility. After interviewing every man who could possibly be considered, he came to the conclusion that the interests of the company would best be served if they appointed Mr. Manfred Aron, the son of the late Professor, to fill his chair. Mr. Manfred Aron had distinguished himself in an administrative capacity in the company, and his father had, to his (the chairman's) knowledge, a very great opinion of his ability, which he expressed repeatedly; he had a large holding in the company, he was the representative of his family, who also had a large holding, he bore the honoured name of Aron, and he knew that amongst the many enterprises of his father their company was nearest to his heart. The whole staff found this selection a suitable and proper one, and they were one and all willing to transfer their allegiance and loyalty to the son of their former chief. He (Mr. Hirst) had personally promised to give Mr. Manfred Aron every assistance in the great task he had undertaken, and he felt that he had acted in accordance with the wishes of the shareholders by agreeing to act as joint managing director with him for a period of two years. He was happy to state that his close intercourse with Mr. Manfred Aron and his work during the past few months had proved that their selection had been quite right, and that he would be capable of fulfilling his task like a true chip of the old block.

SIR JAMES PENDER, Bart., seconded the motion, and after some reference by shareholders to the loss of Prof. Aron, the report was adopted.

Montreal Light, Heat and Power Co.

FOR the fiscal year ended April 30, 1914, the gross revenue was $6,245,697, operation and maintenance cost $2,778,451, depreciation and renewal reserve $600,000, leaving as net revenue $2,867,246, less fixed charges $467,977, making the net income $2,399,269. Dividends paid amount to $1,275,000, and dividend payable, May 15th, 1914, $425,000, leave the surplus from the year's operations $699,269, less officers' and employés' pension fund $10,000. The gross revenue and surplus earnings show substantial and satisfactory increases over the previous year, notwithstanding increased operating expenses occasioned by advanced prices for raw materials, notably coal and oil for gas manufacture, and low water and ice conditions at the company's hydro-electric plants, necessitating extended operation of steam plant and purchase of additional power. The net revenue and net income, if accounted the same as in previous years, would also show substantial increases, but in the preparation of this year's accounts and to conform with the more modern practice of conservatively managed public utility companies, the directors have deducted depreciation and renewal reserve before instead of after arriving at net revenue, and the net revenue and net income are by comparison affected to that extent. The constantly increasing cost of raw materials has caused the management much concern, and while the directors propose a further concession in gas rates for the coming year, this condition if continued will seriously affect the cost of manufacture of gas in the future.

The continuous growth of the business adds emphasis each year to the necessity of providing adequate reserve for depreciation and obsolescence of buildings and equipment, and in view of the constantly changing methods and equipment, the depreciation reserve must be ample to take care of these conditions. In the meantime this and other reserves are invested in revenue-earning plant, and the public is getting the advantage of the use of this large investment upon which no dividend has to be earned.

The new steel pole transmission line between Cedars Rapids and Montreal is under way and will be completed simultaneously with the hydraulic development of the Cedars Rapids Manufacturing and Power Co., with whom the company has contracted for part of its power supply. The company's new ten storey addition to its office building was completed during the year.

It will be necessary to make the usual large extensions to both the gas and electric distributing systems to meet the constantly increasing demand for service in the newer sections of the city and suburbs. Notwithstanding increased costs reflected in the operating expenses, the directors have decided to make further concessions in both gas and electric rates and in due course will announce a reduction of 5c. per 1,000 cubic feet in the price of gas, equal to upwards of 5¾ per cent., and 4/10c. per K.W.H. (for overhead service) in the rate for electric incandescent lighting, equal to upwards of 6¾ per cent. The directors regret that they cannot consistently reduce the electric lighting rate for underground service; in fact the great difference in costs for this class of service as demonstrated by the cost of the new civic conduits and equipment will render it necessary to establish some fair differential to offset the additional cost entailed, and as the civic conduit system is extended into new territory, the consumers there will be required to pay increased rates for service. With these reductions the maximum rate for gas will be 85c. net per 1,000 cubic feet, and the standard rate for electric incandescent lighting (overhead service) 6c. net per K.W.H., which compares most favourably with rates charged elsewhere.

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Bombay Electric Supply and Tramways Co., Ltd.

THE annual meeting was held on June 23rd at the Electrical Federation Offices, Kingsway, W.C., SIR CHARLES OLIVANT, K.C.I.E., presiding.

In moving the adoption of the report (ELEC. REV., Vol. 74, p. 1003), the CHAIRMAN remarked that the report, like others of recent years, showed steady progress in the earnings of the undertaking. It showed that the net receipts for the year were £145,572, compared with £128,682, an increase of £16,890, which was equivalent to 13.12 per cent. The past year's results of the working of the traction branch, which still continued from the revenue standpoint the most important branch of the undertaking, showed an improvement. The proportion of expenditure to receipts had fallen from 49 per cent. to 48 per cent., and the net earnings had advanced from £84,820 to £89,548. This increase, however, could not be wholly assigned to growth in their traffic, as a considerable portion of it was due to the fact that they were justified last year, in consequence of their lower generation costs, in reducing the rate at which their supply branch sold electrical energy to the traction branch from 1.5 annas per unit to 1.3 annas per unit. The company carried 40,692,000 passengers on the lines last year, against 38,613,000 in 1912, an increase of 5.2 per cent. During the first five months of the current year their gross traffic earnings had recorded a further comparative growth of 5 per cent. The directors had applied for municipal sanction to lay an extension of the tramway along a considerable portion of the new Sandhurst Road, which promised to become the principal east to west trunk thoroughfare of the city. The question of the introduction of an experimental service of motor omnibuses was discussed by the managing director with the authorities concerned, during his recent annual stay in Bombay. There appeared to exist a consensus of official opinion that these vehicles were unsuited to the local conditions of the city, while, after giving to the matter very careful study, the directors were convinced that they could not be operated at a profit, except upon a scale of fares considerably above those in force upon tramways. To the introduction of an experimental service of railless trolley cars the same objections did not to an equal extent apply, and the directors were hopeful of being enabled to inaugurate a service in the not distant future. The business of the electric supply branch of the undertaking continued to show a steady progressive expansion. The many advantages of electric lighting over all competitive illuminants, coupled with the cheapness of the company's rates, appealed more and more to the people of Bombay, and from all districts of the city, applications for connections flowed in to an extent with which it was not always easy to keep pace. What he had said about the growing popularity of electric lighting, applied no less to electric fans. The growth of the company's power load for industrial purposes, was also a very welcome feature. Their sales of electric energy for power—apart from traction and from fans—aggregated 1,882,111 units against 1,103,824 units in 1912, and important developments lay ahead of them. So far in the current year there had in their supply branch been no abatement in their upward progress. During the year the capital expenditure amounted to £58,315, of which £51,993 was for the electric supply branch, chiefly for extensions to mains; the balance of £6,322 was the capital outlay in the tramways branch, mainly upon additions and improvements to the rolling stock. The investments which the company held on account of the depreciation and sinking funds were taken into the balance sheet at their cost price of £62,656. In recommending the payment of a dividend of 6 per cent. upon their ordinary shares out of the available balance of profit after meeting fixed charges, and providing what they regarded as adequate provision for their depreciation and sinking funds, the directors were making no departure from the financial principles which had throughout governed their administration of the company's affairs. When they assumed office nine years ago they found, through no fault of their own, the company burdened with a heavy capitalisation, a considerable proportion of which was unrepresented by any tangible assets, owing to the facts that a large sum had to be paid to the old tramway company for goodwill under the terms of its agreement with the municipality, and that heavy expenditure for underwriting, promotion and other similar claims had to be disbursed to the parties entrusted by the municipality with the raising of the necessary capital for financing the purchase of the old and the electrification of the new undertaking. The company took over the tramways weighted under the new concession with various obligations restricting their fares, from which the old company was free, and they were faced with the electrification, extension, and remodelling of its services. The supply branch, an entirely new business in Bombay, had to be established, organised, and developed. That being the situation the directors held that their first duty was to place the company on a sound financial basis. They arranged by the provision of an adequate sinking fund, the annual instalments to which were a charge against revenue, to amortise within the period of the concession, that portion of their capital not represented by tangible assets and which might therefore not be covered by the purchase price estimated to be payable by the municipality, should it exercise its option of acquiring the company's undertaking which would arise in 1947. They also had established a depreciation fund, their annual revenue contributions to which were estimated to provide for the replacement, when required, of all wasting assets of the business to which they could assign a definite life, to the credit of which account they had now £90,267, two-thirds of which were invested outside the business. Auxiliary to this, they had a small special reserve fund of £5,000. Since these funds were created they had further safeguarded and strengthened the prospective position of the shareholders, by providing that their second debenture loan of £200,000 should be repaid by annual drawings, which were also a charge against revenue, with the effect that the whole of this indebtedness would have been paid off by the year 1937, when the company would hold, free of cost, the additional tangible assets created by the expenditure of this £200,000. The policy he had outlined did not permit of the company paying any dividend to their ordinary shareholders for a few years, namely, until in the opinion of the board the financial provision the directors had made, the investment in their business of a considerable portion of their surplus revenue, and the expansion of their earnings, had justified a distribution. But he hoped these shareholders would admit that they had now received compensation for their patience in the handsome capital appreciation of their holdings which had taken place, and he believed they would concur with him that the price at which their stocks were quoted that day, both on the Bombay and the London markets, furnished a complete justification for the policy which the directors had pursued. There was another principle which they had always kept in view and acted upon, and that was not to declare a rate of dividend which they had not the fullest expectation of being able to maintain. With regard to the future, they were justified in anticipating a continuance in the steady progress of the business. New capital expenditure on extensions of their mains and tracks required time to fructify. In regard to the increase in capital foreshadowed in the report, the growth of their undertaking had outstripped their present resources, and these demanded augmentation in order that they might be enabled to make adequate provision for the profitable developments which lay ahead of them. A notice to their shareholders summoning a general meeting, to which their proposals would be submitted, would shortly be issued. He believed that the terms upon which the directors proposed offering to the shareholders the subscription of a further issue of the company's shares would prove attractive to them. The directors greatly regretted to be deprived of the services of a chief engineer of the great abilities which Mr. Cooper possessed. It was a source of satisfaction to them that Mr. Cooper had since been able to join the board. Consequent on his resignation of his position in Bombay the directors decided to divide Mr. Cooper's responsibilities between Mr. Baker and Mr. Moberly, his immediate lieutenants there. Subject to the control of the managing director, the former of these gentlemen was now at the head of the supply and the latter of the traction branch. The directors' expectations regarding them had, he was glad to tell the shareholders, so far been fully justified, and they had been well seconded by Mr. Lucas, Mr. Fowler, Mr. Mahaluxmivalah, and by the whole staff. No appreciative survey of their affairs, present or prospective, would be complete without a recognition of their obligations to the Managing Director, Mr. Rimington.

Mr. F. C. RIMINGTON (the Managing Director) seconded the motion, and stated that he had been asked by the Chairman to refer to a telegram which had been received from Bombay in regard to the gross earnings for the five months ending on May 21st last. These showed an increase of 12.4 per cent. as compared with last year and of 8.3 per cent. with the previous year, which was equal to an increase of about 50 per cent.

The motion was carried unanimously.

South American Light and Power Co., Ltd.—**The directors report that the net profit for the year to March 31st is £11,782. A dividend of 5 per cent. on the £172,400 capital issued is recommended, requiring £8,620; there is written off the debenture issue expenses £3,000, leaving to be carried forward £517. The receipts show a considerable increase over those of the previous year, but, owing to the poorness of the last Argentine wheat crop, little, if any, increase in the receipts can be expected for the coming year.**

Credenda Conduits Co., Ltd.—After writing off the goodwill account £1,000, the directors recommend a dividend at the rate of 8 per cent. per annum on the ordinary shares for 19 3, carrying forward £714.

Edmundsons' Electricity Corporation, Ltd.—The directors report steady progress. The net profit is £23,125, an increase of £4,226. After putting to reserve £9,000, and paying the preference dividend, £12,000, £2,125 is carried forward.

Stock Exchange Notice.—The Committee has ordered the following to be quoted in the Official List:—North Metropolitan Electric Power Supply—Further £100,000 6 per cent. cumulative preference stock.

"Harper" Electric Piano (1910) Co., Ltd.—A dividend for the half-year ended June 1st is announced at the rate of 4 per cent per annum.

Held Over.—Pressure upon our space compels us to hold over reports of several City meetings until next week.

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Cape Town Consolidated Tramways and Land Co., Ltd.

In the course of their report for the year ended December 31st, 1913, the directors state that the operation of the Camps Bay Tramways has resulted in a profit of £1,599, against a profit of £2,973 in the previous year, and the number of passengers carried shows an improvement of 33,119, but the increased price of coal, the extra expenditure on permanent way and the damages paid and expenditure incurred in connection with the accident early in the year, has resulted in a reduced balance of profit in spite of increased traffic.

At the annual meeting held on June 24th, at 1, London Wall Buildings, E.C., Mr. Robert Littlejohn (the Chairman) said that taking the results for the past year as a whole, they could not say that the company had done more than maintain its position without serious loss. It had had no revenue from its subsidiary companies, and none of them had achieved results sufficiently satisfactory to enable them to pay a dividend during the past year. So it had practically been out of the cash balance on hand at 31st December, 1912, that this company had paid its administration expenses, £1,790, and advanced a further £342 to the subsidiary companies. Referring to the subsidiary companies, he said that as regarded the Camps Bay Tramway Co., Ltd., although the traffic increased during 1913, the net result was a diminished balance of profit to the extent of £1,370. This was due in a measure to an unfortunate accident on the company's tramway in March, 1913, but principally to the increased price of coal at Cape Town, and to certain necessary renewals to plant and permanent way. They could only expect steadily better figures in the future from the operations of the tramways if the resident population at Camps Bay materially increased. It was increasing, and no doubt would continue to increase; but not as rapidly as could be desired. Under the ordinance in terms of which Camps Bay was absorbed into the enlarged municipality of Cape Town, that municipality had to spend £12,000 on public improvements at Camps Bay during the next three years. The expenditure of that amount on well-considered public improvements, and the expenditure gradually by the company on bungalows and cottages for sale, of the amount to be received from the municipality for public works and improvements already provided by the company, should materially increase the amenities and the resident population of Camps Bay, and consequently enhance the value, not only of that estate, but also of the tramways. In the future it should be as much in the interest of the municipality as of the company that Camps Bay should be judiciously developed and made as attractive as possible to permanent residents as well as to temporary residents and other visitors.

Mr. Ludwig Breitmeyer seconded the motion, which was carried.

National Telephone Co., Ltd.

Mr. Geo. Franklin (Liquidator) presided on June 25th at Hamilton House, Temple Avenue, over a meeting of the shareholders of this company, when the report (Elec. Rev., Vol. 74, p. 1043) was presented.

The Liquidator explained that the meeting was called under the Act to enable him to place before the shareholders a report of his acts and doings in regard to the winding up, and the report now presented was a record of the concluding stages of the winding up, every step of which had been full of pitfalls and difficulties. With regard to the report, the second paragraph showed how matters in issue with the Postmaster-General as the result of the appeals by him and by the company had been disposed of. It was shown that whereas he objected to certain sums, amounting to £397,000, being included in the award, he was enabled, by making a sacrifice of £45,000, in addition to the costs of the arbitration, to which the company was entitled, to make a settlement and so avoid prolongation of litigation. Paragraph 3 explained in a few lines the final result of many months of patient investigation. The presentation of their claim to the Railway and Canal Commission occupied many months of strenuous effort, and although the final result to the shareholders might be somewhat disappointing, he did not think that anything was lacking either in the manner of its presentation or in the preparation of the evidence offered to the arbitration tribunal. The Liquidator referred to the difficulties which had arisen in regard to the unclaimed dividends, and as to deposits paid by subscribers in regard to trunk services and postal facilities in respect of which such subscribers had ceased to exist. On February 9th an Order of the Court was made to deal with this matter, with the result that a final payment was made to the deferred shareholders of 1.48 per cent., making up a total of 105.48 per cent. In paragraph 8 reference was made to the loss of realisation on Exchequer bonds. The directors, in common with the shareholders, regretted the attitude which the Postmaster-General took up in insisting on his pound of flesh, although the circumstances had greatly altered from the time when the agreement was made, but as the Postmaster-General had decided on it, and as the board were advised that he was within his legal rights, they felt that there was nothing further to be done. As to the costs of the proceedings, he did not think that the amount of 1.32 per cent. of the sum realised could be considered excessive. The Liquidator proceeded to give the various dates on which the different steps necessary to be taken were commenced, which, he said, showed that they had not had a restful period since the company went into liquidation. Hardly a day passed without some steps having to be taken to bring about some decision. He had on other occasions expressed the indebtedness of the company to their officers for the great services rendered to him, and he repeated that they owed much to the skill and ability shown in relation to their affairs. Everything, he thought, had been done to produce the best possible results for the shareholders.

Mr. S. H. Sands formally moved the adoption of the report and this was seconded by Lord Harris and carried.

Replying to a vote of thanks, the Chairman expressed regret that the connection between the directors and the shareholders had been brought to a close. Had the shareholders known that their recompense for putting their money into the business for thirty years, was to be an annual dividend of never more than 6 per cent., and sometimes nothing at all, with a return at the end of £105 for every £100 put in, he rather thought they would never have invested their money in the business. He considered they had been treated in a grossly unfair manner, but there was nothing more to be done.

Consolidated Diesel Engine Manufacturers, Ltd.

An extraordinary general meeting of the shareholders of this company, which was very largely attended, was held on Thursday, June 25th, at Salisbury House, E.C., under the chairmanship of Mr. J. M. Fells.

The Chairman, in proposing a resolution for the voluntary winding-up of the company and the appointment of Sir W. B. Peat as liquidator, delivered a long speech in which he gave a history of the proceedings in connection with the company for the last seven months, during which he has been Chairman. He recalled the meeting in December last at which, he said, he told the shareholders that in his opinion grave errors of judgment had been committed by the board; that in the administration of the company there had been want of method, slackness of procedure, lack of engineering exactitude and looseness in the wording of contracts. On the other hand, the directors, in carrying out their bargains with buyers, had been almost quixotically correct. At that meeting he moved the appointment of a committee to enquire into the causes of the company's position, to advise as to remedies and to deal with the question of the board, and the possibility of reconstruction. That committee was not unanimous in its report, but the majority favoured reconstruction with an assessment, on the basis of the Ipswich works alone, and an arrangement by which the members of the Carels family should purchase from the company the shares which that company held in Usines Carels Frères. At the meeting in February last those proposals were rejected. Subsequently, the directors met some of the largest shareholders to see whether some agreed scheme could be brought forward, and on March 10th a meeting of large shareholders was held at which various schemes were discussed, and it was decided that the further necessary funds ought to be raised by a participating preference share issue. Shortly after that meeting negotiations were opened with a well-known financial house on the basis of the suggestions made at the meeting on March 10th, and on April 14th a meeting took place between the proposed underwriters and representatives of the company, as a result of which the underwriters expressed their willingness to proceed further in the matter, subject to their being satisfied on certain points. That proposed scheme involved a re-arrangement with the Usines Carels Frères, involving re-organisation of the relations between the two companies, and that scheme would have come before the shareholders for their ratification. On May 16th Mr. Peddie, who had taken a leading part on the committee, wrote stating that at the next meeting he would propose the election of himself and the Hon. F. N. Stanley as directors. On May 22nd representatives of the underwriters expressed a doubt as to whether the gentlemen who had provisionally agreed to act as directors to replace the present board would do so if there was to be any controversy as to the constitution of the new board. In the end the negotiations were broken off and the board came to the conclusion that voluntary liquidation was the best course to be adopted. It might be that the liquidator would find the only solution in a simple sale of the property, but in view of the trade accounts, the contracts still current, the potentialities of the business, and its association with the name and personality of a great inventor, the liquidator might find it possible to effect a better arrangement by reconstruction than by sale.

Mr. Ball (a shareholder) seconded the resolution. He remarked that they had a fine asset in the half-share which they possessed in Messrs. Carels Frères business plus one vote. He hoped that on no account would the liquidator part with that asset except for a considerable sum. They seemed to have had no representation on the board of that concern and no dominating influence which gave them any power even to regulate the making up of the accounts. The directors of that company had been able to do just what they liked, and it was almost impossible for anybody to imagine how such an arrangement could have been entered into by a body of business men. He considered that the shareholders had been robbed, but even the shareholders' committee did not make any suggestion that a prosecution could lie against anybody. Under the circumstances he thought the best thing was to wind up under the direction of Sir W. B. Peat, who would see to it that the best that could be done for the shareholders would be done. If that was done they would get something, but if the company

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was handed over to Mr. Peddie and his friends he did not believe that the shareholders would get a sou out of it.

Mr. T. Taylor Peddie made a long speech traversing the Chairman's statement in many directions. The promotion of the company was, he said, one of the biggest ramps ever perpetrated on the London public, and he had no intention of leaving the gentlemen alone who were responsible for it, especially when he knew that the internal arrangements of the company still required to be adjusted. It was under the original agreement that the high-speed engines, the half interest in which was bought by the company from Carels Frères and which had since proved an utter failure, were supplied, and upon which the great losses were incurred. The directors had blamed Mr. Bathe, their former managing director, for the losses so incurred, but it must be obvious that Mr. Bathe could not be responsible for the manufacture and design of engines manufactured at the works of Carels Frères. Coming to the crux of the question he held that Messrs. Carels were responsible for a very large portion of the losses incurred. He hoped that if liquidation was to come the shareholders would reject the proposal of the directors and insist upon a compulsory winding up under the supervision of the Court.

After considerable discussion the resolution was defeated on a show of hands by 38 votes to 28. The Chairman thereupon demanded a poll to be taken immediately.

On the motion of Sir Robert Filmer a resolution was carried to the effect that in the opinion of the meeting the liquidator should not employ any firm of solicitors who had previously done business for the company.

The result of the poll as published in the Press shows:—For the resolution, 264,586; against, 115,163. The directors' resolution for voluntary liquidation has therefore not been carried by the necessary three-fourths majority.

The petition of Walter Laurence & Son for a compulsory order to wind up Consolidated Diesel Engine Manufacturers, Ltd., came before Mr. Justice Astbury in the Companies Winding-up Court on Tuesday. Mr. F. Russell, K.C., for the company, asked for an adjournment for a week. The company, he said, had taken a vote on the question whether there should be a voluntary winding-up and on a show of hands that proposal was defeated. A poll was demanded and had been taken, but a question had arisen as to whether certain votes were valid.

Mr. Owen Thompson, on behalf of the creditors for over £7,000, opposed the adjournment. He said the company held 90 per cent. of the shares in a subsidiary company and they could vote for a voluntary winding-up of that subsidiary company during the week.

Mr. Russell gave an undertaking that the company for which he appeared would not exercise their voting power in that connection.

The petition accordingly stood over for a week.

Russian Wireless Telegraph and Telephone Co.

The *Financial Times*, of June 24th, contains a translation of the report of this company for the year ended 31st December last, which was submitted to the shareholders' meeting on 31st May. The gross receipts from work carried out have reached the sum of 307,068 roubles, against 250,189 roubles during the previous year, and the net revenue was 140,219 roubles, against 139,801 roubles, in spite of the considerable increase of general expenses in 1913. This increase, amounting to 166,651 roubles, was partly due to the very high rate of interest paid owing to the state of the financial market, on the capital borrowed for the purpose of satisfying the company's requirements in ready money, and partly to the necessity for enlarging the premises and increasing the number of employees, to deal with the growing business. Further, a very important fact in this respect is the large amount of orders not completed by 31st December, 1913, especially in connection with the contract entered into with the Military Engineering Department for the erection of a station of high power. The resolution regarding the increase of the capital to 3,000,000 roubles has now been carried out, nearly all the shares of the new issue having been acquired by the old shareholders; but in order further to improve the financial position the directors propose to increase considerably the capacity of the works by erecting a special building and providing it with additional equipment. During the last twelve months many new improvements of a technical character have been carried out, and these improvements will still further increase the demand for wireless communication. Special attention has been paid to the installation of high-power stations especially for commercial purposes. Instruments have been designed for the automatic transmission as well as for the automatic recording of messages, thus enabling the stations to increase to a large extent their working capacity. Besides the installation of stations of high power, in the company's laboratories work is being continued in connection with the construction of special types of military and marine stations, and in a short time the company will be able to put some of their apparatus on the foreign market. Lately much attention has been paid to the designing of special types suitable for the requirements of mercantile shipping. It was foreseen long ago that wireless telephony would become possible, but many technical difficulties were met with in preparing to bring it into practical use. Recently these difficulties have nearly been overcome, and the possibility of adopting wireless telephony for military, naval and commercial purposes is becoming an accomplished fact. Finally, it is an interesting fact for shareholders that the station has recently successfully communicated with a Marconi station of high power in Wales and has exchanged messages with that station. This is the first time in the history of Russia that messages have been exchanged direct with Great Britain by means of wireless telegraphy. Taking into consideration the large orders the company will have to deal with, it will be quite impossible to carry these out without having sufficient credit, and, therefore, the board requests the shareholders to authorise it to have a credit, as and when required, up to 2,000,000 roubles.

Consolidated Electrical Co., Ltd.

The directors' report for the year ended March 31st, 1914, states that the ordinary income for the period amounted to £4,786, in comparison with £6,004 for the previous year, the falling off being due to temporary loss of income consequent upon the change in the company's investments explained at the last general meeting. The general charges for the year amounted to £1,220, in comparison with £1,252 for the preceding twelve months. Of the balance of £8,242 standing to the credit of revenue account, the interim dividend of 3 per cent. paid on the preference shares on January 1st, 1914, absorbed £450, leaving a disposable balance of £7,792. The final dividend of 3 per cent. payable on the preference shares on 1st July will absorb a further £450, and the directors now recommend the payment of a dividend on the ordinary shares of 3¼ per cent. for the year. This will require £4,125 and leave £3,217 to be carried forward. The directors are satisfied that the valuation placed upon the company's investments in the balance sheet is within their intrinsic and realisable worth. It has become evident since the last general meeting that the feeling of the shareholders, with very few exceptions, is strongly favourable to the continuance of the company, and a scheme is under consideration for the re-arrangement of the capital account. In the meantime the funds of the company are profitably employed in realisable investments and short loans on securities.

The annual meeting was held on Monday, at River Plate House, Finsbury Circus, E.C., Mr. Herbert Allen presiding.

In proposing the adoption of the above report the Chairman said that was the ninth distribution made by the company on its ordinary shares. In the aggregate those dividends had amounted to 31 per cent. of the nominal amount of the £1 shares, but on the actual cash paid by the shareholders the return had been 124 per cent., or an average of nearly 14 per cent. per annum. With regard to the operations of the past year the first thing that would strike their attention was the drop of £1,218 in the income from investments. The reason for that drop was that until the early part of last year they held over 72,000 shares in the Anglo-Portuguese Telephone Co. Just before the closing of the accounts on 31st March, 1913, they disposed of 70,000 of those shares for £87,500. Their income for the year was not affected by that sale because they stipulated with the buyers that they should receive the 1s. dividend just falling due, so that really they got 25s. each for the shares although nominally they passed at 24s. Out of the proceeds of that sale they paid off their loans and other liabilities and they were left with £70,000 to invest temporarily or otherwise as the case might be. Obviously they could not find safe and profitable investment for that money at five minutes' notice. Investments had to be found gradually, and for a time the greater part of their money lay on deposit at the bank at a very low rate of interest indeed, indeed some of it even now was not invested in the strict sense of the word, but was utilised to even greater advantage by being out on loan at remunerative rates to responsible parties and amply covered by collateral securities. To many of them it was no secret that the great trust companies, such as that company might become one day, employed as much of their capital as they possibly could in temporary loans, because the more frequently they turned over their money the better return they would get for it in the long run. At last in investments and loans they got all their money out and it was giving them an excellent return, combined with equally excellent security. Temporarily, they had suffered a loss in interest, but they were still paying the same rate of dividend, to maintain which they had only had to encroach upon their revenue balance to the extent of £1,125. He had no hesitation in saying that their financial position at the present time was better than it had ever been before. A year or so ago they had £85,000 worth of eggs all in one basket and they were not all marketable. They had outstanding against them loans of £15,000 which might possibly have been called in at an inconvenient moment. Those had since been got rid of and at the present time their loans and investments together amounted to nearly £75,000. They were spread over 20 or more entirely distinct channels and between investment and loaning their income was larger than it used to be. As to the nature of their business there had never been a moment when they could not have realised the whole of their investments at their full cost price or even more and they could do that at the present moment. As to the future of the company, at the last meeting some reference was made to a possible winding up and a distribution of

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assets, and at that time he was inclined to think that that step was not far distant. Since then, however, they had taken some trouble to ascertain the general feeling of the shareholders on the subject and with the exception of about half a dozen gentlemen, the shareholders, generally speaking, were content with their investment as it was, particularly now that they had got rid of the old manufacturing business which was the undoing of the old company. Having satisfied themselves that the great majority of the shareholders were with them, nothing remained but for the board to bring forward a scheme of reconstruction and enlargement of the company. What they proposed was that the present £1 shares should be written down to 10s. each and that one new fully-paid £1 share be given for each two shares—in other words, the ordinary capital would be reduced from £110,000 to £55,000 and they would get rid of those fictitious assets which figured in the balance sheet. On the share capital so re-constituted they would be able to pay 7½ per cent. where they were now paying 3¾ per cent. The next step would be to enlarge the business of the company by the issue of further ordinary shares until the amount reached £100,000 or £150,000, possibly more. They might also issue a like amount of 5 per cent. preference stock or possibly a 4 per cent. stock. That, of course, was a matter that could not be decided upon at that meeting, and the board intended to convene a special general meeting in the autumn, when the whole scheme, together with the necessary resolutions, would be submitted for the consideration of the shareholders. With regard to the disposal of the Anglo-Portuguese Telephone shares, one reason they parted with them was that at the time the board of the Portuguese company—which had always been distinct from the board of that company, excepting that two of its five directors were also directors of the Consolidated Electrical—had decided against a bonus distribution from its reserve fund. With the sale of their 70,000 shares they parted with the control of the Portuguese company, and quite recently the board of that company had reversed its former policy and made a bonus distribution and also an issue of new shares. He was glad to say that they had been allowed to participate in that new issue to the extent of 10,000 shares at par, carrying dividend from 1st January last.

MR. RICHARD BARNETT seconded the motion.

Replying to shareholders, the CHAIRMAN said that on liquidation he estimated that the assets would produce about 10s. per share. Personally, he thought it would be a good thing to reconstruct, and he believed that was the view of the great majority of the shareholders. However, the full scheme, together with the necessary resolutions, would be sent out to all the shareholders and until they voted it was impossible to say which way the majority would vote.

The report was then adopted.

J. G. White & Co., Ltd.

MR. J. BEAVEN WHITE presided on Monday, at the Cannon Street Hotel, E.C., over the annual meeting of this company.

In moving the adoption of the report (ELEC. REV., Vol. 74, p. 1085), the CHAIRMAN said that the directors had referred to the depressed financial conditions now existing. These conditions had chiefly affected them in the following manners. First, they have not received new contracts as fast as they had been completing those in hand; and, secondly, they had been unable to follow as closely as they might wish the policy that the company had had since its inception, of keeping its position liquid, by the realisation of the securities taken in connection with contracts or where they had been assisting in financing new enterprises. The business had largely to do with the construction and development of hydro-electric enterprises, electric lighting and power development, electric tramways, railway and drainage works, and other public works. The most profitable field for these works had naturally been in countries where development had been rapid during the past few years, so that South America had been their principal field. In connection with these works, the present financial depression had made it difficult, if not impossible, to secure the necessary capital for the development of new enterprises, and in many cases had prevented the extension of established companies even where their earnings had been sufficient to place the security on a good investment basis. The works which they had in hand had been continued, and in this respect they had been fortunate. They had also been fortunate in securing some new contracts of importance, notwithstanding the conditions referred to. The Municipal and General Securities Co., Ltd., the capital of which it had been desirable to double, had continued to do a satisfactory financial business and had paid them a dividend of 10 per cent. per annum on its capital. The International Light and Power Co. owned a number of electric lighting and power undertakings in South America and also one in Yucatan, Mexico. All of the company's properties were making satisfactory progress, and it had been fortunate that the property in Mexico was in Yucatan, where there had been no disturbance, and therefore had been largely free of the difficulties that had occurred in other parts of Mexico, except for the effects of the fall in exchange. Their interest in this company was such that they had been financing its requirements until an issue could be made of the company's debentures. The earnings of the company's properties were at the present time at such a rate that the interest on the debentures was two-and-one-half times covered. From this they might judge as to the safety of the investment, and so soon as market conditions were satisfactory they would be able to realise the securities which they had taken, so as to provide them with the funds for taking up new enterprises and developing their business opportunities which would come with a return of more settled conditions. The enterprises in the Amazon Valley, with the management of which they were connected and in which they had a considerable interest, though representing less than 10 per cent. of their investments had had some set-back due to the general depression and to the rubber crisis. They had, however, considering all conditions, held their own as well as could be expected, and there was a growing opinion amongst those interested to the effect that the crisis might have reached its climax, and that conditions might shortly improve. The Amazon Valley was showing a resourcefulness that its best friends hardly anticipated, so that it was not impossible that it might emerge from its present trials with a new vigour and greater possibilities. The Building Construction Company had been finally liquidated by a distribution of certain of its investments which had been taken into their account and would be realised at an opportune time. The net profit for the past year had been £70,387. This was somewhat smaller than for the two preceding years, but under the circumstances they felt encouraged rather than discouraged by the result. This profit enabled them, after putting £15,000 to the general reserve account, to recommend dividends at the same rate as for the past three years, viz.: a total of 12 per cent. on the preference shares and 62 per cent. on the ordinary shares of the company. Referring to the balance sheet the assets side showed that the cash and quick assets amounted to £145,597 as against £178,361 last year, a very moderate reduction under the circumstances. The item of "Works in progress" showed a large reduction, partially for the reasons already explained that the turnover in the construction department was less, but mainly because works in connection with the purchase and development of certain new electric lighting properties which were last year in the "Works in progress" item, this year appeared in the investment account. The investment account showed an increase from £163,728 to £420,257 for reasons previously explained. The dividends and interest from the securities held amounted to about 8 per cent. per annum on the book value, so that they might judge from these as to the conservative figure at which they had been valued. They would be disappointed if they did not realise very considerable profit when they were finally realised. With regard to the outlook for the year now current, he might say that they anticipated a further reduction in profits; at the same time, the amount of business in hand, although reduced, was still of considerable volume, and should be sufficient to bring the results for the year above rather than below the average which the company had shown since its inception. With regard to the resolution which they were asking the shareholders to pass with regard to the borrowing powers of the company, their articles now provided that the total amount borrowed at any time should not exceed the issued share capital of the company. At the time when the articles were drawn up in this way the issued share capital represented the total assets which the company had to deal with; in fact, it represented more than the tangible assets. The ordinary shares at that time represented goodwill to the extent of £47,000. They had now written off the goodwill account and accumulated surplus profits in the business equal in amount to the share capital, with the consequence that they were now able to do business on a larger scale than they were at the time the original articles were drafted, and there might be times when it was necessary in connection with the company's normal business temporarily to borrow amounts in excess of the share capital, and in asking them to give them borrowing powers equal to the share capital and reserves for the time being, they were merely asking to be reinstated in the position they were in when the original article was drawn.

MR. W. C. BURTON seconded the motion and the report was adopted without discussion.

The CHAIRMAN then proposed a resolution amending the articles of association so as to carry out the object he expressed in his speech.

The resolution was also carried without discussion.

Charles Churchill & Co., Ltd.—For the year ended March 31st last, the directors place to reserve £8,000, and propose a dividend of 20 per cent. (£10,000) on the ordinary shares, less £2,500 already paid by way of interim dividend; to distribute a bonus of 4s. 6d. per share on the ordinary shares; place an additional sum to reserve account of £8,000 and carry forward £4,629, —*Financial Times.*

Greenwood & Batley, Ltd.—The directors recommend dividends of 7 per cent. per annum on the preference and 5 per cent. on the ordinary shares for the year ended March, 1914. £8,000 is put to depreciation and £4,824 carried forward.

Japan.—The amount of fresh capital invested in the electrical and electricity supply industries in Japan during May last is returned at £385,000, of which £190,000 was for new undertakings, and £195,000 for the extension of old concerns.

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Aluminium Corporation, Ltd.—At the recent annual general meeting it was determined not to hold the extraordinary meeting to pass resolutions varying the rights of the holders of the participating shares, in consequence of attention having been called to an ambiguity in the resolutions proposed to be submitted. The resolutions were recast so as to avoid the possibility of ambiguity, and notice of a fresh meeting on July 1st was issued. The secretary states that "the existing rights of the participating shares are the receipt of one-fifth of the whole profits of the company after payment of debenture interest, and, in the event of liquidation, to one-fifth of the assets of the company, after discharging liabilities to debenture-holders and other creditors. The modification of their rights as proposed will be to the advantage not only of the ordinary shareholders, but also, in a less degree, of the preference shareholders."

Trafford Power and Light Supply (1902), Ltd.—After charging debenture stock redemption fund and transferring to depreciation account £3,000, the accounts show a net profit for the past year of £4,846, as compared with £1,509 last year. The directors recommend a dividend of 5 per cent. on the preference shares. Terms were some months ago arranged with the Manchester Corporation for the purchase of the company's undertaking, but Parliament has disallowed the clauses relating to this purchase. "The directors consider it reasonable to anticipate that an offer to purchase may, in the near future, be received from one source or another."—*Financier.*

Rushden and District Electric Supply Co., Ltd.—Mr. F. H. Thornton, J.P., presided at the second annual meeting held at Northampton on June 24th. He said that, considering the short existence of the company, it had done very well. The number of consumers was now 57, and he hoped to see the manufacturers in the district avail themselves of electricity for power purposes. Mr. Brook Sampson seconded, and the report was adopted.

Imperial Tramways Co., Ltd.—Sir George White presided at the annual meeting held at Bristol on June 24th. He said that the general results of the business of the year could not be other than satisfactory to the shareholders. They were no longer under a cloud, and there were prospects of development in new directions.

Eastern Telegraph Co., Ltd.—A first quarterly interim dividend of 1½ per cent. on the ordinary stock is announced.

STOCKS AND SHARES.

Tuesday Evening.

The hot weather must be the excuse for the old joke that the principal rise has been in the thermometer. Markets before the heat-wave set in were inclined to lassitude and inertia, and with the fresh advance in the temperature, disinclination to deal in the Stock Exchange has become emphasised. At the same time, the observer will do well to notice the growing cheapness of money. This week's Consol settlement has been arranged on the basis of no more than 2 per cent.—nor can this light rate be ascribed to the preponderance of a bear party. Lombard Street authorities are almost unanimous in prophesying a long spell of pronounced ease in the money market, and this cannot fail of its effect, however much its influence may be checked by outpouring of new capital issues.

Consols have again started on the upward path, and rearrangement of investment quotations is general throughout all the Stock Exchange markets. The other day, for instance, half-a-score of Debenture stocks in the cable department were raised from ¼ to a point, though it is probable that in less than half the number did any stock change hands. The hardening tendency is curiously partial in its operation, for the Home Railway list—to quote one of the principal sections of the purely investment markets—exhibits scarcely any advances this week in its pre-ordinary securities. Again, in the case of electric supply Debenture stocks, while demand is insistent, quotations are allowed to remain at their current levels. Business, it may be thus inferred, is patchy. The fanatical murder of the Austrian Archduke last Sunday had no effect upon Stock Exchange prices.

Metropolitan Consolidated stock is ¼ higher at 39¾. Opposition from the North London Railway brought about the withdrawal of the Bill for the joint working of the Great Northern and City line by the Great Northern and the Metropolitan Railway Companies. This means, of course, that the plan for extending the tube to a proposed Lothbury station, and afterwards to the Bank, will also be abandoned—or, at all events, postponed. Echoes of the Swansea Conference continue to trouble the Home Railway market. At this season of the year, there should be at least some spark of animation in connection with the forthcoming dividend announcements; but Home Railway stocks are for the time being the fastest asleep of any issues in the Stock Exchange, and while this may be regarded as a high compliment to certain of the mining departments, it is, nevertheless, well deserved, so far as the railways are concerned. Districts went up with Metropolitans, and have retained part of this improvement, but in the other Undergrounds there are no changes worth mentioning.

The news from Mexico is of sufficient interest to keep attention on the *qui vive* for what may be the next development. During the past few days, rumours have insisted that the diplomatists at Niagara are practically agreed on some of the major points touching the questions of dispute; on the strength of this, many of the Mexican prices hardened, although, so far as the utility companies go, the movements are unimportant. Monterey Debenture is a point lower. Mexican Light & Power Preferred and First Mortgage bonds are both better. Brazilian Tractions, after touching 80½, reacted to 79. Shawinigan Water Capital stock lost part of its previous improvement, but the 4½ per cent. Debenture is amongst those to benefit by the demand for sound investment securities. Canadian General Common at 102½ is *ex* dividend. Calgary Power 1st Mortgage bonds have receded a trifle, and British Columbia Electric Railway issues are slightly lower.

Of the many dozen changes in our price lists over-leaf, by far the greater majority owe their movement to *ex* dividend markings. In some few cases deductions have been recovered, leaving the quotations unaltered on the week; and amongst these may be noticed Victoria Falls Preference, Western Telegraph shares, Commercial Cable Debenture and several others. The tendency throughout the markets is to lower prices by something less than the amount of the dividend, because it is found that the public buyer waits for the amount of the distribution to be taken off the price before sending in his orders. This is neutralised to some extent by the inclination—peculiar to most of us—not to sell until a security is quoted *ex* dividend, when the company's cheque may be retained without any reminder that it belongs to a purchaser. When markets are good, it probably pays the seller to wait for the quoting of the price *ex* dividend, though theoretically, of course, the deduction simply represents the amount of the dividend as near as possible.

The Constantinople Telephone Company notifies that no dividend will be paid for the half-year just ended, as authority to pay interest during construction ceased with the opening of the system on February 28th last. The president of the company, who has been to Constantinople, has returned with satisfactory reports, so dividends should be resumed in another six months or so. Meanwhile the price remains at 4¾ for the £5 fully-paid shares.

The excitement of the week has been furnished by lively dealings in Marconis. The legal cases now pending are thought in the Stock Exchange to be likely to have a prejudicial effect, inasmuch as they may serve to check ordinary buying of the shares; and on Tuesday morning a line was offered at 2¾. Although a subsequent recovery ensued, it was of small extent, and the prices are substantially lower on the week, both Ordinary and Preference showing a drop of ⅞. West India and Panama Telegraphs eased off to 30s., and the First Preference at 9 are 5s. down. Otherwise the list is generally firm, with small rises in a few of the principal Debenture stocks.

The Manufacturing group is inclined to harden. India-Rubber Preference, *ex* dividend, are 7s. 6d. better on the week, allowing for deduction of the 5s. just paid. Edison & Swan picked up to a couple of shillings. Aron Ordinary hardened to 16s. 3d. on the issue of the report. Brush Second Debenture at 33 *ex* dividend is in the proud position of returning 13 guineas per cent. on the money. The rubber share market plods along placidly. With the price of the produce keeping about 2s. 2¾d. per lb., there is no temptation for either investment or speculation to take a hand in the market, and so prices are what the newspapers call "marking time." Some of the rubber shares which used to be popular not very long ago, have become so passive that they are not dealt in from one week's end to another.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	Inc.
		£	£		£	£		
Bath	June 24	5,055	+ 305	25	22,724	+ 1,747	..	..
Blackpool-Fleetw'd	,, 20	4,409	+1,611	24	12,939	+ 585	8	..
Bristol	,, 26	40,464	+6,919	26	209,460	+20,258	30·5	..
Brit. Elec. Trac. Co.	,, 19	241,434	+39,855	..	..	..	429·8	..
Chatham and Dist.	,, 18	8,873	— 30	24	21,361	+ 244	14·98	..
Cork	,, 25	2,183	+ 28	25	12,235	+ 248	9·89	..
Dublin	,, 19	25,486	—1,088	25	137,162	— 3,696	54·25	..
Hastings	,, 24	4,575	+ 547	26	..	+ 303	19·3	..
Lancashire United	,, 24	7,023	+ 864	25	41,087	+ 4,657	42	·3
Llandudno-Col. Bay	,, 19	1,758	+ 596	29	6,493	+ 49	6·5	..
London United ..	,, 19	28,286	— 465	25	14,902	+ 2,751	..	..
Tyneside	,, 17	2,853	+ 189	24	12,814	+ 816	11	..
Anglo-Argentine ..	,, 24	123,703	+ 865	25	1,405,980	+ 7,851	..	..
Auckland	,, 5	20,919	+ 912	48	247,311	+ 6,331	25·42	1·06
Calcutta	,, 27	178,647	+1,815	..	..	+ 6,465	..	..
Kalgoorlie, W.A. ..	May	3,025	..	22	12,830	..	20·5	..
Madras	June 15	3,718	+ 205	23	21,199	+ 1,691	15·25	..
Montevideo ..	May	29,016	— 815	80	229,192	— 401	..	..
Cen. London Rly.	June 20	19,459	+1,178	25	125,868	— 2,593	6·78	·4
City & S. Lon. Rly.	,, 20	10,290	+ 83	25	67,765	— 4,230	7·26	..
Dublin-Lucan Rly.	,, 19	497	+ 63	24	3,271	— 20	7	..
L'pool Overh'd Rly.	,, 21	7,203	+ 269	25	42,659	+ 1,584	6·6	..
London Elec. Ry. Co.	,, 20	54,675	+2,755	25	355,880	+ 2,775	21·25	..
Mersey Railway ..	,, 20	9,068	+ 328	25	56,420	+ 863	4·5	8·5
Metropolitan Rly.	,, 21	78,260	+7,843	25	464,296	+39,435	29·25	..
Met. District Rly.	,, 20	53,009	+ 764	25	328,924	+ 1,074	25	..

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SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations June 30th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	..	⅜ — ⅝	..	Nil
Do. 5 % Pref.	1	5	5	⅝ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	18½ — 15½	..	..
Do. Do. Deferred	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	85 — 89 xd	..	6 11 2
Do. 7 % Non-Cum. Pr'f.	100	8	8½	53 — 56 xd	..	5 18 8
Do. 5 % Perp. Deb.	100	5	5	92 — 94	— ½	5 6 5
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 80	..	5 12 9
Central London Railway, Ord.	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 8
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	84 — 86	..	4 18 0
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	80 — 82	..	4 17 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	91 — 94	..	5 6 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1908	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	86 — 88	..	4 11 0
Hastings Trams, 6 % Pref.	1	6	6†	⅝ — ⅞	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76 xd	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	84½ — 86½ xd	..	5 15 4
London and Suburban, Ord.	1	..	..	⅞ — 1	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅜ — ⅝	— ⅛	8 0 0
Do. Do. 4½ % 1st Deb.	100	4½	4½	74 — 79 xd	— 1½	5 14 0

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations June 30th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
London Elec. Railways, 4 % Deb.	100	4	4	88 — 90 xd	..	4 9 0
London United Trams, 4 % Deb.	100	4	4	54 — 58 xd	..	6 18 0
Metropolitan Railway Consol.	100	18	18	39½ — 40	+ ½	4 12 10
Do. Surplus Lands	100	2½	2½	59 — 61	..	4 10 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	83 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	79 — 81	..	4 6 4
Metropolitan District Ord.	100	Nil	..	24½ — 24¾	+ ¼	Nil
Do. 6 % Deb.	100	6	6	186 —189 xd	..	4 6 0
Do. 4 % Deb.	100	4	4	91 — 93 xd	..	4 6 0
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	88 — 86	..	5 4 8
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	85 — 88 xd	..	5 2 3
Do. 5 % Deb.	100	5	5	85½ — 88½	..	5 18 0
Potteries, Ord.	1	3½	3½	⅜ — ⅝	..	8 12 10
Do. 5 % Pref.	1	5	5	⅝ — ¾	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	81½ — 84½	..	5 6 2
South Metro. Trams, 4 % Deb.	100	4	4	64 — 68 xd	..	5 17 8
Underground Elec. Railways	10	..	..	8½ — 8¾	..	Nil
Do. "A"	1/-	..	..	1/16 — 1/8	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	115 —117	..	5 2 7
Do. 4½ % Bonds	100	4½	4½	100 —102	..	4 8 2
Do. 6 % Income	100	6	6	90 — 91	..	6 11 10
Yorkshire (West Riding), Ord.	5	Nil	Nil	⅛ — ¼	..	Nil
Do. 6 % Pref.	5	3	4	4 — 4½	— ⅛	4 9 0
Do. 4½ % Deb.	100	4½	4½	83 — 86 xd	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4 11/16 — 4 13/16 xd	..	5 17 5
Do. 2nd Pref.	5	5½	5½	4 3/16 — 4 5/16 xd	+ 1/16	6 2 8
Do. 4 % Deb.	100	4	4	91 — 93 xd	..	4 6 0
Do. 4½ % Deb.	100	4½	4½	96 — 99 xd	..	4 11 0
Do. 5 % Deb.	100	5	5	94½ — 96½ xd	..	5 3 6
Auckland Trams, 5 % Deb.	100	5	5	101 —104 xd	..	4 16 8
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11¾	..	5 2 2
Do. 4½ % Deb.	100	4½	4½	94 — 96 xd	+ 1½	4 18 9
Do. 5 % 2nd Deb.	100	5	5	100 —102	..	4 18 0
Brazilian Traction, Light and Power	$100	6	6†	78 — 80	— ½	7 10 0
Brisbane Trams Invt., Ord.	5	8	8	6¾ — 7⅝	..	5 8 3
Do. 5 % Pref.	5	5	5	4¾ — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	98 —100 xd	..	4 10 0
B. Columbia Elec. Rly., Def.	100	8	8†	108 —112	—1	7 2 8
Do. Pref. Ord.	100	6	6	108 —107	..	5 12 1
Do. 5 % Pref.	100	5	5	105 —108	+1	4 12 7
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 0
Do. 4½ % Vancouver Deb.	100	4½	4½	94 — 98	..	4 12 0
Do. 4½ % Con. Deb.	100	4½	4½	95½ — 97½	+ ½	4 7 2
Calcutta Trams, Ord.	5	7½	9½	6¾ — 7	..	6 15 9
Do. 5 % Pref.	5	5	5	4⅜ — 5 xd	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	96 — 99 xd	..	4 11 0
Cape Electric Trams	1	5	5	⅜ — ½	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5 21/32 — 5 23/32	..	4 11 11
Do. 4 % Deb.	100	4	4	95 — 100 xd	+4	4 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	91 — 95	..	5 5 3
Havana Elec. Rly., 5 % Bonds	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie El. Trams 5% A Deb.	100	5	5	82 — 87	..	5 15 0
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil

La Plata Elec. Trams, Ord.	1	..	..	⅛ — ¼	..	..
Do. Pref.	1	4½d.	6	⅜ — ½	..	6 5 0
Lisbon Elec. Trams, Ord.	1	6	6	1 3/32 — 1 5/32	..	4 9 8
Do. 6 % Pref.	1	6	6	1 3/32 — 1 5/32 xd	..	5 3 8
Do. 5 % Deb.	100	5	5	95 —100	..	5 0 0
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4½ — 5½	..	5 14 3
" Elec. Tr. (1904), Deb.	100	5	5	98 —101 xd	..	4 19 0
Manaos Trams & Lt., 1st Deb.	100	5	5	78 — 81	..	6 8 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ —100½	..	4 19 6
Mexico Trams Com	$100	7	7	72 — 76	..	..
Do. Gen. Con. 5 % Bonds	..	5	5	80 — 84	..	5 19 1
Do. 6 % Bonds	100	6	6	77 — 81	..	7 8 2
Para Elec. Rlys. & Lt., Ord.	5	10	10	4 — 4½	..	11 2 2
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	87½ — 90½	+1	5 10 8
Rangoon El. Tr. & Sup., Pref.	5	6	6	4⅞ — 5⅜ xd	..	5 11 7
Do. 4½ % 1st Deb.	100	4½	4½	94 — 96 xd	+1	4 18 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	100 —102	..	4 18 0
Do. 5 % Mort. Bonds	100	5	5	90 — 92	..	5 8 8
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	97 —101	+1	4 19 0
Singapore Trams, 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Un. Elec. Trams Monte Video	5	7	7	4½ — 5 xd	..	7 0 0
Do. 6 % Pref.	5	6	6	4¾ — 5⅛ xd	..	5 17 8
Do. 5 % 1st Deb.	100	5	5	93½ — 96½	+1½	5 3 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 8

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9½ — 10⅛	..	4 5 9
Do. Second 6 % Pref.	10	6	6	10⅜ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96 xd	..	4 18 9
Brompton & Kensington, Ord.	5	10	10	8⅜ — 9⅛	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8½	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	89½ — 92½	..	4 6 8
Charing Cross, West End & City	5	5	6	4⅜ — 6½	..	5 14 9
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 3/16 — 4 7/16 xd	..	5 1 5
Do. Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Chelsea, Ord.	5	5	5	4⅜ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	95 — 98 xd	..	4 11 0
City of London, Ord.	10	9	10	16½ — 17½	..	5 16 0
Do. 6 % Cum. Pref.	10	6	6	12½ — 13½	..	4 7 3
Do. 5 % Deb.	Stock	5	5	115 —118 xd	..	4 4 9
Do. 4½ % Second Deb.	100	4½	4½	98 —101 xd	..	4 9 1
County of London, Ord.	10	6	7	11⅜ — 12½	..	5 14 8
Do. 6 % Pref.	10	6	6	11⅜ — 12½	..	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	101 —104 xd	..	4 6 7
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 1
Edmundson's, Ord.	£8	..	..	5/16 — 7/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3¾ — 4	..	7 10 0
Do. 6 % Non-Cum. Pref.	5	..	..	1⅜ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	88 — 96	..	5 4 6
Folkestone	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % First Deb.	100	4½	4½	93 — 96	..	4 14 9

Hove	5	8	9	8¾ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7⅞ — 7¾	..	5 14 8
Do. 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	8	2½	3	1⅜ — 1⅝	..	5 10 7
Do. 6 % Pref.	5	6	6	4⅜ — 5¼	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	4½	4½	8½ — 8⅞	— ⅛	6 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4½ xd	— ⅛	4 10 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 99 xd	..	4 11 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	82 — 84 xd	..	4 3 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10¼ xd	..	5 17 8
Oxford	5	7	7	5⅞ — 6⅛	..	5 10 0
St. James' and Pall Mall, Ord.	5	10	12	9¼ — 9½	..	6 3 1
Do. 7 % Pref.	5	7	7	6¾ — 7⅛	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	82 — 86 xd	..	4 2 4
South London, Ord.	4	5½	5½	2¾ — 3⅛	..	6 10 4
Do. 5 % First Mort. Deb.	100	5	5	97 —100 xd	..	5 0 0
South Metropolitan, 7 % Pref.	1	7	7	1 3/16 — 1 5/16	..	5 6 8
Do. 4½ % First Deb. Stock	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£8	Nil	..	5/16 — 7/16	..	..
Do. 5 % Cum Pref.	5	8‡	4	2⅜ — 3	..	6 18 4
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	+1	5 3 8
Westminster, Ord.	5	10	10	8¾ — 9¼	..	5 12 8
Do. 4½ % Cum Pref.	5	4½	4½	4 13/16 — 5 1/16 xd	+ 1/16	4 6 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Bonded Certs.

Continued on next page.

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SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 30th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 11 7
Calcutta, Ord.	5	8½	9	7¼ — 7⅜	..	5 18 0
Do. 5 % Pref.	5	5	5	5 7/16 — 5 9/16	..	4 14 1
Calgary Power, 1st Mort. Bds.	100	5	5	89½ — 91½	—1	5 9 3
Canadian Gen. El. Com.	$100	7	8	100 — 105 xd	..	7 12 6
Do. 7 % Pref.	$100	7	7	118 — 123	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	5	..	⅞ — ⅞	..	7 12 0
Do. 5 % Deb.	100	5	5	80 — 85	..	5 17 8
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	81 — 83 xd	..	8 19 6
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	94 — 97 xd	+6½	5 8 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93⅛ — 95½	..	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/16 — 5/16	..	Nil
Do. 6 % Pref.	1	6	4	¾ — ¾	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101 —104	..	4 16 2
Madras, Ord.	5	Nil	..	1¼ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 —106 xd	..	4 14 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	61 — 66	..	7 11 6
Mexican Lt. & Power, Common	$100	4	4†	45 — 48	..	..
Do. 7 % Cum. Pref.	$100	7	7	73 — 77	+1½	9 4 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	75 — 80	+1	6 5 0
Do. 5 % 2nd Mort. Bonds	100	5	5	59 — 64	..	7 13 3
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	50 — 54	—1	..
Montreal, Lt., H. and Power	$100	9	10†	230 —235	..	4 5 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	10	235 — 245	..	4 1 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	97 — 103	..	5 16 6
Do. 5 % Deb. Stock	Do.	5	5	99 — 101 xd	..	4 19 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5½	6	133 — 137	—2	4 7 7
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	100 — 102	+ ½	4 8 3
Toronto Power, 4½ % 1st Deb.	Do.	4½	4½	97 — 99	+1	4 11 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	85 — 87	..	5 15 0
Victoria Falls Power, Pref.	1	6	6	⅛ — ⅜ xd	—1/32	8 0 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 105	..	5 14 3

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	7	⅜ — ⅞	+1/16	8 0 0
Do. 6 % Pref.	1	6	6	⅝ — ¾	..	6 17 2
Babcock & Wilcox	1	16	16	2⅞ — 3	..	5 6 8
Do. Pref.	1	6	6	1⅛ — 1⅜	..	4 7 6
British Aluminium, Ord.	1	..	5	1/16 — 1/8	..	4 14 1
Do. 6 % Cum. Pref.	1	6	6	5⅝ — 5⅞	..	6 9 0
Do. 5 % Prior Liens Debs.	100	5	5	97 —100	..	5 0 0
Do. Deb. Stk.	100	5	5	90 — 95	..	5 5 8
B.I. & Helsby Cables	5	10	13	9⅜ — 9⅝	..	6 11 8
Do. Pref.	5	6	6	5⅝ — 6⅛	..	4 14 1
Do. Deb.	100	4½	4½	100 —108 xd	+1½	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref.	2	Nil	5	1⅛ — 1⅜	..	5 6 8
Do. Deb.	100	4	4	72 — 75 xd	+ ½	5 6 8
Do. 6 % Prior Lien	100	6	6	101 —104	..	5 16 6
Brewett, Lindley, Ord.	1	..	..	8/- —8/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ½	..	Nil
Do. 6 % Prior Lien Deb.	100	5	5	80 — 85 xd	..	5 17 8
Lo. 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb.	100	4½	4½	39 — 43 xd	..	13 12 8
Callender's Cable	5	15	15	11⅜ — 12½	..	6 3 8
Lo. Pref.	5	5	5	5 — 6⅛ xd	..	4 15 3
Do. Deb.	100	4½	4½	97 —100 xd	+2½	4 10 0
Castner-Kellner	1	20	25½	2 7/16 — 2 9/16	—1/16	8 15 5
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Dick, Kerr	1	Nil	..	⅜ — ½	..	..
Do. Pref.	1	6	6	⅝ — ¾	..	6 17 2
Edison & Swan, A, £2 paid	5	Nil	..	1⅛ — 1⅜	+1/16	Nil
Do. fully paid	5	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	57 — 61 xd	+1	6 11 1
Do. 5 % Second Deb.	100	5	5	61 — 66	..	7 11 6
Electric Construction	1	5	6	⅞ — 1 1/16	..	8 14 6
Do. Pref.	1	7	7	1 — 1⅛	..	6 4 5
Greenwood & Batley, Pref.	10	7	7	6½ — 7½	..	9 18 2
Do. Deb.	100	5	5	92 — 94	..	5 6 6
General Electric, 5 % Pref.	10	6	6	10⅜ —10⅞ xd	..	5 10 4
Do. Deb.	100	4	4	88 — 92	+1	4 7 0
Henley's, Ord.	5	15	20	14½ — 15½	..	6 9 0
Do. Pref.	5	4½	4½	4⅝ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	99½ —101½	..	4 8 8
India-Rubber, G. & T.	10	7½	7½	9¼ — 10⅛ xd	..	7 2 10
Do. Pref.	10	5	5	8⅝ — 9⅜ xd	+ ⅛	5 4 0
Telegraph Construction	12	20	20	86 — 88	..	6 6 2
Do. Deb.	100	4	4	99 —101	+1	3 19 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	..	63 — 67	..	5 19 8
Do. B 4 % Cum. Pref.	100	..	£4	40 — 44	..	9 1 10

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	4½	5⅝ — 6½	..	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	96 — 99	+1	5 1 0
American Telep. & Teleg., Cap.	$100	8	8	122 —126 xd	..	6 7 0
Do. Collat. Trust	$1000	4	4	92 — 95	..	4 4 8
Anglo-American Telegraph	Stock	8	8	64 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	107½ —109½	..	5 10 7
Do. Def.	Do.	30/-	30/-	22¾ — 23¼	..	6 9 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	6†	7½ — 7¾	..	5 6 8
Commercial Cable, Stg. 4 % Deb.	Stock	4	4	79 — 81 xd	+2	4 18 9
Cuba Telegraph	10	6	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	10	10	10	16 - 17	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4	3⅞ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	7½ — 7⅞	..	6 9 0
Direct United States Cable	10	4	4	6⅜ — 6⅞	..	5 16 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	129 —132	..	5 6 8
Do. 8½ % Pref. Stock	Do.	8½	8½	76 — 78	—1	4 9 9
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97	+ ½	4 2 6
Eastern Extension	10	7	7	12⅜ — 13	..	5 7 9
Do. 4 % Deb.	Stock	4	4	95⅛ - 97⅛	+ ⅛	4 2 1
Globe Telegraph and Trust	10	6	6†	10½ — 11½ xd	..	5 6 8
Do. 6 % Pref.	10	6	6	12½ — 13½ xd	..	4 14 1
Great Northern Telegraph	10	20	20	81¼ — 83¼	..	5 19 5
Indo-European Telegraph	25	12	12	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	5	5	83 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 72	..	5 11 1
Marconi's Wireless Telegraph	1	20	20	2¼ - 2⅜	—7/32	7 2 4
Do. 7 % Cum. Partic. Pref.	1	17	..	2⅜ — 2⅝	—1/16	7 3 2
Monte Video Telephone, Ord.	1	6	6	1⅝ — 1¾	..	6 8 0
Do. 5 % Pref.	1	5	5	1⅝ — 1¾	..	5 18 6
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100⅜ — 101⅛	+ ⅛	4 9 0
Oriental Telep. and Elec.	1	10	10	2 3/16 — 2 5/16	..	4 7 6
Do. 6 % Cum. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 13 5
Do. 4 % Red. Deb.	Stock	4	4	86 — 88 xd	..	4 11 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98 xd	..	4 1 8
Reuter's	10	10	7	7⅛ — 8⅛	..	8 4 8
Submarine Cables Trust	Cert.	6	6	126 —129	..	4 13 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	97 - 99	—1	4 11 0
United River Plate Telephone	5	8	6†	6½ — 6⅞	..	5 18 5
Do. 5 % Cum. Pref.	5	5	5	5 — 5⅛ xd	..	4 11 0
West Coast of America	2½	2½	N	¾ - 1⅛	..	Nil
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	97 - 100	+1	4 0 0
West India and Panama Teleg.	10	1½	1½	1⅜ — 1⅝	—1/16	7 18 10
Do. 6 % Cum. 1st Pref.	10	6	6	8⅛ — 9⅛	—⅛	6 9 9
Do. 6 % Cum. 2nd Pref	10	6	6	8¼ — 8⅝	+2/16	6 16 9
Do. 5 % Debs.	100	5	5	98 — 100 xd	+1	5 0 0
Western Telegraph, Ltd.	10	7	7	18½ — 19⅜ xd	+ ⅛	5 1 11
Do. 4 % Debs.	Stock	4	4	95 — 97 xd	..	4 2 8
Western Union 4½ % Fdg. Bonds	$100	4½	4½	94 — 97	..	4 12 9

* Unless otherwise stated all shares are fully paid. † Interim dividend. a Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Electric Cooking on the U.S.S. "Texas."—A recent issue of the *Electrical World* contains particulars of the extensive electric cooking equipment on the U.S. battleship *Texas*, which only left the Brooklyn Navy Yard in May last. Coal-fired ranges have been entirely replaced by 10 electric ranges in the general mess galley and five in the officers' galley, also two bakers' ovens. The officers and crew number 970, and about 6,300 lb. of bread per week are required, exclusive of the officers' requirements. All the boiled food for the men is prepared in steam-jacketed cauldrons (non-electric), but for the officers electricity is used exclusively for all cooking. In the crew's galley eight-plate ranges equipped with broilers and ovens are installed. Leaf elements are used in hot-plates—four connected in two series groups per plate; the broiler elements, of exposed spirally wound resistance wire, are stretched across the top of the compartment, and supported at intervals, and the oven units are similarly arranged at both top and bottom of the compartments. Extra "quick-heating" elements are also provided for rapid oven heating. The switches are arranged at the back over the hot-plates. A main switch and fuses are fitted with 10 knife switches, one for each heater on the range. The hot-plate and oven switches have each an auxiliary blade, to energise the extra-heat unit for rapid heating.

The two bakery ovens have each six baking levels and control switches on one side for the heaters placed at the top and bottom of each pair of baking levels. The heaters are similar to those in the range ovens. The apparatus installed allows of one-fifth being idle each week. The cooking staff greatly favour the electric cooking apparatus, which has been in constant use since March last.

The I.M.E.A. Bill.—On Tuesday last this Bill, for giving increased powers to the municipal authorities with reference to electricity supply, was introduced by Sir Howell Davies and read a first time.

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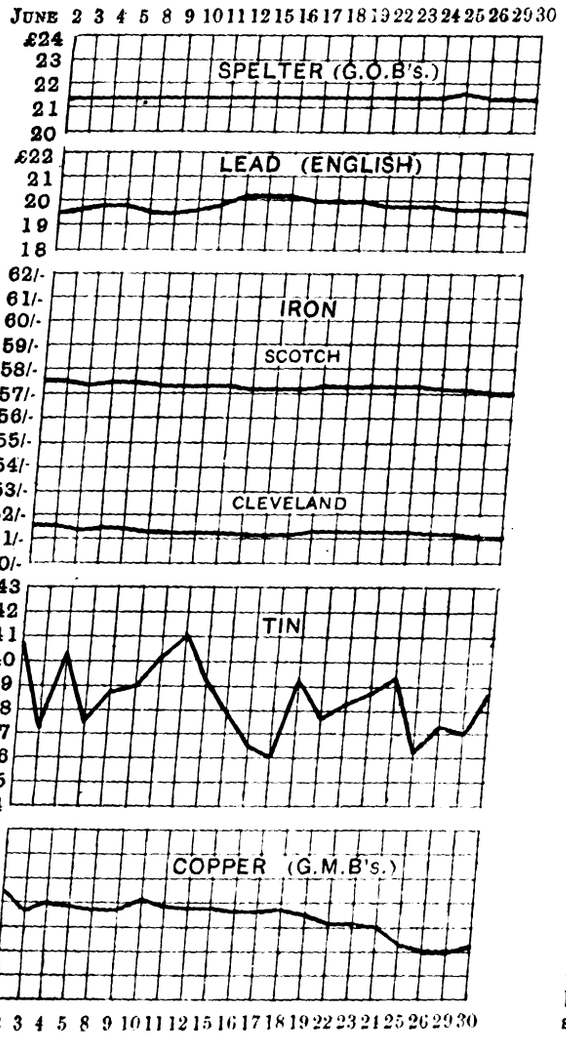
METAL MARKET.

Fluctuations in June.



Gas.—Our friend the *Gas World*, with admirable candour, discusses the Carpenter system of purification of coal-gas, which reduces the sulphur content to the "almost inappreciable minimum," and remarks: "The ultimate arbiter in the case of gas burned for lighting, the human nose, remains as active and as powerful as ever. Some persons' sense of smell is far more acute than that of the majority. There may be grounds for the opinion of certain physiologists that this sense is being gradually lost by civilised people, except for the strongest odours. The point is, however, that to many the odour of burned gas is very noticeable and equally offensive. The question is, will the reduction of sulphur claimed by Dr. Carpenter remove this objection? Or is it worth considering at all, in the actual and prospective state of the gas industry?"

The complete removal of the sulphur would remove one of the most serious objections to the use of gas; and we regret that our contemporary leaves the matter in the form of a question, and does not plump solid for amendment. But what we would ask is how the fact that "the odour of burned gas is very noticeable" squares with the teachings of Prof. Lewes, that the products of combustion go up through the ceiling and thus draw in fresh air? What becomes of the unparalleled efficiency of gas as a ventilating agent? Or is it in the room above that ceiling, blackened with the remains of innumerable microbes, that "the odour of burned gas is very noticeable?"

New Radiations.—In an address to the members of the Physical Society who visited the Cavendish Laboratory recently, the President, Prof. Sir J. J. Thomson, described experiments which had been conducted in that laboratory with a view to filling up the gap between the red light radiation and the shortest known electrical waves. No radiation due to the impact of positively charged atoms had previously been detected, but by using the exceedingly sensitive Schuman photographic plates, they had succeeded in obtaining unmistakable evidence that they gave out a type of Röntgen radiation with a Crookes tube. A second method, using an ordinary Röntgen-ray tube, was under investigation. Sir Oliver Lodge, in moving a vote of thanks, welcomed the important discovery as an event of considerable magnitude.

THE MUNICIPAL ELECTRICAL CONVENTION.

(*Continued from Vol. 74, page 1095.*)

The Standardisation of Tariffs.

(Abstract of paper by J. HORACE BOWDEN, Chief Electrical Engineer, Poplar.)

IN the author's opinion the primary object of a municipal supply of electricity is the universal use of energy for power, light and heat at the lowest possible cost to the consumer, compatible with efficient service.

The secondary object is the concentration of fuel combustion in a given area, and at that centre the obtaining of efficient combustion.

The question of relief of rates is a controversial one. The author contends that it should only be incumbent upon the undertaking to make good any contributions that may have been received from the rates, providing that all public services are rendered on an absolute cost basis.

If it is recognised in the policy of an undertaking that the supply is established for the benefit of all ratepayers, there is no logical reason for restricting the progress of the supply by imposing charges higher than are necessary to cover actual expenditure.

If it were possible to so arrange tariffs as to produce an income exactly equivalent to expenditure, such tariffs, if conceived on an equitable basis, would undoubtedly be ideal.

The question of acquisition of an asset producing revenue free from debt should be at once dismissed from the minds of all councillors so that the present capital restrictions may be readily removed.

No one can conceive of the enormous impetus that will be given to the electrical industry during the next few years if the management is untrammelled by false capital restrictions.

The author does not advocate the borrowing of money to supply cooking and heating appliances on hire; provision should be made out of revenue for any expenditure that may be necessary in this direction.

The L.G.B. now allows periods from twenty-five to fifteen years for the repayment of loans on account of mains, and the London County Council has fixed the maximum period at twenty-five years. Twelve and ten years are considered suitable periods for services and meters respectively.

The law of continuity of supply renders it imperative that mains, services and meters shall always be kept in a perfect state of efficiency, and there does not appear to be any valid reason why the extreme limit allowed by law for repayment of the loans for these purposes should not be granted, namely, sixty years.

Loans in perpetuity for these purposes and for land might very reasonably be advocated, excepting for the remote possibility that at some future date electricity supply may be superseded by some as yet undiscovered power.

Buildings and machinery are not governed by the same law as the means of distribution. It can never be anticipated that engineering science will stand still, and there must be a succession of replacements for many years to come.

These are matters for consideration at the hands of electricity committees which must be well defined before the responsible manager can attempt to evolve an equitable tariff.

The author submits, without fear of contradiction, that any system by which a return to the undertaking could be made by each consumer of the exact cost entailed by the demand of each consumer, would be ideal.

While it may be true that the laws of expediency govern private enterprise, it should never be lost sight of that municipal enterprise is governed by the laws of equity.

No argument, however specious, will alter the fact that it is inequitable to supply to one class of consumer at a loss which is to be recouped from another class.

The future practice in electricity supply is undoubtedly that which will enable an authority to assess an annual charge for declared requirements, irrespective of the purpose to which power may be applied or to the extent that such power may be used.

There is a possibility in the near future that running costs will be entirely eliminated by the sale of by-products; until then a secondary charge remains essential, and it is in the interests of all concerned to standardize such charge, and for this purpose the Association known as the "Point Fives" came into being.

The charge of 0.5d. per unit carries with it, in modern undertakings, a sufficient margin over and above running cost to allow for fluctuations in price of coal, and provision against all contingencies such as breakdown of electrical machinery and failure of distributing and feeder cables.

The practice which called the Point Five Association into being is undoubtedly a mere stop-gap, but the opportunity should now be taken of using this means to obtain the ultimate end in establishing a system that can be applied universally to all classes of supply.

Some undertakers have considered it expedient to apply only the secondary charge for domestic purposes. Others, again, have considered it expedient to impose the primary charge on one class of supply only, viz: lighting, and to apply the secondary charge to all other uses. It does not require great reasoning powers to foresee that a policy of this sort is of a transient nature.

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Many undertakers have adopted the rateable value system for assessing a primary charge; but no more pernicious system has ever been introduced into electricity practice. Tenants in houses similarly assessed may make most divergent demands upon the resources of an undertaking.

The assessment on dwellings at and under £20 per annum is generally much lower than the better class, due to compounding by the landlords, yet this class of tenant will make a greater demand in proportion to rateable value.

In the Poplar area there are 3,259 houses rated over £20 per annum, and the author estimates that an average use of energy could be made by each tenant of 3,000 units per annum under present conditions of supply, which would be materially increased if the secondary charge were to be eliminated. But there are 19,866 houses rated at and under £20 each, having a prospective use of 1,000 units per annum under present conditions. The field for exploitation in the first instance is only 10,000,000 units per annum, whereas in the second instance it is about double, therefore the working class of supply demands equal consideration with the genteel class. But when the case of the shop-keeping class is considered, there does not appear to be any justification for the system.

The assessment of licensed premises is generally considerably greater than other business premises making a similar demand for light.

It appears to be a curious fact that the only equitable application of the rateable value system would act as a deterrent to the adoption of electricity because, as a natural sequence to the installation of, say, an additional 100 H.P. motor, the electricity department would apply to the rating department to make an increased assessment on the property of that particular consumer.

But apart from the inherent impracticability of rateable value as the basis of fixing a charge for universal supply, there is the objection of handing over to another department the onus of fixing the primary charge for electricity.

It is the diversity in the use of energy that imposes upon supply authorities the necessity to adopt a form of assessment as the primary charge, and if it can be shown to be practicable to establish a tariff on an equitable basis applicable to the demands of any area, it is equally practical to standardize a system that is applicable to all areas.

The accepted definition of the diversity factory in a supply of electrical energy is "the result of the sum of the consumers' maximum demands, divided by the combined maximum demand upon the system."

There is apparently no reason why every consumer should not utilize the service to such an extent as to make a return in full, as nearly as may be, to the undertakers, of the cost of such service.

This can best be done by studying the conditions of *each class of supply in each individual area upon its own merits*, and estimating the relationship of the demand for each class to the actual maximum demand upon the system.

Assumption and experience must, to a large extent, control these estimates. In Poplar, which is an industrial area, the following scale has been adopted, viz.:—

Nature of Demand.	Diversity Factor.
Public Lighting	Unity.
Business Lighting, internal	Unity.
Business Lighting, external	1.2
Intermittent power	2
Domestic Lighting, general	2
Domestic Lighting, occasional	8
Cooking and Heating	20

The maximum demand occurs between 4.30 and 4.40 p.m.

Business Lighting.—The charge is assessed on watts installed, it being assumed that a consumer does not instal lighting points unless required, and that all internal lighting will be in use at the period of maximum demand. It is not the usual business practice to light up externally until later in the day, and by dividing the ascertained standing cost per KW. by 1.2 any discrepancy lies in favour of the undertaking.

Intermittent Power.—As a general rule 75 per cent. of the total kilowatts installed may be taken as the normal load, but what may be termed the internal diversity should be considered in each case on its merits.

The diversity factor of two has been taken as the relationship of the normal load to the maximum demand.

Domestic Lighting.—A distinction has been drawn between general and occasional lighting. The demand has been assessed upon watts installed.

In fixing the diversity factor at two for general lighting regard was had to the fact that the whole supply would not be in use at 4.30 p.m.

For occasional lighting the factor of eight is not unreasonable, and certainly admits of many additional points being installed which otherwise would be left out.

Cooking and Heating.—It is obviously unfair to make the assessment on watts installed.

In assuming a diversity factor of twenty, three peak times had to be considered. The daily power peaks occur at 11 a.m. and 3 p.m., and, by the lighting peak converging upon the power load, a third peak is created in early winter at 4.30 p.m.

Bearing in mind the bases of charges laid down in this paper, the following example will illustrate the position:

A moderate-size residence of £26 per annum rateable value required a gas service for cooking and lighting costing approximately £10 per annum. To replace this, twenty-two various lights and a 2.4 KW. cooking outfit were installed.

The cost of the service, meter, and wiring installation was £20 5s. 4d., and the cooking outfit £8 10s. 8d. The total number of units supplied during twelve months was 3,128.

The annual assessment was, on the Poplar tariff, 0.352 KW. general lighting at £4, 0.32 KW., occasional lighting at £1, and 2.4 KW. cooking at 8s., amounting to £2 14s. 7d.

The cost of energy, 3,128 units at 0.5d., amounted to £6 10s. 4d., making a total charge of £9 4s. 11d. or 0.71d. per unit.

The hire of the service (12½ per cent. on cost) amounted to £3 12s. 11d., bringing the total bill to £12 17s. 10d., or 0.99d. per unit.

It will be seen that the supply of energy alone compared favourably with the cost of gas, but in order to obtain the supply it was necessary to expend £28 16s., which, of course, must be expected to produce an adequate return.

The author has no hesitation in stating that for prudent reasons the annual charge on account of this expenditure is greater than the anticipated cost.

By dealing with this class of work on a greatly extended scale, the prime cost may be expected to be considerably reduced.

It is also anticipated that the fixed charge per annum will bear a reduction at an early date from £8 per KW. of maximum demand to £6 per KW., and that the diversity factor of two for general lighting may be equitably extended to three, which would halve the general lighting standing charge, and reduce the occasional lighting and cooking.

Taking the revised basis of charge, the following annual result is arrived at, viz.:

	£	s.	d.
Fixed Annual Charge	1	13	11
3,128 units at 0.5d.	6	10	4
Or 0.63d. per unit	8	4	3
Service Charges	2	7	6
Or 0.81d. per unit	10	11	9

at which price not only will the supply of energy compete successfully with gas, but the disability of competing with a rival power already in possession of the field will be removed.

In making an investigation of the varied costs which comprise the total cost of supply imposed upon an undertaking, it is necessary to dissect same under three distinct headings:

First, the service cost, or the individual charge on the undertaking directly attributable to each consumer;

Secondly, the fixed cost, or the total sum necessary to carry on the undertaking, irrespective of the amount of energy supplied; and

Thirdly, the running cost, or the actual cost of supplying a unit of energy after making provision for service and fixed costs.

Hitherto, engineers have principally devoted their attention to the reduction in cost of generation in order to supply at the cheapest possible rate, but the reduction in service costs is of considerably greater importance to-day. Reduced cost of generation is generally achieved by *increasing* capital expenditure, but the desired effect in service costs is chiefly brought about by *saving* capital expenditure.

Assuming that the service to the consumer embracing connection to mains, meter, wiring and cooker costs £30, under normal conditions, but by contracting on a larger scale, and exercising closer supervision, this cost can be reduced by 25 per cent., and by careful discrimination in the selection of materials and apparatus the "life" can be extended to fifteen years instead of ten years, the service charge would be lowered from the present rate of £3 15s. per annum to £2 5s., which is double the saving effected by a reduction of 5 lb. of steam per KW.-hour, while the capital employed instead of being increased, would be considerably lowered.

The law underlying the allocation of fixed costs may be briefly stated as follows:—

All charges upon an undertaking of any description—other than service costs—which can be accurately stated, or which can be approximately stated at the commencement of each financial year, are fixed costs.

The sum of the charges thus stated, divided by the maximum demand made by the consumers as a whole, will produce a cost per kilowatt chargeable annually to each consumer, governed by the diversity factor of each class.

On the 1908-09 Poplar figures the total cost of coal alone amounted to 0.354d., but by the transfer to standing costs this figure was reduced to 0.258d., while the remaining running costs brought the total figure up to a fraction over .3d. per unit.

The logic of charging .5d. (after providing for all other costs by the assessment of a fixed charge per annum) is obvious. On a five million unit output the calculated margin is about £4,000 per annum, but allowance must be made for "bad" consumers, discounts and bad debts. The actual result in that particular year was £3,668 gross and £2,702 net.

The relative difference between running and total cost of coal decreases in proportion to the increase of output. With exactly the same plant in use in 1912-13, and the output

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doubled the difference amounted to 0.06d. per unit sold, but still an appreciable figure in calculating cost of supply.

The author anticipates that criticism will be made in regard to the human tendency to exceed the number of watts allowed for in the fixed charge; the difficulty in properly assessing the demand where a number of radiators and other domestic utensils are installed; and the opportunity for giving preferential treatment in making assessments. These are weaknesses undoubtedly, but all other systems embody similar weak points without laying claim to the many advantages which are inherent to this system.

Should this system ever become standardized two fetishes of the electricty world must go by the board, viz., "Diversity Factor" and "Load Factor."

Diversity has been exhaustively dealt with; the principal feature of the system outlined is that each consumer obtains the benefit of his own load factor, or in other words, the "good" consumer does not make up for the "bad" consumer.

Hitherto the ideal load obtainable has been that of 100 per cent.

The cooking load offers totally different possibilities. An individual load factor of 10 per cent. is quite usual, but where the diversity is 20 the value of the class is double that of the 100 per cent. individual load factor consumer.

The paper would not be complete without reference to the prepayment system. The author has purposely refrained from introducing this phase of the supply because of the fact that little data are as yet available. It is proposed to go well ahead in Poplar very shortly, but the scheme is not well enough advanced to place before the members.

DISCUSSION.

MR. C. H. WORDINGHAM, in opening the discussion, said there was a tendency at the present time to try to make people think they were getting something for nothing, but it was soon found that electricity had to be paid for as in the case of any other commodity. He agreed with the author that the municipal electrical undertakings were not indebted to the rates beyond money taken directly from them; excess profits should be kept in the undertaking. He thought that electric cooking would progress, but was very doubtful in regard to electric heating. It was a sound argument that things which had to be kept in a high state of efficiency could be allowed long loan periods. His only comment on the phrase "Municipal enterprise is governed by the laws of equity" found in the paper, was Ha! Ha! Under the stress of "expediency" the author rather departed from his principle of charging in proportion to the cost of supply. Consumers were connected up according to their desire and not in proportion to the capital available. He entirely disagreed with a fixed charge based on the value of a house; it should be based on KW. demand.

MR. F. M. LONG (Norwich), expressed appreciation of the author's analysis of costs; a tariff evolved on principles of equity, as suggested, might not be equally equitable from both suppliers' and consumers' point of view. It was almost impossible, especially for private houses, to base a tariff on the amount of apparatus installed; and it was not really necessary in view of the high diversity factor. The increased loads involved a very small extra capital cost per KW. and there was no need to charge old capital against, say, cooking; the author admitted this in regard to motors. It was possible to put all the high standing charges on the lighting and in that way to charge ½d. per unit for cooking and heating. Private houses should be treated as a class by themselves, and his experience was that rateable value did bear a close relation to demand for lighting by the consumer. The author took as an example a house of £26 rateable value and on the Poplar tariff the fixed charge was £2 14s. 7d., while with the Norwich tariff of 15 per cent. of the rateable value this charge would be £3 18s. 0d., but it would include the cost of service and meter. The author would presumably add at least 15s. for service and meter charges which would bring his charge up to £3 9s. 0d., so that the Norwich system gave much the same result and was much simpler.

BAILIE SMITH (Glasgow), said a private concern did not pay money to the rates, therefore why should a municipal concern do so? If the latter were necessary the consumer would be better off with a private concern, which added nothing to the price to ficticiously relieve the rates. Under the present system the user of electricity often paid some of the rates of the man next door who used steam and added to the smoky atmosphere of the district. He suggested that steps should be taken to make it illegal to take surpluses for the relief of the rates.

COUNCILLOR CROWTHER (Sheffield), considered that some loan periods were ridiculously short and went on to defend the rateable value system of charging, which was established for other municipal services. In Sheffield out of 107,000 houses, 91,000 were of annual rentals under £15. Between £25 and £30 rentals the houses numbered 1,703, and over £30 rental, 3,618. No house under £15 rental took electricity supply; between £15 and £20, 10 per cent. took it; between £20 and £25, 35 per cent.; between £25 and £30, 40 per cent.; and above those rentals 65 to 70 per cent. of the houses had an electricity supply. The poor houses were not reached, and not one of the 91,000 houses mentioned got any relief from surpluses voted to the rates, as the landlords pocketted this owing to the compounding arrangement. Rate relief only benefitted higher rental houses. He contended that steps should be taken to supply small houses, and that the idea that electricity was a luxury should be swept away.

MR. H. RICHARDSON (Dundee), thought there was no ground for optimism as to the sales of energy for cooking at the present time, until hiring powers were obtained the cooking load would grow slowly. The consumer had been taught to hire gas stoves, and therefore electric suppliers must be prepared to hire apparatus. He found that at ½d. per unit electricity for cooking would compete with gas at 2s. 6d. per thousand cubic feet. In Dundee he had tried the rateable value system, but found it difficult, as similar sized houses differed largely in rental. He urged the advantage of a simple tariff.

MR. A. S. BLACKMAN (Sunderland), congratulated the author on results obtained in a working-class district in East London, which should be an example to other districts. He was surprised that the author should have stuck to the KW. charge when the rateable value system was so much simpler, and could not agree that with the latter system it was a case of handing over to another department the fixing of the electrical standing charges. The 1-KW. radiator was being displaced by 3-KW. and 4-KW. radiators, which were very satisfactory. He urged the members to copy the practice of the draper and fix their charge at, say 1½d. or 2½d., rather than 2d. or 3d. per unit; he had found this successful. He did not regard standardisation of tariffs as feasible.

ALD. SINCLAIR (Swansea), thought that while they might never obtain standardisation of tariffs, they might standardise methods. Neither the rateable value or the KW. charges were really equitable; the former increased the charges to large houses out of proportion to size and the maximum demand system was better in its result. The fixed KW. charge penalised the best and biggest consumer. Electric cooking would not wait for any Bill to pass; it would progress with suitable charges. He thought the time was approaching when engineers would have to disregard peak loads.

Mr. A. H. DYKES (Beckenham) said the paper was valuable if it killed the bogey of "price per unit"; differences in price were not understood by the consumer. There was something wrong in our methods when the small consumer used gas or oil, when it was more expensive than electricity. The author showed that the small consumer could be profitably supplied, and he (the speaker) went on to refer to the progress made in this direction by the Fixed Price Light Co. at Wimbledon, to which reference was made in the ELEC. REV. of May 15th last.

Mr. A. NICHOLS MOORE (Newport) considered the first part of the paper open to very severe criticism, as it might mislead the Councils, whose support was necessary to the engineer in the matter of cheap units. The author was very contradictory, and the speaker came to the conclusion that he was after equity plus expediency. He appeared to base the whole of his theory on diversity factor and to overlook the idea of load factor. He congratulated the author on his allocation of accounts, and thought the real secret of his increasing surplus was in his 86 per cent. of power units. He apparently ignored load factor; cooking only brought him in some £600 a year.

Mr. J. W. BEAUCHAMP (West Ham) said he had never noticed that consumers took the trouble to treat the supply department with equity. There seemed no justification for dropping the secondary charge altogether; if the service rendered was of any value it was worth paying for. Any surplus in aid of the rates should take the form of an electrical asset, such as street lighting. There was a considerable relation between the rateable value and the energy consumed, and his only fear was that it might not remain as at present. Now they got 5-6ths of the revenue as a fixed charge and only 1-6th as an energy charge, and if the assessment were tampered with it would affect 5-6ths of the revenue. This could be got over by fixing the charge on the rateable value but not disclosing this to the consumer, in which case the charge could be maintained even if the assessment were decreased. A point in favour of the rateable value was that if small C.P. half-watt lamps were introduced, the drop in revenue should only affect 1-6th of the receipts, but he was afraid the consumer would ask for a share of the plunder.

Mr. GROGAN did not see why the electric light bill should be reduced just because the consumer succeeded in reducing his rates; the engineer was the only man who could judge what was an equitable tariff. The author, towards the end of his paper, referred to cooking load possibilities, and apparently stated that with a 10 per cent. load factor, and 20 per cent. diversity factor, he would obtain a class of consumer with a 200 per cent. load factor; he would be glad to hear this explained. The diversity factor for cookers of different types would probably change with the introduction of quick-heating stoves.

Mr. H. R. BURNETT (Barrow-in-Furness) wished to correct the idea that it was necessary to give away electricity to get small consumers. In Barrow they were supplying about 1,000 artisans' houses; originally this was done through prepayment meters and much dissatisfaction existed. Two years ago a fixed charge based on the rent plus 1d. per unit was substituted, and it was found that these consumers took 100 per cent. more energy but were quite satisfied. He failed to see why, instead of the rateable value system, engineers should not fix a value based on the KW. He felt that some gentle-

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men had in the pursuit of notoriety allowed their judgment to be over-ruled as regarded the fixed charge.

This concluded the discussion, to which Mr. Bowden is to reply in writing.

Tariff Standardisation.

To the layman, and particularly those connected with the direction of municipal and private electricity undertakings, it is a matter of wonder and some anxiety that station engineers should differ so widely and so continuously concerning the methods and rates by which their commodity is sold.

The reasons for the present welter of tariffs are primarily that :—

The engineer is, by training, scientific, and in making tariffs is apt to strain at an excellence not usually achieved in commerce.

He labours under restrictions, to some extent imaginary, with regard to the equitable treatment of consumers.

But the chief cause for so much disparity in methods of charging lies in the fact that many present-day tariffs are designed to create demand, and where they succeed in this object they naturally tend to destroy themselves in the process.

Examples of similar fluidity in price-making surround us in regard to other growing commercial enterprises which, however, are not obliged to work within those restrictions which have been placed upon electricity supply under the impression that the providers would enjoy the benefits of monopoly, which, as a matter of fact, they only do to a limited extent and by virtue of competitive effort.

The paper read by Mr. Bowden before the I.M.E.A., in Birmingham, is a most valuable contribution to this subject, the more so because he has worked persistently, if quietly, for many years with the object of providing electricity for all purposes on a common and equitable basis of charge; in doing this he has consistently adhered to a scientific foundation, and has not hesitated upon occasion to adopt an independent attitude with regard to certain aspects of tariff making. That his work has been justified is amply demonstrated by the results achieved in Poplar, and by the attention given to any contribution from his pen upon this important subject.

The fact that the author stands for a certain school of thought in municipal policy in no way weakens the value of his work, although it must oblige many to accept his more general conclusions with reserve.

He strikes a somewhat unusual note in a Convention paper by inviting the attention of members of electricity committees to his problem, and suggesting that they may assist in no small degree in its solution; for this attitude there is much to be said, but it is sincerely to be hoped that the responsible managers will make a co-operative study of the subject with a view to giving their committees a strong lead in this as in all matters affecting the policy of their undertakings. The success of any commercial enterprise depends upon the sane and continuous policy of one or a very small number of individuals, whose whole time and interest is devoted to the business, and upon his or their power to command the confidence of the governing body—from the members of which most valuable assistance can, it is true, be obtained, but rather in the direction of query and criticism than in that of construction.

Those who are familiar with the author's views on the subject will not be surprised at the insistance with which the paper refers to cost as the main basis of charge and to the desirability of supplying at the lowest price possible having regard to the stability of the undertaking. With regard to the value of the service to the consumer he is silent, and it behoves the engineer to consider this omission with care and examine the foundations of his own commercial beliefs in dealing with the question of tariffs.

There appears to be no sound reason for selling any commodity at a price lower than its value to the user subject to such reduction as may be needed to induce him to abandon the use of competing commodities or to attract him to areas where the facilities can be enjoyed.

Persistence in such a course could only widen the gap existing between the charges for private and municipal supplies, damage competitors to an unnecessary extent, and weaken the undertaking by depriving it of surpluses which might be devoted to development of the business, and so ultimately to the benefit of the community served.

It must be remembered that in framing tariffs, one should most carefully ensure against the need to advance rates in the future, than which nothing can be more disastrous to a competitive business, particularly in the case of electricity supply where the consumer is often called upon to expend large sums on apparatus to enable him to take advantage of the service.

In this matter, the current practice of commerce is typified by the action of tradesmen in the West End, who, having met the needs of their customers in the day time at current prices, do often dispose of their surplus stock to the poor at night for any reasonable figure. In each case the consumer pays what the goods are worth to him in view of his circumstances, and no complaint arises.

On the disposal of surplus profits the author is emphatic, declaring for the smallest of contributions to the ratepayers and these in the form of public improvements. The mind is agreeably stimulated by the conception of a public park provided from the profits of electricity supply, and adorned with statues of the engineers whose efforts have brought it into being.

It would appear, however, that the soundest method of disposing of any surplus which can really be spared after providing for plant improvement, contingencies, and the reduction of hire charges on consuming apparatus, would be to offer the community some assets of an electrical character which otherwise it would not feel justified in obtaining, as, for instance, public time service, a more generous scheme of street lighting, electric vehicles for Corporation use, &c. In this way the profits distributed would benefit all, and allow none to forget the source from which they came.

On the subject of loan periods, Mr. Bowden will probably arouse criticism; he is, perhaps, a little unfair to the L.G.B. and L.C.C., whose object is probably nothing more than to equate the repayment period to the actual life of an adequately repaired item of plant; in point of fact, the officials of these authorities do realise that a cable will last indefinitely, and a turbine may be kept moving for more than 15 years, but who will venture to say that any generating plant or mains system put in to-day will be profitably employable in even 10 years from now?

The author's view of the time when secondary charges may be dispensed with and unlimited service given for a fixed sum per annum, appears open to question; that such systems exist we are aware, but suspect that in certain areas where "white fuel" is available, it is found cheaper to allow unlimited use than to meter the supply, and that most of such contract consumers are not in a position to obtain heating and cooking apparatus.

Arguments in favour of an unlimited supply for a fixed price per year of maximum demand are often based upon a fallacious analogy between the service of water and electricity; to a man of ordinary means a continuous supply of electricity offers possibilities of heating and power which he would not be slow to take advantage of under an unrestricted contract, whereas a supply of water, although absolutely necessary, is of limited utility, and offers no advantages beyond the satisfaction of certain daily wants. It will be noted that even the water companies impose an extra charge in summer for garden use, and the consumer who tries to improve their load factor by the erection of a fountain or a water motor, will soon be asked to accommodate a meter and pay a secondary charge.

Under our own conditions the author appears to look to the sale of coal by-products for the revenue which will enable him to dispense with secondary charges. Here he enters upon doubtful ground. The price of such by-products may vary widely with the supply of and the demand for them, and in any case he is departing a little from his standard of equity in suggesting that the farmer shall pay more than he need for his fertiliser in order to let his customer, the townsman, cook his vegetables free. Such conditions might conceivably lower the cost of

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living, whilst raising the price of food in a way which would sorely puzzle the economist!

The rateable value system of charging comes in for severe criticism at the hands of the author, and it certainly contains elements of danger which should have the consideration of those who are attracted by its simplicity; invented for use in a residential district where considerable uniformity of property exists, it has been very successful and is, perhaps, now in danger of becoming a fashion without regard to its limitations, and the fact that the bulk of the revenue is measured by a standard over which the supplier has no control, and which may be subject to variation under some altered scheme of taxation.

The paper, a lengthy one, is full of interest and contains valuable figures with regard to the Poplar undertaking; it is safe to say that with the discussion it will take its place as a useful work of reference with some few other classic papers on this, the most elusive and fascinating problem which lies unsolved before the supply engineer of to-day.

INTERNATIONAL RUBBER AND ALLIED TRADES EXHIBITION.

THE Fourth International Rubber and Allied Industries Exhibition and the First International Cotton, Fibres and other Tropical Agricultural Products Exhibition was opened on Wednesday, June 24th, by Prince Arthur of Connaught, and will close on July 9th. Over fifty British and Foreign Governments are taking part officially in this exhibition. Their participation undoubtedly makes the latter representative and of great interest and value to experts, but to the laymen one Government exhibit is distressingly like another, and we question whether the ordinary visitor—whose shilling is, presumably, as much desired by the organisers as that of the rubber expert—will not find a little wearisome the many (individually excellent) collections of photographs and samples of rubber in its various stages of preparation shown by the exhibiting Governments and rubber companies. To the expert these exhibits are, of course, most valuable, and the layman will find them more interesting if taken in conjunction with certain of the special articles in the official handbook and the particulars there given of entries for the numerous trophies open to competition. The official handbook and catalogue, compiled and edited by Mr. A. Staines Manders, is a volume of well over 1,000 pages, containing nearly 70 special articles, fairly well indexed, and constituting a most valuable cyclopædia on rubber, cotton and fibre topics. The published net price of this volume being 5s., visitors should purchase copies at 1s. in the exhibition building; besides forming a detailed (and ponderous) guide to the exhibits, the work is one of real technical merit.

Considering the great importance of rubber in its many forms in the electrical industry, we are surprised and sorry to find so little of direct electrical interest in this exhibition. Anything connected with the production of good and cheap rubber is of electrical, indeed, national, interest and importance, but surely more rubber firms could have shown rubber in its specific electrical applications, while electrical firms might have done much to show uses for electrical apparatus in the rubber industry. The exhibits of rubber washing, mixing, sifting, forcing and grinding machines, presses and elevators, etc., while excellent in themselves, offer no features of special electrical interest. Any electrical firm arranging an exhibit to show applications of electric driving and electric heating in rubber preparation and vulcanising might have reaped a good harvest.

Messrs. Pirelli, Ltd., show, in addition to rubber goods of practically every other class, light and heavy electric wires and cables for all purposes; insulating strip and compounds; and ebonite sheet, rod, telephone parts and battery cells, etc. In King George's Hall, the Leyland and Birmingham Rubber Co. show a distinct novelty in the shape of a rubber tennis court paved with British-grown plantation rubber. Even more interesting, in view of the vast possibilities which it offers for rubber consumption, is a section of the actual rubber-paved roadway laid in the Old Kent Road, nearly twelve months ago, at a point where traffic is very heavy. Much experience has been gained from this experiment, and, considering that this was the first piece of rubber street paving ever laid, the rubber has stood remarkable well. Among the some thousands of other rubber articles shown by this firm (which should stand a good chance of winning the prize offered for greatest variety) may be mentioned special railway, surgical and tiling goods, besides the infinite variety included under the heading "mechanical" rubber goods.

The North British Rubber Co., Ltd., show asbestos packing, rubber belting for power transmission and conveyors, band and solid tires, rubber mats, tiling, paving and piping of every description, besides examples of practically every other class of rubber goods. The same firm is responsible for the Rubber Room, which shows an extraordinary variety of forms and applications of rubber. From the delicate window curtains to the legs of the substantial settee, from the entrance mat and room carpet to the wall "paper" and picture frames, everything in this room is of rubber. The Polack Tyre & Rubber Co., Ltd., have an interesting exhibit of their well known steel-backed solid tires and fresh remarkable record mileages to communicate. We are glad to see that they emphasise the importance of good tires on electric vehicles and the assistance rendered by each to the development of the other. Louis Schopper (Leipzig) shows a number of rubber testing machines and accessories deserving careful inspection by all visitors interested in the specification, testing and purchase of rubber. The United States Rubber Reclaiming Co. have arranged exhibits showing stages in the reclamation of rubber and testing apparatus for determining the breakdown strength of and leakage current through rubber insulation.

In the Balcony visitors should inspect the co-operative collection of articles made from india-rubber. This extensive collection shows to what extent rubber enters into every phase of modern life and activity. One of the most instructive official exhibits is that organised by the Belgian Government (and reminiscent of Ghent). The six sections cover the history and manufacture of rubber and deal with Belgian commercial and social activities in the Congo, and include a number of trade exhibits.

Many exhibits of raw, prepared and manufactured plantation rubber are included, and the layman cannot fail to be impressed by the excellent appearance of the plantation samples exhibited. In being thus impressed, he will fall into the first and most tempting of the traps which await the unwary, for appearance counts for little in this connection; indeed, in creping rubber, good appearance is apt to be purchased at the cost of lost nerve and increased difficulties of vulcanisation. Doubts are still expressed as to whether plantation rubber is as uniform and reliable as the wild product. Certainly it seems to us that it should be so, and that the brightest prospects for plantation rubber are to be found in the fact that its production is (in all ordinary cases) well organised and efficiently conducted, so that costs can be kept to a minimum and profitable working continued (where companies are not over-capitalised), even with rubber at 1s. 6d. per pound. Tire manufacturers and users will find much to interest them in the plantation rubber tires on view, with full particulars of service tests to which they have been subjected. This important topic will doubtless be discussed at the International Conference, hence some definite conclusion as to the best tire rubbers should soon be forthcoming. The subject of synthetic rubber and its prospects in competition with wild and plantation rubber was discussed briefly by Prof. W. R. Duncan in his presidential address to the International Congress of Tropical Agriculture, and this topic also will receive further attention during the Rubber Congress, opened on June 30th by the President (Sir Henry Blake). As in previous exhibitions, many important papers are to be read and discussed at this congress, and the proceedings, which will be published in book form, will constitute a fitting memorial to the part played by the International Rubber Exhibitions, in conjunction with systematic observations and experiment, in advancing the technique of rubber production and manufacture during recent years.

In the balcony cinematograph hall, films are exhibited to show the manufacture of rubber goods in the Edinburgh works of the North British Rubber Co., the production and preparation of rubber on plantations, and so forth. The general arrangement of the stands and exhibits is excellent, maximum advantage being taken of the space available while eliminating completely the monotony of rectilinear gangways. Provisions for the comfort and entertainment of visitors are numerous and elaborate.

The Batti-Wallahs' Outing.—The Batti-Wallahs' Society went for their summer river outing on Saturday last. The attendance showed an advance on last year's figures; in all about 90 Batti-Wallahs and their ladies and friends participated. Mr. D'Arcy, of the B.T.H., by his services at the piano, contributed largely to the success of the impromptu concert on board. The company started from the Sun Hotel, Kingston, at 2 o'clock, and tea was served at 3.30 at the Weir Hotel, Sunbury. On arrival at the Lincoln Hotel, Weybridge, an excellent meal was provided, and the party returned to Kingston about 9 o'clock. Amongst prominent Batti-Wallahs present were President Avila, Past-president and Mrs. Snow Huddleston, Mr. and Mrs. F. Pooley, Mr. and Mrs. Ashley Pope. Mr. and Mrs. Prangnell, Mr. and Mrs. Barfield, Mr. and Mrs. Wyld, Mr. Lange, Mr. and Mrs. Newton Russell, Mr. R. W. Hughman, Mr. and Mrs. Fisher, Mr. and Mrs. Sharp, Mr. and Mrs. Denison, and Mr. Ralph Ball.

A Large Steam Turbine.—A large turbine has recently been completed in the shops of MESSRS. BROWN, BOVERI & CO., of Mannheim, for the Mark Communal Electricity Works Co., of Hagen. It is of 40,000 H.P., and has been built to work with superheated steam at 350° C. and 12½ atmospheres, and with a surface-condensing plant with cooling water at 12° C. The speed is 1,000 R.P.M., and the generator produces three-phase current at 11,000 volts and 50 periods. The length of the set is 16 m., and the width 4·2 m., the total weight being 385 tons with condensing plant. A train of 10 special trucks is required to transport the plant to its destination.

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INNOCENCE AT SAFFRON HILL.*

We are loath to believe in metempsychosis, yet ever and anon come stray bits of evidence from the circumambient ether or elsewhere that almost persuade us to confidence. Just now comes a projection of odic force or something like that, from an etheric vibrator, or its kin, at Saffron Hill, which suggests with convincing force the reincarnation of the late Prof. Keeley. A French gentleman, with a long enough American experience to acquaint him with the commercial value of publicity, has been weaving spells about the London daily Press in a way to suggest the finest efforts of the lamented M. Svengali. By tradition one looks upon the London newspaper man as partaking somewhat of the hard-headed materialism usually attributed to this country, but in this instance he appears in the genial confiding rôle of a Wall Street lamb.

The inventor of the latest traction marvel, 300 miles an hour at no particular expenditure of energy, seems to have taken his cue from the alleged exploit of the Fish Commission of crossing the shad with the jelly fish to avoid bones, and has produced a fearsome blend of the late New England Port-electric system with the principles of electric dynamic repulsion enunciated by Prof. Elihu Thomson in a notable lecture before the Institute some twenty-odd years ago. His car, cigar-shaped as befits all of its kind, is hurled through space by the attraction of a series of solenoids distributed along the track. Meanwhile it is booted out of contact with the supporting structure by a series of alternating current magnets which impel it as it flies through space. It has no wheels save those supplied by the inventor and the admiring reporters. The result is, according to the inventor, that it practically eliminates all friction by floating in the air, and can be driven at almost any speed desired with the expenditure of very little power. Besides such an achievement as this the Brennan mono-rail system and all that has gone before it sink into utter insignificance. If two sets of wheels imply formidable friction and one set of wheels very little, then surely no wheels at all should bring complete escape from all the confines of dynamics. And the most delightful feature of the invention is that reporters, politicians, a worthy admiral or two, and other non-technical persons seem to have taken it with true British seriousness. A friendly acquaintance with our engineering confrères on the other side of the water had almost persuaded us that the supposed inability of the Briton to see a joke was baseless slander, but the incident of Saffron Hill brings us grave evidence to the contrary. We have looked in vain for a telltale "Advt." at the bottom of the newspaper accounts of this marvel, and have wondered.

To be serious, we do not fancy that our American readers, hardened as they are by a long series of epoch-making inventions that have not worked, will attach very much importance to this latest marvel, nor do we think that American tramways will be denied sufficient capitalization to lay tracks and run motors thereon for some time to come. The American investor now hails from Missouri, although to judge from these latest reports, a sanitarium in that exhilarating climate might profitably be colonized from London. We shall await further details of the hypnotic project from Saffron Hill with vast interest. In the meantime we shall only suggest that those who think that M. Bachelet has discovered a new principle in transportation might look up with advantage the history of the other systems which have been proposed along this line. The same objection applies to them all, and is expressed in our comments on the Albertson car about ten years ago, when we said editorially, "Why this struggle to avoid the smallest item of resistance at high speeds? Has not the Professor ever heard of air resistance, or does he plan to run his train in vacuo? If rolling friction, due to weight on the wheels, and track resistance properly so called, were the only obstacles to high speed, railroading would be a joy for ever. The hundred-mile-an-hour train would be a back number, and no up-to-date witch would ride anything so slow as a broomstick."

Electrifying the Belgian State Railways.—In examining this problem, J. Carlier assumes the cost of electrical energy delivered to the third rail as high-pressure D C. to be 0·6d., including capital charges, or 0·78d. per KW.-hour at the driving wheel, assuming 30 per cent. less between conductor rail and driving wheels. Average annual costs per train-mile under the existing steam system are:—Wages, 2·6d.; fuel, 5·7d.; stoking, 0·24d.; lubrication, 0·225d.; various, 0·93d.; total, 9·7d. per train-mile. Under electric working, it is estimated that corresponding charges would be:—Wages, 2·62d.; fuel, 3·19d.; lubrication, 0·16d.; various, 0·32d.; total, 6·3d. per train-mile, *i.e.*, about 35 per cent. less than the present total. The total cost of the Belgian State Railway system being at present about £2,190,000, electrification would result in an annual saving of, say, £770,000. Traffic density could be increased 30 per cent. by electrification, thus securing a much better return on invested capital.

"Lest we Forget!"—In his report to the Board of Trade on the collision between an express train and a goods train at Burntisland on April 14th, Major Pringle states that he has no doubt that the origin of the fires which broke out was "burning gas."

* *Electric Railway Journal.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"Beta" Type Midget Automatic Accumulator Switch.

Where a smaller type of automatic accumulator switch than the Crawley is required, and it is necessary to arrange for a minimum amount of space on the switchboard, this new design of Messrs. Nalder Bros. & Thompson, Ltd., offers many advantages. Like the Nevile automatic, the new type of instrument has a permanent magnet, but in the case of the "Beta" Midget it is arranged so that it cannot be reversed; in fact, the action of the switch in use

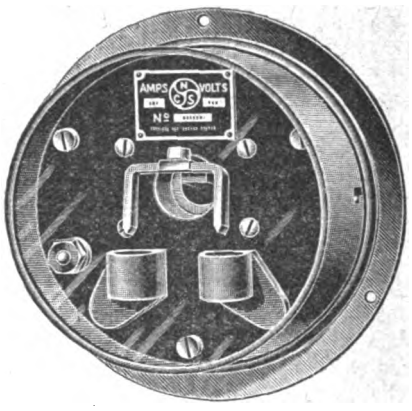

Fig. 1.—N.C.S. "Beta" Midget Automatic Accumulator Switch.

is to reinforce the magnet instead of reversing it. This instrument, like the Crawley automatic, is purely differential in its action, and is joined up in the manner indicated in the diagram, fig. 2.

As in the original pattern of Midget automatic battery switch, minimum weight is secured on the moving part, as the differential coil is wound on the same bobbin as the current coil, and not on the moving iron, consequently the mass to be moved is very small. Compactness in design is secured by arranging for part of the instrument to be let in flush with the board; only that part of the mechanism carrying the mercury cups and the dipper stands

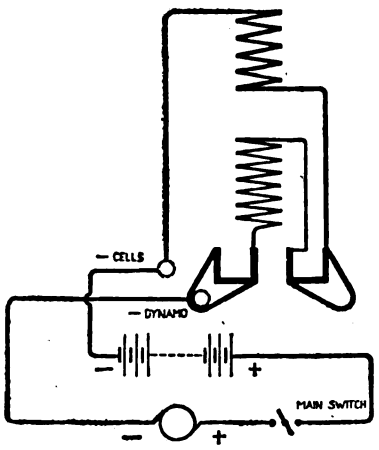

Fig. 2.—Diagram of Connections.

out on the front of the board. These are protected by a glazed polished brass case, which can be easily removed. This is a point of advantage, as where skilled labour is not employed, instances have occurred in which the dipper has been tampered with.

Generally speaking, this instrument is only made for voltages up to 80 volts, and currents up to 50 or 60 amperes. The diameter of the hole which it is necessary to cut in the board is 5⅞ in.

Push-Button Speed Control.

The Igranic Electric Co., Ltd., of 147, Queen Victoria Street, E.C., have introduced an improved method of push-button control, in which the speed of the motor, as well as the starting and stopping, is controlled by push buttons and the same completeness of control is attained as is usual with large rotary newspaper machines, but the new system now under discussion is much more simple and less costly.

Fig. 3 shows the complete controlling panel, which has only one solenoid and a number of clapper switches.

The solenoid is compensated so that the lever which it controls remains on any resistance contact according to the wish of the attendant who is manipulating the push buttons shown in fig. 4.

For instance, if the "start" button is pressed momentarily, the motor starts up but runs only at the lowest speed, whereas if

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pressure on the button is maintained, the motor will gradually accelerate, finally attaining full speed.

If it is required to reduce the speed, the operator presses the "retard" button until the motor is running at the required speed.

Pressing the "inch" button causes the motor to run at its lowest speed so long as pressure is maintained, but the motor stops immediately the pressure on the button is released.

A depression of the "stop" button will always cause the motor circuit to be opened; the "stop" button acts as a master button and always prevails over the others.

Various combinations of armature and shunt field resistance and also armature diverter resistance are used to obtain suitable

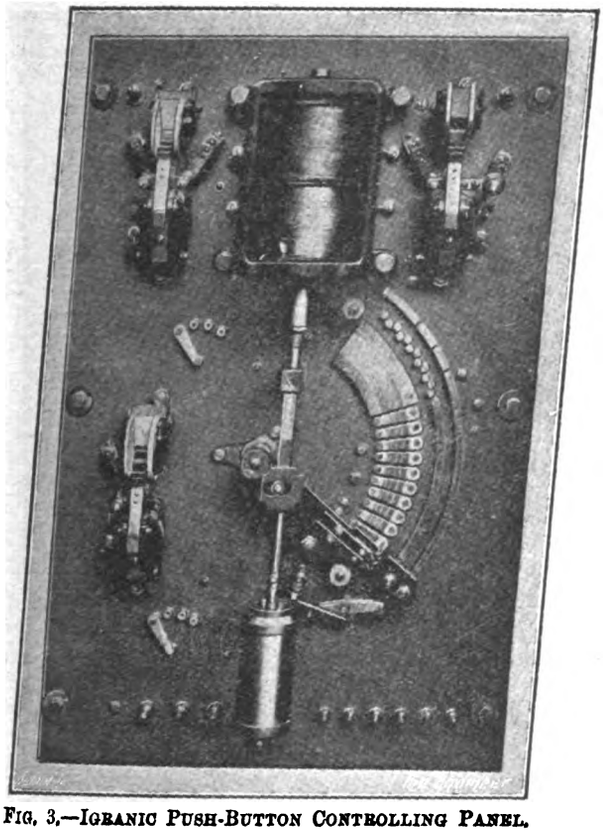

FIG. 3.—IGRANIC PUSH-BUTTON CONTROLLING PANEL.

ranges of speed regulation, for any particular requirement, and the main motor circuit is always handled by the clapper switches, no matter which push-button is being operated.

The sliding contacts on the switch front are, therefore, only used for cutting the various sections of resistance in or out, never being called upon to open or close the motor circuit, and thus they are not subjected to injurious sparking or burning.

All the clapper switches are completely interlocked so as to render careless or malicious mis-handling perfectly harmless, and

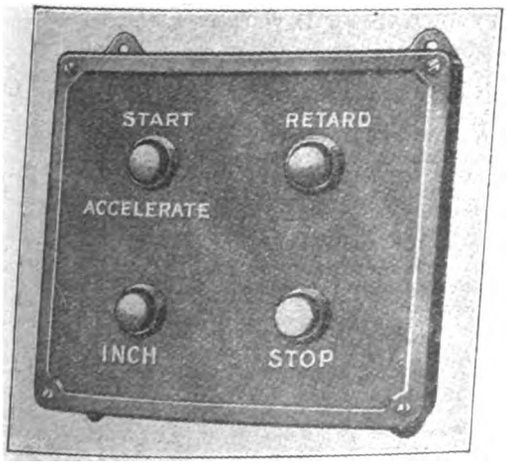

FIG. 4.—PANEL OF PUSH-BUTTONS.

the same time to offer complete protection to the motor and to machine in its driving.

The Igranic Co. inform us that a number of these new trollers are already at work, and that some of them have pro- ed repeat orders.

he controller is capable of being applied to rotary web presses en by either one or two motors, and it is claimed to have many ntages in the control of some kinds of machine tools.

"Grundy" Temperature Control Apparatus.

FROM MESSRS. SCHONFIELD & CO. (GLASGOW), of 21, Hope Street, Glasgow, we have received particulars of the "Grundy" system of temperature control, which has been successfully applied for the automatic control of the electric heating of rooms, to water heating, and to the control of ventilating fans, amongst other things.

The essential part of this apparatus is the "Grundy" thermostat, shown in fig. 5, which is of the bi-metallic type. Instead of "straight-on" or "rubbing" contact, a small glass tube con-

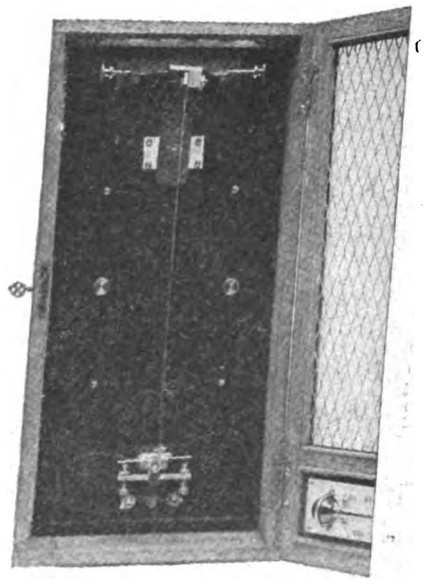

FIG. 5.—"GRUNDY" THERMOSTAT.

taining a globule of mercury is used, which, on being overbalanced by the thermostatic strip, gives a quick and positive contact, which operates an automatic relay switch, fig. 6, which in its turn controls the heating or ventilating apparatus.

A predetermined temperature can be maintained within a mean variation of ½°C. The thermostatic strip is free to bend to an

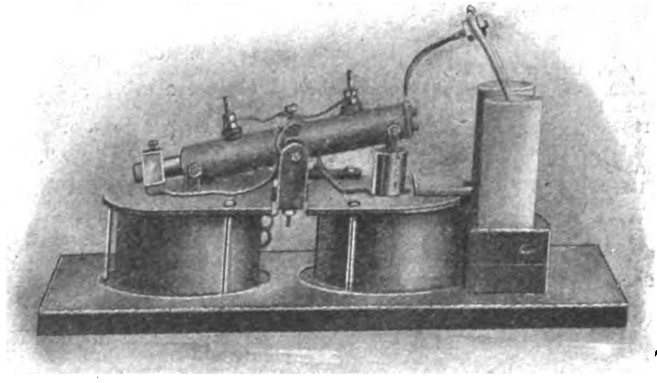

FIG. 6.—"GRUNDY" RELAY SWITCH.

unlimited extent after overbalancing the mercury tube, and the thermostat can be adjusted to any temperature between 30° and 90° F.

The armature switch is specially adapted for use with the "Hestia" electric stove supplied by Messrs. Schonfield, although it can be applied to any electric heater, or for bringing a fan into operation when the temperature of a room rises above a predetermined amount.

The "Hestia" stove has a cylindrical ruby glass body giving a subdued glow when in use; the heater is guaranteed for five years, and a special feature is a portable water belt for moistening the heated air, and thus preventing the latter from becoming dry and unpleasant to breathe.

A Device for Cleaning Silver.

MR. J. M. HOTCHKISS, of Fairfax, U.S.A., has devised a simple method of cleaning gold, silver, and other metal ware without friction and consequent attrition of the surface, and without dissolving the metal or otherwise injuring the articles treated. The method is electrolytic in character, and is carried out with a zinc tray or frame provided with a grid of copper bars, on which the ware to be cleaned is placed; the whole is immersed in a solution of common salt in the proportion of about two tablespoonfuls of salt to a quart of tepid water. The silver being electro-negative to zinc, the combination forms a voltaic cell, liberating hydrogen at the surface of the silver, and the nascent hydrogen reduces the oxide or sulphide with which the silver is tarnished, leaving the surface bright and clean. We have tried the process and find it perfectly efficient and satisfactory; even in the case of silver that appeared to be untarnished, the added lustre resulting from the application of the process proved that an invisible film of tarnish had been present. The patent rights for the appliance are in the hands of MESSRS. LUND BROS. & CO., of 78, Queen Victoria Street, London, E.C.

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NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

14,311. "Electrically-operated reciprocating apparatus." T. F. WALL. June 15th. (Addition to 9,893/13.)

14,316. "Electric traction motors." C. TURNBULL, JUN., & W. T. DALTON. June 15th.

14,342. "Combined insulating and fastening means for rails." W. R. GORRELL. June 15th. (Convention date, April 20th, 1914, United States.) (Complete.)

14,358. "Means for conveying articles through the bath of an electro-plating or other apparatus." C. K. MILLS. June 15th. (Hanson & Van Winkle Co., United States.) (Complete.)

14,376. "Means for controlling the use of keys or other articles, but primarily keys employed in connection with electric locking signals." A. A. JEWELL & F. S. JEWELL. June 15th.

14,377. "Manufacture of metallic filaments for incandescent lamps." T. T. BAKER. June 15th.

14,378. "Process for starting a combined rotary converter and a synchronous generator set." SIEMENS BROS. DYNAMO WORKS, LTD., & C. A. B. D. KOETTGEN. June 15th. (Complete.)

14,379. "Implement for laying cables or wires in the ground." R. H. FOWLER. June 15th. (W. Turner, Germany.) (Complete.)

14,380. "Regulation of alternating or three-phase current generators. VOIGT & HAEFFNER AKT. GES. June 15th. Convention date, June 16th, 1913, Germany.) (Complete.)

14,381. "Rendering tungsten ductile." C. TRENZEN. June 15th.

14,384. "Switching-arrangements for rotary converters. SIEMENS BROS. DYNAMO WORKS, LTD. June 15th. (Siemens-Schuckertwerke G.m.b.H., Germany.) (Complete.)

14,392. "Fittings for metallic conduit systems of electrical wiring." T. MANSON. June 15th

14,394. "Electric heaters or resistance elements therefor." J. R. QUAIN. June 15th.

14,415. "Dynamo-electric machines." H. H. JEFFCOTT. June 16th.

14,438. "Means of applying the radiating properties of aluminium or other metals or alloys to the cooling of sparking-plugs, compression taps, and exhaust valves of all internal-combustion engines or to the cooling of the cylinders of air-cooled internal combustion engines." F. H. KITCHIN. June 16th.

14,439. "Telegraphone." F. SEELAU & A. M. NEWMAN. June 16th. (Convention date, August 22nd, 1913, Germany.) (Complete.)

14,440. "Cylinder record magazine for phonographic talking-instruments, particularly telegraphones." F. SEELAU & A. M. NEWMAN. June 16th. (Convention date, October 16th, 1913, Germany.) (Complete.)

14,441. "Telephonic receiver and transmitter boxes with phonograph styles." F. A. SEELAU & A. M. NEWMAN. June 16th. (Convention date, September 1st, 1913, Germany.) (Complete.)

14,469. "Electrical heating-apparatus." A. F. BERRY. June 16th.

14,470. "Means for controlling the heating effect of electric heating-apparatus." A. F. BERRY. June 16th.

14,471. "Electric switches." A. F. BERRY. June 16th.

14,474. "Electric fuses." W. D. HENSELL. June 16th. (Convention date, June 18th, 1913, Australia.) (Complete.)

14,483. "High-tension electric apparatus." MEIROWSKY & Co. AKT. GES., and K. FISCHER. June 16th. (Complete.)

14,494. "Electro muscle-developing machine. T. MAHER. June 17th.

14,504. "Metallic insulated nipple or bush with or without bonding or earthing connexion for electric metallic conduits." T. TOPPING. June 17th.

14,513. "Method of and apparatus for use in, and in connection with, electrolytic processes." A. E. BATTLE. June 17th.

14,514. "Electrolysis of metals." A. E. BATTLE. June 17th.

14,521. "Thermo-electric generators." P. FERRA. June 17th.

14,548. "Electric switches." J. H. TUCKER. June 17th. (Divided application on 19,388/13. February 27th, 1914.)

14,557. "Electrical measuring-instruments." I. W. BROGGER. June 17th. (Complete.)

14,558. "Sparking-plugs for internal-combustion engines." S. R. JACKAMAN. June 17th.

14,561. "Spark plugs." M. RALL. June 17th. (Convention date, July 10th, 1913, France.) (Complete.)

14,567. "Transmitting rotary motion." JANDUS ARC LAMP AND ELECTRIC CO., LTD., and A. D. JONES. June 17th. (Complete.)

14,577. "Systems of electric distribution." BRITISH THOMSON-HOUSTON CO., LTD. June 17th. (General Electric Co., United States.)

14,582. "Electrode-making machines." S. L. CASELLA. June 17th. (Convention date, July 3rd, 1913, United States.) (Complete.)

14,595. "Mechanical selector for electromagnetic waves applicable to wireless telegraphic receiving apparatus." R. B. GOLDSCHMIDT. June 17th. (Convention date, December 29th, 1913, Belgium.) (Complete.)

14,617. "Insulating fittings." IOCO PROOFING CO., LTD., and N. B. ROY. June 18th.

14,623. "Recipients for electric storage cells." G. DAVIS. June 18th.

14,638. "Safety apparatus for use with electric lighting installations." SOC. ANON. DES AUTOMOBILES ET CYCLES PEUGEOT. June 18th. (Addition to 21,445/13. Convention date, July 8th, 1913, France.) (Complete.)

14,642. "Electric-alarm show-stand." A. H. IRWIN. June 18th.

14,643. "Accessories for use in connection with telephones." R. F. HOWELL and R. P. MULHOLLAND. June 18th.

14,669. "Electric candle lamps." C. DAMEY and G. BRADLEY. June 18th.

14,683. "Tensioning-arrangements for overhead electric conductors. SIEMENS SCHUCKERTWERKE G.M.B.H. June 18th. (Convention date, June 21st, 1913, Germany.) (Complete.)

14,686. "Portable electric-lamp dry batteries." J. S. HAMILTON. June 18th. (Divided application on 3,643/14. February 12th.) (Complete.)

14,695. "Means of reading the indications of magnetic compasses, clinometers, and the like." J. H. STEWARD, LTD. June 19th.

14,697. "Electric projectors and the like." W. T. COULSON. June 19th.

14,698. "Electricity meters." H. J. FISHER. June 19th.

14,739. "Apparatus for continuously disinfecting telephone mouthpieces." H. H. MAHIEU. June 19th. (Complete.)

14,746. "Electrical conduits and the like." H. H. LONGBOTTOM and T. FARRAR, trading as STEEL TUBES & CONDUITS CO. June 19th.

14,747. "Combination clutch and switch for motor vehicles and the like." G. H. C. LUMSDEN. June 19th.

14,767. "Compounds for use as coatings or coverings for insulating purposes and the like or for making slabs or blocks." A. J. ROACH-CUMING. June 19th.

14,768. "Compounds for use as coatings or coverings for insulating purposes." A. J. ROACH-CUMING. June 19th.

14,780. "Process for producing a filling-material for use in connection with direct-current converters." K. SIEVERS and O. MUNCH. June 19th. (Complete.)

14,789. "Incandescent electric lamps." E. B. Y TORRENS. June 19th. (Convention date, October 30th, 1913, Spain.) (Complete.)

14,798. "Telephonic transmitters and receivers." INTERNATIONAL ELECTRIC CO., LTD. June 19th. (Akt. Ges. Mix & Genest, Germany.) (Complete.)

14,800. "Apparatus for and method of operating electric signs, devices, indications and the like." L. MARTIN. June 19th.

14,808. "Telephone systems." R. H. BURFEIND. June 19th. (Convention date, June 21st, 1913, United States.) (Complete.)

14,817. "Electrical condensers." BRITISH INSULATED AND HELSBY CABLES, LTD., E. A. BAYLES, and H. HIGHAM. June 20th.

14,824. "Electric water sterilisers." C. W. DENNY. June 20th.

14,825. "Electric ozone generators." C. W. DENNY. June 20th.

14,834. "Electrical condensers." A. J. B. E. DARRAS. June 20th. (Convention date, June 21st, 1913, France.) (Complete.)

14,841. "Electricity meters of the mercury motor type." CHAMBERLAIN & HOOKHAM, LTD., and W. S. SPRAGUE. June 20th.

14,861. "Manufacture and construction of commutators for dynamo-electric machines." A. H. MIDGLEY & C. A. VANDERVELL. June 20th.

14,884. "Spark gaps for radio-telegraphy." E. GIRARDEAU & J. BETHENOD. June 20th. (Convention date, June 23rd, 1913, Belgium.) (Complete.)

14,891. "Receivers for use with electrical apparatus for transmitting and receiving signals." SIR A. T. DAWSON and G. T. BUCKHAM. June 20th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

5,157. ELECTRICITY METERS. J. Elster. February 28th.

5,310. SYSTEM OF GUN CONTROL. A. H. Wegner. March 3rd.

5,352. ELECTRO-MAGNETICALLY CONTROLLED PERFORATING APPARATUS. B. Soldatencow. March 3rd. (March 16th, 1912. Patent of addition not granted.)

10,000. APPLIANCE FOR TESTING THE HEARING OF PERSONS, PARTICULARLY APPLICABLE TO DEAFNESS. E. T. Hincks. April 20th.

10,200. TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) April 30th.

10,399. TELEPHONES. A. Plecher. May 2nd

12,421. MANUFACTURE OF TUNGSTEN METAL BODIES. C. Gladitz. May 28th.

12,723. TESTING OF INSULATION. Evershed & Vignoles, Ltd., and S. Evershed. May 31st.

12,740. CONSTANT-TEMPERATURE ELECTRICALLY HEATED OVENS. T. B. Freas. May 31st.

12,950. SIGNS OR ADVERTISEMENTS, ALSO APPLICABLE TO OTHER DEVICES USED FOR DISPLAY OR LIKE PURPOSES, AND FORMED WHOLLY OR PARTLY OF GLASS OR OTHER TRANSPARENT MATERIAL. W. J. Beville. June 4th.

12,966. CALLING DEVICE FOR TELEGRAPH OR TELEPHONE CIRCUITS. C. W. Lund and New Phonopore Telephone Co. June 4th.

13,015. MACHINES FOR INTERMITTENTLY DISPLAYING POSTERS AND THE LIKE. E. W. Brown. June 5th. (Cognate applications, 15,292/13 and 25,259/13.)

13,065. CALLING OR ALARM APPARATUS FOR USE IN WIRELESS SIGNALLING. W. T. Ditcham & Grindell-Matthews Wireless Telephone Syndicate, Ltd. June 5th.

15,392. VAPOUR ELECTRIC DEVICES. British Thomson-Houston Co. (General Electric Co.). July 3rd.

15,658. ELECTRIC RAILWAYS. C. M. White (Sturges). July 7th.

15,682. ELECTRIC CONTROL OF ELECTRIC MOTORS. Otis Elevator Co. (Otis Elevator Co.) July 7th. (Patent of addition not granted.)

16,349. ELECTRICAL STOP MOTIONS FOR KNITTING MACHINES. G. Stibbe. July 16th.

16,601. APPARATUS FOR HEATING LIQUIDS ELECTRICALLY. British Electric Heater Co. & C. Kratt. July 19th. (Cognate application, 28,355/13.)

17,264. ELECTRIC OVENS AND THE LIKE APPLIANCES. M. Railing & G. H. Ide. July 28th.

18,024. WIRELESS APPARATUS. G. E. Heyl & T. T. Baker. August 7th.

18,073. ELECTRIC SHAFT FURNACES. W. N. Crafts. August 8th.

18,400. ELECTRIC LIGHT CEILING FITTING, FITTED WITH A SPECIAL DEVICE TO FACILITATE THE FITTING OR REMOVAL OF A GLASS OR ALABASTER BOWL OR METAL REFLECTOR, OR THE LIKE. A. Higgins & S. Griffiths. August 13th.

19,588. CONTINUOUS-CURRENT TRANSFORMERS. P. M. J. Boucherot. August 29th. (September 18th, 1912.)

19,757. RAILWAY SIGNALLING. H. W. Firth & F. W. Leake. September 1st.

21,140. REGENERATIVE BRAKING SYSTEMS FOR ELECTRIC MOTORS. N. W. Storer. September 18th. (October 5th, 1912.)

25,643. TELEPHONIC RECEIVING APPARATUS. Western Electric Co. (Woodward, acting for Western Electric Co.). November 10th.

26,251. ELECTRICAL ACCUMULATORS. H. C. Weeks. November 15th.

26,502. DYNAMO ELECTRICAL MEANS FOR STARTING INTERNAL-COMBUSTION ENGINES AND LIGHTING SYSTEMS IN CONNECTION THEREWITH. L. J. Wolf. November 18th.

26,778. LAMPS OR HEAD LIGHTS. H. V. J. Jouffret. November 21st. (November 22nd, 1912.)

27,137. APPARATUS FOR RECORDING NUMBER OF TELEPHONE CALLS. A. J. Fitzgerald and E. G. Fitzgerald. November 25th.

29,270. COMMUTATION ARRANGEMENTS FOR ELECTRIC ROTARY CONVERTERS COUPLED TO ALTERNATING-CURRENT BOOSTERS. Siemens Bros. Dynamo Works, Ltd., & J. C. Wilson. December 18th.

29,831. MEASURING INSTRUMENTS FOR RONTGEN-RAYS. R. Furstenaü. December 27th.

1914.

72. PROCESS FOR RESTORING THE ACTIVITY OF A POSITIVE ELECTRODE MASS FOR ALKALINE ACCUMULATORS. Svenska Ackumulator Aktiebolaget Jungner. January 1st. (January 16th, 1913.)

1,640. ARRANGEMENTS FOR REGULATING THE TORQUE OF POLYPHASE ELECTRIC MOTORS. Siemens-Schuckertwerke Ges. January 21st. (January 22nd, 1913.)

3,818. THERMAL CONTACT DEVICE FOR ELECTRIC CIRCUITS. B. Jeidel, née Hendel. (February 13th. (December 5th, 1913.)

4,309. CONTROLLING OF ELECTRIC MOTORS FOR SHIP PROPULSION AND MEANS THEREFOR. Siemens-Schuckertwerke Ges. & F. Hulss. February 19th. (Divided application on 13,148/13. June 6th.)

6,454. ROTARY TRANSMISSION DYNAMOMETERS WITH RECORDING APPARATUS. M. Rockstroh. March 13th.

8,719. ELECTRIC HEATING AND COOKING DEVICES. R. Sprenger. April 6th. (April 7th, 1913.)

12,032. TESTING OF INSULATION. Evershed & Vignoles, Ltd., and S. Evershed. May 31st. (Divided application on 12,723/13. May 31st.)

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THE

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Vol. LXXV.] CONTENTS: July 10, 1914. [No. 1,911.

	Page
The Report on Electric Mains Explosions	41
Copper	43
Another Australian Wages Award	43
The Betulander Relay Automatic Telephone System (*illus.*) ...	44
The Organization of the Electrical Industry, by C. Ashmore Baker	46
Correspondence—	
The Training of the Instrument Maker	48
Electricity Supply in London	48
Zero Resistivity	49
Concerning Switchgear	49
Legal	49
Coal-Handling Plant at Southend-on-Sea (*illus.*)	52
Notes from Canada	52
The Chicago Underwriters' Code	53
Business Notes	53
Notes	61
City Notes	64
Stocks and Shares	68
Market Quotations	68
Share List of Electrical Companies	69
Reviews	71
Electrical Terms and Definitions (*concluded*)	72
Electric Mains Explosions	74
The Municipal Electrical Convention	76
Report of the Council	76
Engineering Standards Committee	77
New Electrical Devices, Fittings and Plant (*illus.*)	78
New Patents Applied For, 1914	90
Abstracts of Published Specifications	90

Contractors' Column ... ... Advertisement pages xxii and xxiv

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THE REPORT ON ELECTRIC MAINS EXPLOSIONS.

WHEN explosions first took place in connection with mains for the distribution of electrical energy, it was natural, and probably correct, to ascribe them to the presence of coal gas derived from the network of pipes in close proximity to the electrical lines. Usually the explosions were in underground boxes which were obviously well adapted for the accumulation of gas escaping from a leaky pipe. When, however, explosions began to occur on mains laid on the solid system and in which it was clear to any fair-minded man that coal gas could not well be the agent of destruction, it became necessary to look nearer home and inquire whether the electric main itself might not supply the gaseous mixture as well as the means of its ignition.

Some 14 or 15 years ago it was clearly brought home to at least one well-known authority in connection with a bad fault that occurred within his experience, that mains laid solid in bitumen could generate large quantities of highly explosive gas. On his arrival at the site of the damage, a flame three or four feet high was seen escaping from between the flagstones with great violence, and the natural inference was that a gas main had been fused and the gas ignited. On opening out the ground, however, it proved to be due entirely to cables laid solid in bitumen.

The knowledge that bitumen could give rise to such dangerous conditions was probably confined to comparatively few persons for a number of years, none of whom were anxious to publish the information in their possession, and it is only recently that it has become public property.

So alarming was the danger from this cause considered at the end of 1913 that a Committee, consisting of Messrs. Robert Nelson, W. Slingo, James Swinburne and Alexander P. Trotter, with Sir T. Edward Thorpe as chairman, was appointed to consider the causes of explosions in connection with bitumen used for cable laying, and what steps should be taken to prevent them in future.

This Committee, after hearing evidence from some 14 witnesses, comprising central station engineers, cable manufacturers, consulting engineers and scientific experts, has just presented its report, of which we give a lengthy abstract in this issue. The most striking thing about this document is the contradictory nature of the evidence given, and, probably as a consequence, the indecision in the conclusions arrived at. The report itself, through which are scattered traces of humour, rare in a Government publication, is somewhat discursive, the arrangement having little method and certain matter of doubtful relevancy being rather dragged in.

It is curious that it is tacitly assumed that the whole danger of the formation of an explosive mixture arises from the bitumen filling, the insulating and protecting covering of the cable itself being wholly ignored. It is within our experience that a most serious explosion can arise with no other source for the gas than these coverings Some 18 years ago a striking instance of this cause came

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under observation. Two lengths of culvert, containing bare copper, were connected at a street crossing by rubber cables, of the best quality then obtainable, laid in a pipe, which cables became faulty. Destructive distillation of the rubber and braiding took place, with the result that one of the pits in which the cables were joined to the bare copper, and the whole of the culvert communicating with this pit, were filled with gas derived solely from the cables, and on ignition a violent explosion took place, disturbing the flag-stones over the entire length of culvert, and damaging the basement of the building alongside which the culvert ran. Other examples of exactly the same thing could be cited. It is thus evident that with drawing-in systems risk of serious explosion may arise if the cables are not lead-covered, in spite of the fact that there is not an ounce of bitumen or pitch filling present.

The report begins by reciting the facts that led to the inquiry being held, and states that explosions of the kind under investigation have only taken place in connection with single-core separately laid cables, insulated with rubber or vulcanised bitumen, and that all serious explosions in houses have been in connection with vulcanised bitumen cables laid solid or in bitumen casing. Too much reliance should not be placed on this latter statement, as, though it is possible that no serious explosions have been reported as occurring with non-lead-covered cables drawn into pipes for services, it would be most regrettable if it were assumed that such services gave immunity from risk of explosion; as a matter of fact there can be no question that cables so laid are peculiarly liable to faults, and the conditions are highly favourable to the products of the distillation of their coverings entering the house and exploding. No unstopped pipe should ever be allowed to enter a building.

It is quite fairly pointed out that although thousands of separate cables have been laid on the solid system, the number of serious accidents has been small. It is curious, however, that it should be stated: "gradual deterioration sometimes takes place," and that "failures have occurred on cables which have been laid for 10 or 20 years, but on taking them up the bulk has been found to be in perfect condition." It would seem as though gradual deterioration and occasional failures were remarkable or peculiar to the solid system of laying mains. Surely it must be anticipated that all mains will deteriorate in time, and all experience goes to show that the rate of deterioration is less with the solid system than with any other in which continuously insulated cables are employed.

As a general rule, it is stated that explosions have taken place in large, and not in small towns, and this is ascribed to the relatively high resistance of the main cables in use in small towns. This explanation is open to grave doubt, for although much larger cables are, of course, used in the big towns, there is no large town without long lengths of small cables, and the resistance between the fault and a heavy main there is likely to be as high as between the fault and the generating station in the small town, for, after all, every station, however mean, has to look after its drop. A much more likely explanation would seem to be that in a small town every cable can be made a household pet, and faults can be detected and removed at an early stage, whereas in a large one the cables have to rough it and take their chance, a leak having to be fairly bad before it is noticeable at all amid the general distributed leakage.

A brief account of the kinds of fault experienced on vulcanised bitumen cables laid solid and their results is given, and it is pointed out that, as single cables of this kind laid in this manner rarely give a metal to metal dead short, they can be, and often are, run on while a fault is present, whereas concentric, three-core, and lead-covered cables generally, when faulty, cause such serious trouble that means are usually taken to cut them out automatically, and, it may be added, interrupt the supply to consumers supplied from them. Nothing is said about the drawbacks of these other cables which are not shared by vulcanised bitumen.

Rubber cables, which most central-station engineers regard with distrust of the deepest, are spoken of rather favourably, though somewhat inconsistently. On page 3 of the report, it is stated: "Although at one time vulcanised rubber cables of excellent quality were made, and it appears might still be made at a higher price, inferior qualities have given trouble." On page 5 we are told: "Rubber mains of poor quality having been abandoned and those of good quality giving no trouble . . . " Some of those who in the early days were afflicted with rubber cables which were sold as being of the highest grade by makers of the best reputation would be interested to know who were the fortunate individuals who got the cables of "excellent quality," and it would be equally interesting to know who is putting down rubber mains of good quality nowadays; the Committee does not seem very sure, as it says these high-class cables "might be," not "are" made. The conclusion arrived at is that all bad cases of explosion have been due to simple vulcanised-bitumen insulated cables drawn into bitumen casing or laid solid in Trinidad bitumen or in pitch.

Subdivision of the mains into districts and careful localisation and repair of faults have resulted in no explosions of bitumen gas occurring on mains laid in bitumen casing, so that the question is narrowed down to the solid system with bitumen or pitch. The relative properties of the two fillings are stated, but there was much conflict of evidence on the subject. The same remark applies to the best material to be used for the troughing, witnesses having large practical experience of main-laying and maintenance holding diametrically opposed views, but the Committee apparently has no hesitation in saying: "Earthenware troughs with separate chases, or a separate trough for each cable, is the best method," so there is nothing more to be said, and all the witnesses will know what to use in future. Some of them, however, may be forgiven if they are sometimes haunted with thoughts of the fragile nature of earthenware, the want of truth in the troughs which may lead to varying thickness of the protective covering of their cables, the liability to damage of the cables at the numerous joints in the troughing and other drawbacks, all ignored by the Committee, to say nothing of the bulky nature of the troughs in a crowded street.

The importance of giving proper care to service joints is pointed out, though it can hardly be regarded as a discovery of the Committee, and the danger of damage at bends is very properly emphasised. Bad work is often done at bends, and mains have been taken up in which the cables were resting on the sharp edges of the dividing bridges instead of in the grooves, it need hardly be said, with disastrous results. The Committee recommends that bridges should be omitted altogether at bends, but this can hardly be so good as retaining the bridges and putting them in with special care so as to ensure their being properly fixed. With the method favoured by the Committee, the cables will almost certainly rest on the bottom of the trough in course of time, and the protection of the bitumen will be lost, thus destroying the whole *raison d'être* of the solid system, *i.e.*, the surrounding of all cables at all points with a covering impervious to moisture.

The danger arising from a pavement over the main through which the gas cannot escape is rightly indicated, as the gas will tend to force its way into adjacent houses. It is recommended that mains should not be laid too near the buildings from the stingy motive of saving cost of services.

It is assumed that services from vulcanised bitumen mains must be made with cables insulated in the same manner, though the reason for this is not stated. Armoured service cables are recommended, while the taking of the solid system into the house is condemned. It is, nevertheless, admitted that there are over 10,000 services on the solid system in one Midland city on which there has never been a single fault.

The report next makes a long digression on the subject of testing and insulation, which, though no doubt interesting in itself, does not appear to have much bearing on bitumen explosions.

The burning-out of faults is naturally viewed with disfavour, and that some central-station engineers are of the same mind is shown by the case of one extraordinary individual who "prefers to keep no less than 206 districts electrically separate, connected neither by fuses nor links." One would think he must be the owner of a copper mine!

Next follow some remarks on fuses, and the views of witnesses are cited who thought that the maximum current in a district should be limited to amounts varying from 300

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to 800 amperes, though it is admitted that some prefer a single network with an occasional burn-out; perhaps the two views might be summed up by a heretic as thousands of fuses, uncertain, and possibly dangerous, in their action, and ever present as a source of expense, anxiety, and annoyance *versus* one which only appears when it is wanted, requires no maintenance, will most probably act, and may be dangerous. It would seem that the witness who would subdivide his network into 300-ampere districts had not much faith in electric heating or cooking.

The Committee next proceeds to its "Conclusions." The blame for explosions is laid on vulcanised bitumen-insulated cables, carrying continuous current, laid solid, or in bitumen casing. A clean bill of health is given to all alternating-current mains and concentric, three-core and lead-covered paper-insulated cables. Pitch as a filling for the solid system is looked at with suspicion, the absence of explosion where it has been employed being ascribed, with good reason, to the relatively small amount of it used as compared with Trinidad bitumen. In spite of its condemnation, the Committee does not recommend the Board of Trade to cease approving vulcanised bitumen cables laid solid, or to exclude wood troughing, but it does recommend separate troughs with 2 in. of sand between them.

The Committee makes definite recommendations that separate mains on the solid system should not be laid under impervious pavements, or close to walls of buildings, that armoured services should be used, and that they should be taken into buildings in such a manner that gas cannot enter, and it makes certain recommendations as to the mode of laying cables at bends. Finally, it draws attention to the Board of Trade regulations which require notification of fires and explosions, and recommends the publication of reports on such accidents.

So ends the Report itself, and it must be confessed that it is singularly disappointing. The conclusions arrived at are so lame and halting that no appreciable additional security to the public is afforded, and, while nothing of importance is forbidden, serious damage will probably be done to the prestige of a class of cable laid in a particular manner that, viewed from the general standpoint of all-round merit, rather than from the narrow one of a possible explosion once in a blue moon, has probably given, and will continue to give, by far the best results of any continuously insulated main on continuous current networks.

That the possibility of explosion with separate cables on the solid system cannot be wholly eliminated, we would be the last to deny, but the same or other dangers hardly, if at all, less serious exist with other systems of continuously insulated cables. The opinion is still held by some, even though it be an unfashionable and antiquated one at the present day, the only thoroughly safe, convenient and indefinitely durable main for continuous current distribution in districts in which a heavy demand exists (*i.e.*, in the large towns in which alone, we are told, explosions have occurred) is bare copper, strained between suitable porcelain insulators, in concrete culverts.

The report is accompanied by two appendices, to which we hope to refer next week.

Copper. TRUE to its traditions, no sooner did copper wear an utterly dejected appearance and appear to be without a friend, than the market took a swift turn for the better, and with advancing prices a substantial amount of buying was released, which has done a good deal to render the position of producers more comfortable. The entire outside conditions of the trade had become poor. There were financial difficulties in metals generally, and while it is true that these were connected more with tin than with copper, they nevertheless exercised a depressing influence, while the share markets in the United States were quite discouraging.

With the removal of the more particular difficulties to which allusion is made, however, copper very quickly picked up, and who, in the attempt to quit stocks, had accepted down to a shade below £62 for electrolytic, suddenly realised that temporarily at least prices had grounded, and under the lead of some of the more important people an upward movement was started. Due credit for this must, however, be given where it is owing, and that is to American speculators, who sent good buying orders for standard copper based apparently upon the belief that the rate decision would be issued in a few days, and that it would be favourable to the railway companies. So much importance, however, is generally attached to this decision, and there has been so much talk about what it would mean as regards the general industrial position of the United States, should it prove favourable, that the chances are very much in the direction of its falling flat when it actually makes its appearance.

It is preposterous to imagine that a mere judicial decision can make or mar the industrial operations of a great nation, yet people talk as if this were so. Sentimentally, of course, it could help matters forward, but it is a matter of time for the course of affairs industrial to be really altered. The tone of the European markets has, however, been decidedly improved, and it is quite plain that there is a good deal of buying to be done, both of refined and of manufactured material. There has been rather more doing in the United States, too, though there is a very general inclination to hold back there until the outlook is more clearly defined.

The European statistics for the month of June were by no means bad, even if they were not exactly good. The European visible supply at the end of the month was 33,171 tons, against 32,370 tons a month previously, while the stocks of standard copper were 14,374 tons, compared with 12,429 tons on May 31st, the stocks in England and France being 20,464 tons, against 18,618 tons a month ago. The quantities coming into sight during the month totalled 50,636 tons, North America 36,086 tons, Spain and Portugal 3,209 tons; and other countries 5,471 tons. The Chile shipments were 3,500 tons, and those from Australia 2,550 tons, the month's deliveries being 49,735 tons. The next United States statistics are expected to be fairly satisfactory, but for all this they will probably show a moderate increase in the stocks in the hands of the refineries.

Another Australian Wages Award. WE have received particulars of another award affecting the wages of electrical workers which has been made by Mr. Justice Higgins, the President of the Commonwealth Court of Conciliation and Arbitration. This award affects telegraph and telephone linemen, who through their Union had claimed higher wages, shorter hours, and improvements in their employment conditions.

It was stated that the number of workers affected by the decision was 3,114, most of whom were members of the Union. The Judge, in his award, held that the work was intermediate between skilled and unskilled. It necessitated the power to read, understand and obey a number of official instructions, and to make, in some cases, fairly complete reports. The Union wanted a minimum wage on the basis of £150; the employers were paying £132; the new award is £138. This means £11 10s. per month. Linemen in charge are to be paid £168; line foremen £186; and line inspectors £216. Provision is made for increments of pay with long service for linemen up to £168, linemen in charge up to £186, line foremen up to £210, and line inspectors up to £264, with possible further increases at the discretion of the Commissioner up to £360.

The hours are defined as 46½ per week, or if employed in tunnel work 44 per week. For Sunday work time and a half is to be paid, and for duty on public holidays double time.

The remainder of the award deals with district allowances, forage allowances, holidays, the establishment of a Board of Reference composed of representatives of employers and workers, and the special rates to be paid in Western Australia. To prevent accidents it is ordered that all poles are to be thoroughly examined for decay or ant holes at least once a year.

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THE BETULANDER RELAY AUTOMATIC TELEPHONE SYSTEM.

This system, to which we briefly referred in our last issue, is one in which the whole of the operations in a telephone exchange of connecting subscriber to subscriber, ringing, and disconnecting are performed entirely by relays.

These relays are of the ordinary telephone type which have been used in practice in central-battery manual exchanges throughout the world for the last 15 to 20 years. They are familiar and well-tried simple units, and are thoroughly reliable. There are no moving parts, as generally understood, to get out of order, for the whole of the operations are performed by these simple units.

The new system, invented by Messrs. Betulander and Palmgren, Swedish engineers, differs most strikingly from all systems employing electro-mechanical devices which have movement in one or two directions (vertical and rotary), and which after performing the operations of selecting and connecting idle junction lines and subscribers' lines remain associated with the completed connection; these devices are thus doing no useful work during the period of conversation, whereas in the Betulander relay system the common relay groups, equivalent to the electro-mechanical devices mentioned above, after connecting calling line to junction, and junction to junction as required by the size of the system, free themselves from the circuit immediately it is set up and are instantly available for setting up other connections, which is their only function; they are, in fact, comparable with the hands and brain of the operator in a manual exchange.

The relay selector and connector units may be likened to electrical operators which first test the line wanted, and if it is disengaged, connect with the calling line and with a junction just as an A operator on a manual system would insert an answering plug in the jack of the line calling, and a calling plug in the outgoing junction jack, and go out of circuit. At the next link the electrical operator would connect the junction line and the subscriber wanted, in a 1,000-line exchange, just as the operator would on a manual system, and go out of circuit.

The talking circuit from subscriber to subscriber is then held and controlled by relays, which break the circuit and return all sections to their normal condition when the receiver at the subscriber's station is replaced on the rest.

It would appear extraordinary if the operator in a manually operated exchange were to hold the plugs in the jacks during the conversation, but this is practically what is being done in automatic systems by retaining a complicated electro-mechanical operator tied up to a connection at each stage of the connection, as in all other automatic systems.

The basic principle which permits of all the operations being carried out entirely by relays is a series of "link lines" comparable with a number of double-cord circuits of a manual exchange, which, at the first stage of a call, effect a connection between the calling line and an idle outgoing junction leading to the ten thousands, thousands or hundreds group, depending upon the size of the exchange. The subsequent stages down to the tens, and the individual unit required, are reached in exactly the same way, and when the connection is set up the various groups of common relays which searched for the idle junctions, and responded to the impulses from the subscriber's instrument from stage to stage of the call, immediately free themselves from the connection and take charge of other calls. When a connection is completed, the two subscribers are connected by a transmission circuit on the "Stone" system equal to that employed in the best central-battery manual practice.

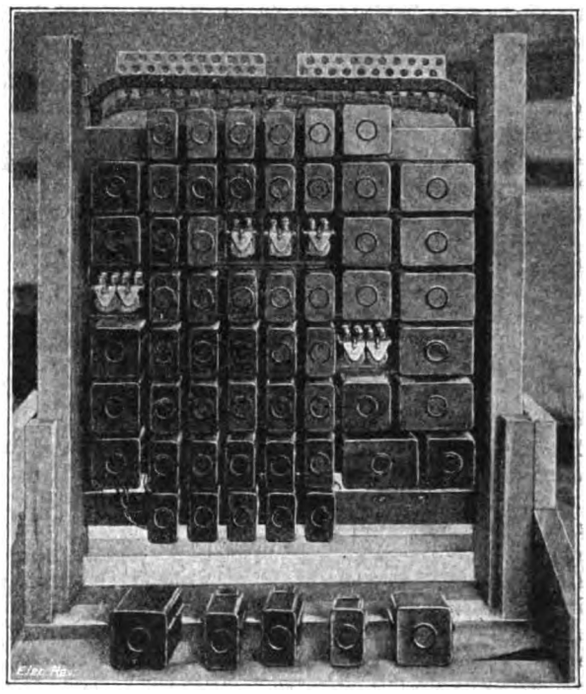

Fig. 2.—Front View of Subscribers' Section of Relays.

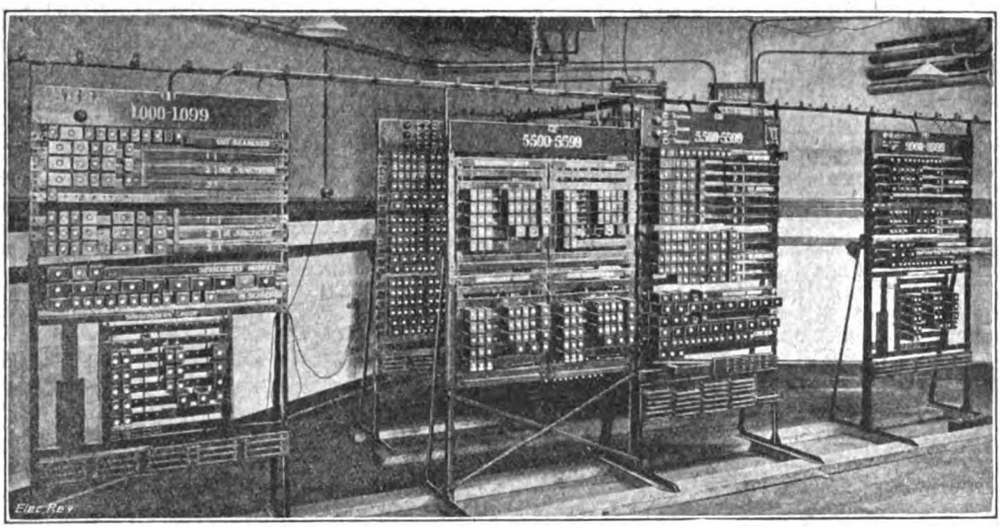

Fig. 1.—Experimental Installation of the Betulander Relay Automatic Exchange at Marconi House.

The apparatus installed at Marconi House is of an experimental character, designed to illustrate the operation and possibilities of the system; it consists of three sections, respectively representing the ends and the middle of a ten-thousand line exchange, so that calls can be made from any one to any other of these sections. The illustration, fig. 1, therefore does not represent a complete installation, but is intended to show two things—the general appearance of the apparatus, and the supremely important fact that it consists of *nothing but racks of ordinary relays*. Figs. 2 and 3, however, show the front and back of an actual completed 5-line panel which is to be used in building up a 100-line exchange in Marconi House. The wiring is not more elaborate than in a manual exchange—the costly subscribers' multiple is entirely omitted—and

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every bit of the apparatus and wiring is accessible. The Betulander system depends on the life of its relays, in which there is the minimum of friction, and the points of contact are either of gold-silver alloy or platinum. Telephone relays of the standard type have been in use in this country for about 14 years, and they appear to be as good, and give as little trouble, as when first fitted. Some of the relays are shown in fig. 4.

It has become necessary with electromechanical switches to take special precautions to keep the air of the rooms equable as regards temperature, dryness and freedom from dust. With a relay apparatus this trouble is greatly reduced, as the relays are enclosed in cases of small dimensions; therefore, when trouble arises, it is only necessary to expose a very small portion of the apparatus, the rest remaining dust and damp-proof.

Experience with great masses of relays in this country on central-battery systems shows that with individual covers,

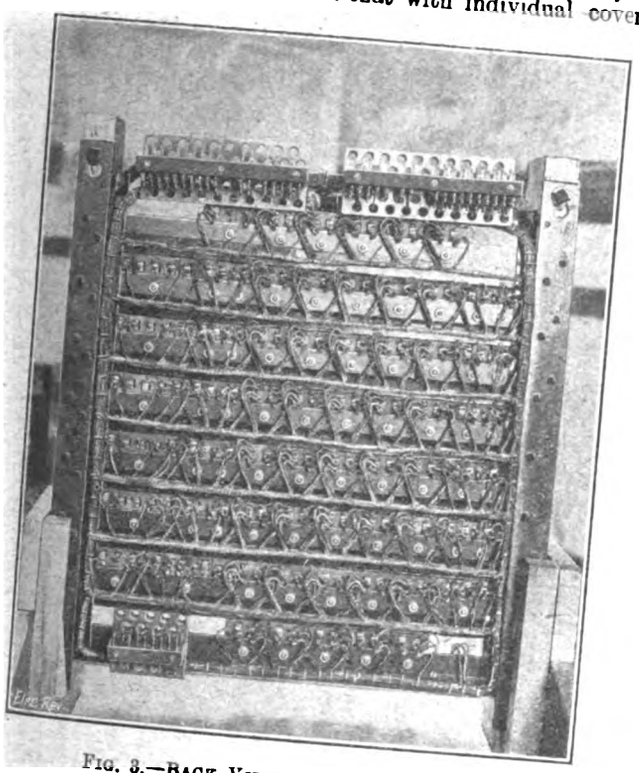

FIG. 3.—BACK VIEW OF RELAY PANEL.

or covers for strips of 10 pairs, there is practically no trouble, and that they will work for many years without attention, their adjustment remaining unaltered.

In the manually-operated system it is customary to speak of "double-cord" and "single-cord" working. The subscribers', or "A" positions, are worked "double cord," *i.e.*,

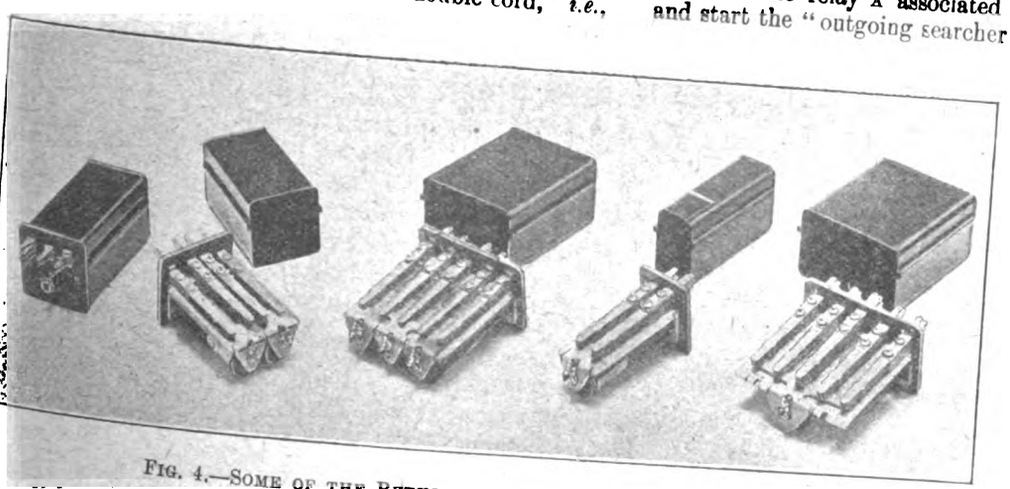

FIG. 4.—SOME OF THE BETULANDER RELAYS AND THEIR COVERS.

cord broken centrally to admit the operator's telephone, has ach end terminated in a plug. At the "B" position the ncoming junction lines end in a cord and a plug, and are oken of as being worked "single cord."

The Betulander relay system of working is equivalent to e "double-cord" working, and the equivalent to the cord is known as an "intermediate line" or "link." In a three-figure installation (999) lines, there would be :—

A "primary link" which is equal to the line switch or pre-selector of other automatic systems, and connects the subscriber's line to a junction automatically when the receiver is lifted.

A "first junction" in which there is a condenser in each line, a device for feeding current to the calling line, and an impulse repeating device.

A "main link" which connects two junction lines together, the associated "relay operator" responding to the first digit of the number wanted.

A "final" or "connector junction" which ends in relays which control the "relay operator," and cut off the latter when the connection is completed.

A "secondary link" which contains the battery feed for the called subscriber's telephone, the ringing generator and busy signal.

A "primary link" which with the "secondary link" connects the "final junction" with the line called. (The "primary link" is used in common for either an incoming or an outgoing call.)

A "relay operator" associated with the "final junction" responds to the last two digits of the called number, and causes to be joined together the "final junction" and the "secondary link," and the latter to the subscriber's line by the "primary link."

The "relay operator" consists mainly of two parts, viz., a relay unit or selector to build up a circuit corresponding to the number of impulses sent, so as to complete circuits through particular wires and apparatus which relate to the line being called, and a searcher or tester which puts the engaged lines into such a condition that a line calling them cannot be connected, but remains open at a relay of the "primary link," a busy signal then being given to the calling party. When the called line is idle, initial energising impulses are sent by the "relay operator" which actuate relays to join the line circuit through; a second circuit on these relays forms a locking circuit to hold them energised, and cuts the line relay out of circuit.

The impulse sender at the subscriber's office may consist of a dial, or of a series of levers which are set to the number required before the receiver is lifted to send in the train of impulses. The combination requires that one wire be "earthed" during the impulses of a digit and opened between digits, the impulses being sent over the other wire.

Fig. 5 shows in skeleton a portion of a Betulander relay exchange, with symbols for the various relays and groups of relays; the thick lines show the course of operations when subscriber No. 1 calls subscriber No. 93 on a 100-line system.

On subscriber No. 1 taking his telephone off the rest, the line relay A associated with his line will operate and start the "outgoing searcher" X. The purpose of this "outgoing searcher" is to search out an idle outgoing junction and then to effect a connection between the calling subscriber's line and the idle outgoing junction thus found.

The searcher relays *x* having determined that No. 3 outgoing junction is idle, operate No. 1 subscriber's cut-off relay B and also the two connecting relays C and D on "link No. 2" corresponding with No. 1 subscriber and No. 3 out-going junction. The "outgoing searcher" does this work almost instantaneously, and then drops out of circuit and is ready for another call.

Subscriber No. 1 is now extended *via* relays A, B, C, D, and the selector relay *y* to the "tens and unit selector" Y.

The foregoing operations have taken place following on

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the removal of No. 1 telephone from the rest, and before the impulses are sent. The tens and units impulses are now received by the "selector" Y, and as it is No. 93 that is being called for, 10 tens and 4 units impulses will be received.

The 10 tens impulses will result in the 90-99 marking circuit being chosen by the selector, and the four units impulses will provide for the fourth subscriber in that ten, which is being marked as ready for connection with an idle incoming junction.

The "incoming searcher" Z now comes into operation and *via* relays *z* searches out an idle incoming junction, in this case No. 5.

The connecting relay E at the point where outgoing junction No. 3 and incoming junction No. 5 cross now operates, also the two connecting relays F and C′ on "link No. 3" corresponding with incoming junction No. 5 and subscriber No. 93, also the cut-off relay B′, while the selector Y and incoming searcher Z drop out of circuit and are ready for other calls.

It will be seen that subscriber No. 1 is now connected to subscriber No. 93 by five connecting relays—namely, C, D, E, F and C′.

Ringing is now automatically applied to the called line for operating the bell, and on the called subscriber answering, a standard talking circuit connects the two subscribers.

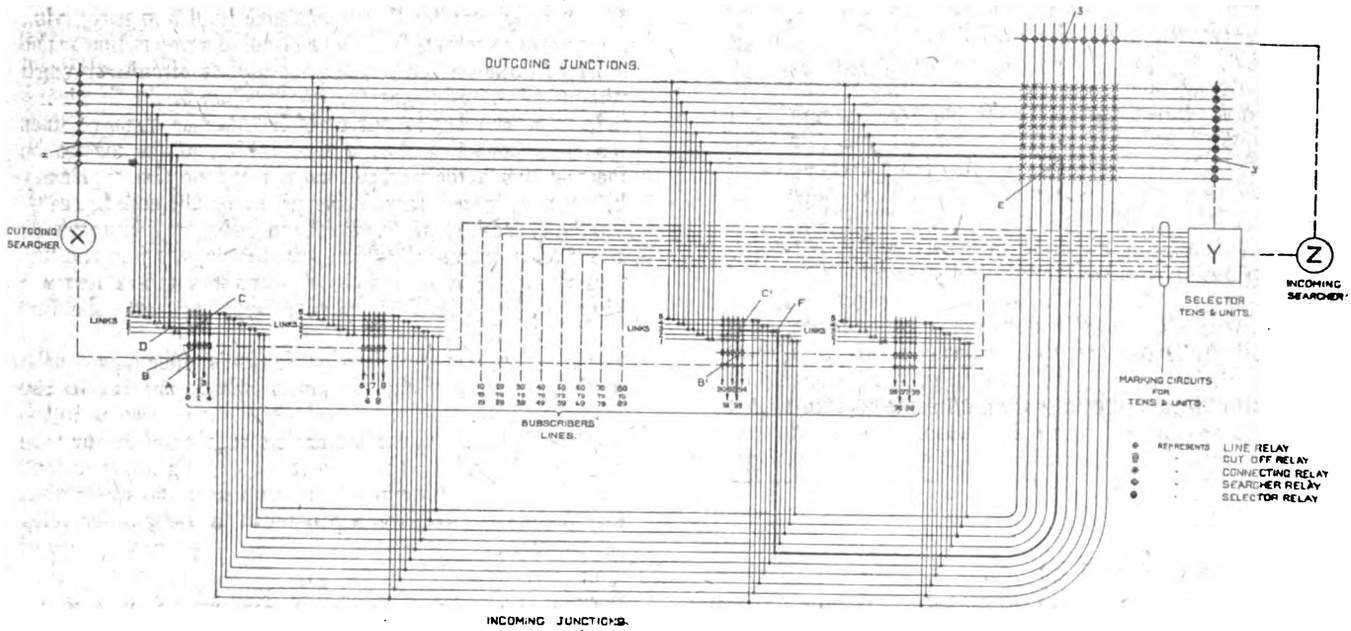

Fig. 5.—Diagram showing the Course of a Call through the Exchange.

If No. 93 had been engaged, No. 1 would have received the busy-back in the usual way.

The following advantages are claimed for the system :—

1. The exchange switching apparatus consists entirely of relays.

2. Relays are practically frictionless, and there is, therefore, little wear.

3. Being compact in form, relays are conveniently covered in small units by dust covers, which give ready access to small portions of the plant at a time.

4. Relay covers can be made dust and damp-proof.

5. Relays being of small movement and direct acting, are the simplest possible apparatus for doing circuit-changing and switching work.

6. Relay adjustments do not alter readily, and experience in central-battery exchanges proves that once they have "settled down" they give little trouble.

7. Relays being largely used in all central-battery telephone systems, most administrations would have a staff ready trained in the maintenance of relays.

In conclusion, we must congratulate the Betulander Automatic Telephone Co. on having secured an invention of the first importance in the sphere of telephony ; and we wish to thank Mr. Clay and Mr. Williamson, joint managers, and their assistant, Mr. Bryant, for the patience and pains with which they initiated us into the working of this wonderfully clever system.

THE ORGANISATION OF THE ELECTRICAL INDUSTRY.

By C. ASHMORE BAKER.

We of the electrical fraternity are now widely discussing a question, or rather, group of questions, which must some day, somehow be settled, and which in the ordinary course of events would be settled by the familiar, but expensive, process of trial and error, especially error.

There is no reason, however, why we should not make some attempt to apply a more scientific method to our development, and thereby avoid some of the "heat losses" incidental to the method of "blind staggers."

Our problem is to correlate the various interests involved in the electrical industry so that they will intermesh with a minimum of friction while reserving to our system sufficient elasticity and mutability to enable us to meet, and adapt ourselves to, such temporary stresses and evolutionary changes as the times may produce.

What in the first place are the interests involved? We have: —

I. The capitalist, who as mortgagee, debenture holder, &c., is the real owner of the means of production and use of electricity and electrical appliances.
II. The manufacturer.
III. The contractor.
IV. The expert adviser.
V. The technical engineer.
VI. The operative worker.
VII. The consumer.

This general classification is crude and requires further analysis and examination.

In the first place all these categories merge into one another, and it is impossible to draw a sharp dividing line between the limits of any two. Roughly speaking, however, they are, at the present day, true categories with perhaps the exception of class IV, which requires further subdivision. Thus we have in class IV (*a*) the consultant, the temporary adviser to any person or group from another category who may for any time or purpose be classifiable as a consumer.

The consultant is now beginning to differentiate

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himself as a member of the Association of Consulting Engineers.

Then we have class IV (*b*), the chief engineer (municipal or commercial), who performs the functions of class (*a*) but is, so to speak, "permanently attached to his host."

Here again we find further subdivision necessary, since we have supply engineers (municipal and company) and chief engineers of manufacturing and contracting houses.

Thence downwards we have in class V the host of assistant engineers, merging by insensible gradations into class VI, foremen, mechanics, wiremen, &c., down to the primordial voltmeter boy, all of whom must be classed economically as workers, notwithstanding wide differences of pay and capacity, inasmuch as they are not technically responsible, their work being under the control of expert chiefs.

Here again, economic differentiation is beginning to take place, at present tentatively and from below upwards, thus we have various engineering societies, trade unions, &c.

Finally, in class VII the consumer, totally unorganized, in fact "sans eyes, sans ears, sans teeth, sans everything."

Now, what are we to make of this collection? Obviously the I.E.E. cannot as at present constituted receive them all under the shelter of its maternal wing. Were the attempt seriously to be made, the wing would run a serious risk of being blown to piéces.

The functions of any system of industrial coordination may be classified under two heads:—Scientific and Economic.

Now as regards the scientific functions, the I.E.E. might be made to fill the bill. The science of our industry touches all of us, and there is no reason why all categories should not function equally upon this plane.

True there is some confusion of thought exhibited at times as to where science ends and economics begin, as when, for instance, some enterprising gentleman from, say, class IV (*b*) comes to Westminster and reads a chapter or two from his firm's catalogue to the horror and scandal of professors and consultants alike.

Now, I am not objecting in any sort of way to tasteful and informative advertisement, which is, as a matter of fact, a function indispensable to organic life, and there is no reason whatever why it should be confined to the poppy and the pole-cat.

Nor can it be suggested that economic science *per se* (or any other science for that matter) should be excluded from our consideration.

I am of the opinion of a well-known engineer, who was defending the ubiquity of his range of action to a still more famous politician. Quoth the latter: "Should you consider the saving of souls within the province of the engineer?" "It is our business to save everything we can," was the prompt and gallant reply.

Nor do I suggest that discussion, frank open discussion on a common platform of the relative economic interests of the different categories should be debarred at our meetings. Such discussions may well be proper to, or have a bearing on, both electrical and economic science.

But here we must draw a line. The Institution should not be an organ of any interest in particular, should not become involved in the cogs of any political machine, should on no account lend itself as a body to backstairs influence or intrigue of any nature whatsoever.

The record of the whole of its functions should be available to the whole of its members.

Let the members sectionalize as much as they please, let the physicists, the technologists, the business managers, and such groups as the "point fives," the Rontgen Society, the illuminating engineers, and charge engineers, wiremen, fitters, find hospitality beneath its roof for their particular sections in so far as these sections require to discuss their affairs among themselves, and let the general meetings and general membership be open and equal to every member of every branch and every class. But, let no official, or committee of the Institution, as such take part in any dispute or discussion between categories having conflicting economic interests except in so far as to act as arbitrator in disputes, and then only at the free invitation of both disputants.

Thus stability of organization on the scientific plane lies as I have suggested in the direction of integration, of extending as widely as possible the basis of membership of the I.E.E. as the central institution, while leaving individual members, or groups of members, to specialize as much as they please.

On the other hand, stability on the economic plane will, I submit, be promoted by the opposite type of development, namely, by well-defined differentiation between interest and interest.

Thus we see a strong and healthy tendency towards economic differentiation in the formation of such bodies as the B.E.A.M.A., the Contractors' Association, and the Association of Consulting Engineers, not to mention various trade unions.

Now these associations are by their very nature mutually antagonistic from the economic point of view. We might perhaps roughly subdivide them as employers and employed, but even so the classification is at present only relative as the employer of one class may be the employed of another, *e.g.*, the consultant.

A very large number of men in the industry are not organized at all. Thus there are numerous assistant engineers, draughtsmen, departmental managers, &c., &c., to whom no economic organization is available.

Now, if economic science teaches us anything at all, it teaches us that an unorganized or ill-organized industry is a weak industry. Our strongest and most successful trades are those which are most strongly organized both on the employers' and the employed side:—cotton, coal, steel work, &c. While those which are least successful in the markets of the world, those which cry loudest for "protection," those in which sweating is most rife, are the trades in which organization is absent or undeveloped.

It is not sufficient from the employer's point of view that he and his brother employers should be knit together in a close sodality. He must have well organized trade unions among his men to act as anvil to his hammer and prevent the evils of the wage-sweating rival, or the unauthorized strike and the hopeless task of trying to control a rabble instead of an army.

To the member of the employed classes also it is necessary that his own unions should have rigidly organized employers' leagues to re-act upon, the memberships of which should be as complete and universal as it is possible to make them. It is just as important for the trade unionist (of whatever class) that there should be no blackleg employers as that there should be no blackleg workmen. If the two interests can meet on the level, they are much more likely to part on the square.

These things are beginning to be realized by the more intelligent men on both sides, and it behoves us as members of the electrical industry as a whole to see that our economic units are differentiated as quickly *and as isomorphically* as possible into their proper tissues. You cannot build good sinew and muscle out of liver cells, while a horny brain would be less useful than a sick headache.

Therefore let the various industrial and professional associations be expanded and strengthened, the trade unions extended to include as far as possible all capable men, and, above all, let a new body, or bodies, be formed to include all those en-

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gaged in the profession to whom existing unions are not available.

Thus there are two lines of action which must be followed if our industry is to be re-vitalized. First, we must broaden the areas of mutual contact on the scientific side, so that such knowledge as we possess may be diffused as widely as possible. Secondly, we must differentiate like economic interests into separate crystalline groups, having the I.E.E. as a sort of mother liquor, a medium for the exchange of energy and the promotion of general balance throughout the industry.

Now, just a word about that consumer. He is at present, as I have said, little more than a cipher, but he is gradually transferring himself by a sort of economic osmosis from category VII to category I, and is destined, I anticipate, to become the significant figure. Those of us who possess any economic value will not, I think, be seriously disturbed by his apotheosis, and I for one should not hold up my hands in horror at the thought of his transformation.

In good American, I am "some consumer" myself.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Training of the Instrument Maker.

I wish to encroach on your valuable space to make a few remarks on the letter of Mr. R. W. Paul *re* the dearth of high-class instrument makers and some of the causes. In the main the dearth may be attributed to two special causes :—

1. The elimination of the chamber master.
2. The introduction of machine operations.

Dealing with the first, most of the good old instrument makers, those whom Mr. Paul mentions as being proud of their handicraft, were mostly trained in the small shops, and knew how to carry a job right through, from making tools, templates, patterns, brazing, silver soldering and, in fact, anything and everything appertaining to the production of any piece of high-class work, without supervision.

Now all these items are specialised, and a lad has no chance whatever of obtaining the knowledge necessary to these operations.

Suppose, as Mr. Paul suggests, that the Continental system of trade schools is adopted by the L.C.C., of what avail is the knowledge acquired under our present factory system? The old chamber masters and their connections have long been absorbed in the huge companies now in vogue, and operations are brought down to infinity with all its soul-destroying monotony.

I must here digress a little to apologise for length of reply, as this is a momentous question; it wants fairly well dealing with, and I am trying to be brief.

We will now deal with the second cause, viz., introduction of machine operations.

Before this came into vogue, men were shamefully betrayed. Let me explain: a clever mechanic is picked out for a certain job, say it is competitive, he is asked to do his utmost to produce this job as economically as possible, he gets to work and devises many ingenious rigs, &c., to do the job; what is the result? All his endeavours are of no avail as far as he is concerned, as all the clever devices he has made are used against him to reduce the price to him and bring him down to a mediocrity, and he gets no more pay than the man who uses his clever tools and ideas; this causes much discontent and antagonism.

As a workman and foreman of 40 years' experience, I have watched all these points intently, and do know for a certainty that a good sound technical workman is not required as a foreman, but a bully wholly incompetent; all that is required of him is output; a man who understands his business rarely stoops to the dirty tricks that are witnessed daily in our shops; there are others but few and far between. I feel truly sorry to see lads in our modern shops on a fairly dead end job, it takes all initiative out of them even if they had any, and they see the highly skilled man thought very little of in the fierce struggle for huge profits.

The selection of lads for instrument makers is not fair, many are thrust into it without inquiry as to their fitness; in days past most had a very great aptitude for the work, these are the men Mr. Paul deplores the dearth of.

The pay, too, is wholly inadequate for high-class work.

Considering the time and study a man has to spend to acquire his knowledge, the pay is poor; in any other walk of life amongst artisans there is no trade so complex as that of an all-round scientific instrument maker; and, candidly speaking, his pay is far from what it ought to be, no matter what his skill be, and, in fact, all producers are brought down to the lowest level of subsistence.

Scientific Instrument.

Electricity Supply in London.

In your leading article of 3rd inst., you compare company and local authority undertakings in London and conclude that the companies are endowed with a double dose of original sin. Now there is no particular reason to suppose that the directors of companies would deliberately employ less competent people to work their business than local authorities, and, therefore, presumably there is some other reason for the results you mention. You give two—insecurity of tenure and early pioneering expenditure. If the difference in the charges on capital, *i.e.*, interest and dividends and depreciation or repayment of loans be taken as a measure of these and be deducted, we get a difference between companies and local authorities of ·21d. instead of ·61d. per unit overall. But the higher rate of interest required by companies carries, as a consequence, increased rates and taxes, and if these also be deducted the ·21d. is further reduced to ·14d. Even on the basis of an average overall price, things do not look quite so black for the companies as at the first glance.

But unless the supply of current for different purposes is in approximately the same proportion, a comparison on the unit basis is not altogether an accurate way of stating the case.

The actual units sold per consumer for private lighting in 1911-12 were almost identical—934 for local authorities, 928 for companies, but in addition the local authorities sold 1,120 units for power and 330 for street lighting per consumer, against 661 and 44 for the companies. If, in the case of the companies, the units sold for street lighting, power and traction had borne the same proportion to those sold for private lighting, as they did in the case of local authorities, it would, of course, have greatly reduced the companies' average price, because these units are the cheapest to supply, and are sold at a much lower rate.

The reasons for the difference in the proportions are fairly obvious. Local authority undertakings are situated generally in better districts for power than are companies, and where the Borough Councils own the supply undertaking they are willing to take more current themselves, both for ordinary lighting and for lighting the streets than where the undertaking is owned by a company. Moreover, they are willing to pay a higher price for it.

Let me give you another, and, I think, a fairer comparison. If either the units sold by the local authority undertakings be worked out at the companies' rates, or the companies' sales at the local authorities' rates, the difference between the two classes of undertaking is less than the difference in capital charges mentioned above. It seems fair, therefore, to say that, given equal conditions, the companies in London would certainly not be behind the local authorities. After all, this is only what one would expect, and it does not in the least detract from the good work being done by the local authorities.

I am not arguing that everything is perfect. Prices would certainly have been lower to-day had it not been for the policy forced on the companies by Parliament. The effect of the purchase clause is that consumers have to pay

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extra in order that the ratepayers of the future may be able to purchase the undertakings below their fair market value, while the non-association clause prevents combination to reduce expenses. Nevertheless, improvements in method and reductions in price are being made constantly, and will continue.

What I am concerned about, however, is to show that it is not correct to tell the consumer that "the companies stand between him and a cheap supply of electricity," as some interested parties are so fond of proclaiming.

L. H. Hordern, *Manager,*
Westminster Electric Supply Corporation, Ltd.

London, S.W., *July 6th*, 1914.

Zero Resistivity.

There has been published lately a report of an experiment proving that lead when cooled to a very low temperature holds an electric charge.

Further particulars of this would be most interesting, either through your columns, or by reference to some authority of note.

It occurs to me that it is not at all unlikely that most, or at least many other substances, behave in this manner. Should air be one, then have we not a better explanation of the Aurora Borealis than that of Franklin, viz., that the cold air being warmed loses its charge in the form of a brush discharge?

Alec T. Scott, M.I.E.

London, N.W., *July 6th*, 1914.

[We would refer our correspondent to the note headed "Zero Resistivity," on page 16 of our last issue.—EDS. ELEC. REV.]

Concerning Switchgear.

With reference to the above article published in last week's REVIEW, we are, as a firm of insulating material manufacturers, particularly interested in all such questions, and we trust that you will therefore publish our remarks in your next issue.

We are in entire agreement with the author's adverse criticism of fibre when used in electrical apparatus where high insulation is essential. It seems to us that the question which will naturally arise in the minds of your readers is whether there is any substitute which might be used, and which, while possessing all the mechanical properties of fibre, will also have higher electrical properties.

We are large suppliers of fibre, but we also manufacture many other insulating materials. We are now manufacturing a new insulation, which we term high-grade paxolin, and which would be perfectly suitable for all switchgear work. High grade paxolin is built up of layers of paper impregnated with Bakelite varnish, this varnish being a condensation product of phenol and formaldehyde. The material has even greater mechanical strength and thermal properties than fibre, has a dielectric strength of not less than 500 volts per mil of thickness, is absolutely non-hygroscopic and will not warp, twist or lose its shape under any conditions whatsoever. It can be drilled, tapped, sawn, turned, and planed by ordinary machining methods. It is non-inflammable, but will eventually support combustion if brought into contact with a flame for any length of time. The guarantees as regards heating are that this material will withstand safely temperatures up to 150° C.

The great advantage of using fibre is its low cost and the easy manner in which it can be worked. Our high grade paxolin is more expensive than fibre for the thin sheets, but whereas fibre is difficult to obtain in thicknesses over 2 in. there is no limit to the thickness in which high grade paxolin can be supplied, and for thick sheets the cost of high grade paxolin is lower than that of fibre. The weight per cubic inch is slightly less than that of fibre, and consequently the small pieces which are used in the manufacture of switchgear would not increase the cost of this apparatus to any appreciable extent.

A consideration of the above properties will commend this insulating material to all electrical engineers, and if, as Mr. Lees so strongly recommends, fibre be eliminated from all switchgear, then it would appear that high grade paxolin would be a most desirable substitute. It would certainly enable manufacturers of switchgear to fulfil readily the new Home Office Rules and Regulations governing the use of electrical energy for industrial purposes. The material can also be supplied in the form of tubes and bushes and other special forms, and it is particularly suitable for oil-immersed apparatus, and is unaffected by weak acids.

The Micanite and Insulators Co., Ltd.
M. MOHR, *Secretary and Manager.*

Walthamstow, E., *July 6th*, 1914.

LEGAL.

ILFORD GAS CO. *v.* ILFORD URBAN DISTRICT COUNCIL.

IN the Chancery Division on Friday, July 3rd, Mr. Justice Sargant had again before him the motion in the action of the Attorney-General at the relation of the Ilford Gas Co. *v.* The Urban District Council of Ilford, by which the plaintiffs sought an interim injunction to restrain the defendants from carrying on the business of suppliers of electric energy *ultra vires*.

MR. MARK ROMER, K.C., who represented the plaintiffs, said it was a double-barrelled motion. It sought, first of all, to restrain the defendants from acting *ultra vires* in carrying on the business of supplying electric light fittings, and so far as regarded that branch of the notice of motion the defendants had given an undertaking not to enter into any fresh contracts at all, and the undertaking, he understood, they were willing to continue. With regard to the second branch of the notice of motion, the plaintiffs asked for an injunction until the trial or further order to restrain the defendants from preferring one class of consumer to another unlawfully. The particular preference in this case was a different scale of charges for the consumer who used only electricity as against the consumer who used both gas and electric light. In December last the defendants' counsel formulated an additional scale which was to apply only to premises electrically lighted throughout. In other words, they proposed to discriminate between those who took all of their light from the defendants, and that was a discrimination that was clearly referred to as *ultra vires* by his Lordship in his decision in the Long Eaton case, whatever view might be taken on the different points that might arise in this case. A certain amount of evidence had been filed in the present motion which was not evidence at all of a technical character, and he did not understand that the defendants were attempting to justify this discrimination. It appeared to him that it was more a matter of argument than anything else, and, under the circumstances, he was not sure what course the defendants proposed to take.

MR. MARTELLI, K.C., for the defendants, said that the position they took up was that this was really a case for an early trial, but he appreciated that that would be difficult at this time of year. He submitted that matters should be allowed to remain as they were until the action could be fought out.

MR. JUSTICE SARGANT asked when this new scale of charges came in force.

MR. MARTELLI said in January of the present year.

MR. JUSTICE SARGANT: Are the accounts half-yearly?

MR. MARTELLI: No, quarterly.

With regard to the supply of electric fittings, he said the defendants were quite prepared to continue the undertaking they had given, and with regard to the alleged undue preference, he should submit that such preference was not within the decision of the Long Eaton case. The question was whether on the evidence as it stood, and on an interlocutory motion the Court would grant an injunction. The defendants proposed to give a new scale when there was part electric and part other lighting, and the evidence they had filed showed that those who took the electric supply for the whole of their lighting were much better customers than those who lighted only partly by electricity. Take, for instance, the public-houses in the district that were lighted wholly by electricity. Many were lighted partly by electricity and partly by gas, and then there was no certainty of the constancy of the supply. Again, in the case of shops, the consumer who had both his shop and residence lighted by electricity was a much better customer than the consumer who took the electricity for lighting his shop and lighted his residence with gas.

MR. JUSTICE SARGANT: What are you proposing to do? Raise your rate to these who do not take wholly an electric supply?

MR. MARTELLI said no. They had six or seven different scales.

MR. ROMER: And there used to be a flat rate?

MR. MARTELLI: And there is now.

MR. JUSTICE SARGANT: So the damage done will be that those who use both forms of light will have competitors trading on more favourable terms?

MR. MARTELLI: Yes.

MR. JUSTICE SARGANT said the question before him was whether the case should be argued then upon motion, or should go for trial. As the plaintiffs were not seeking to restrain an extra charge made to a certain class of consumers, but were seeking to restrain the defendants from giving facilities to others for trading on more favourable terms, he did not think it was a case which he ought to try upon interlocutory motion.

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MR. MARTELLI said one of their new rates was merely to explain to consumers what they did not understand in the old rates. The rate was the same, but was couched in different language.

MR. ROMER: My learned friend says his consumers don't understand a maximum demand, and therefore it is better to have a simpler rate.

MR. JUSTICE SARGENT said the case could be tried early next sittings. Was the existing undertaking to continue?

MR. ROMER: The undertaking as to the further supply of fittings undoubtedly.

MR. MARTELLI said the defendants would certainly continue that undertaking.

MR. JUSTICE SARGANT said that pleadings could be delivered before the long vacation, there could be mutual discovery, and the case could then be tried early next sittings. He would accordingly make no order on the motion except that the costs should be costs in the action.

S. BUCKLEY & SONS *v.* BUCKLEY & TAYLOR, LTD.

AT Oldham County Court, on July 2nd, Samuel Buckley & Sons, of Oldham, brought an action against Buckley & Taylor, Ltd., engineers, of Oldham, to recover £17 14s. 7d., damages sustained in consequence of the defendants negligently and unskilfully turning up a commutator belonging to the plaintiffs.

MR. CLARK (for the plaintiffs) said that in October last his clients sent the armature and commutator of a 10-H.P. electric motor to the defendants' works to have the commutator re-turned. In carrying out the work the defendants reduced the soldering of the ends of the insulating wires from $\frac{1}{8}$ to $\frac{1}{16}$ of an inch by turning too close to the ends of the armature windings. The motor, in consequence, ran unsatisfactorily afterwards, and 10 days later broke down entirely owing to the wires leaving the sockets. Experts called in by the plaintiffs were agreed that the motor had been rendered useless, and that the armature must be re-wound. The British Thomson-Houston Co. re-wound it at a cost of £6 15s. Plaintiffs had suffered loss of production, and had also had to defray the cost of sending yarn elsewhere to be wound.

Evidence bearing out the opening statement was given by J. H. Buckley, a member of the plaintiff firm; P. Barnes, electrical inspector to the Vulcan Insurance Co. (who said the commutator was turned off the whole length up to $\frac{1}{32}$ of an inch of the ends of the windings, leaving them unstable); P. Skipworth, an electrician; S. Charlesworth, the latter's employer; and Mr. Chamberlain, mains superintendent of the Corporation, who attended on subpœna. The last witness said the injury to the commutator was caused by the lathe tool being carried through the top side of the wires in the commutator bars.

MR. H. TAYLOR, manager for the defendants, said that in turning the bars they ran up to the "shoulder" only, and did not cut the ends of the wires at all.

Evidence corroborating this was given by H. TAYLOR (foreman) and J. TYAS, who carried out the work.

MR. BAXTER, foreman electrician employed by the Manchester Corporation, said that even supposing that the wires had been cut down to the extent alleged, it would not be necessary to have the armature rewound. The sixteenth of an inch wire which was left, was quite sufficient to do the work required of it.

JUDGE SPENCER HOGG said that on the evidence, he must find that there was negligence, and, therefore, plaintiffs were entitled to recover. They were not, however, entitled to recover for loss of business, and judgment would therefore be for the plaintiffs for £14 15s. 3d. and costs, and certificate for two expert witnesses and photographs produced.

ROBIN ELECTRIC LAMP CO. *v.* B.T.H. CO., LTD., AND SIEMENS BROS. & CO., LTD.

[Tungsten Wire Patent: Petition for Compulsory Licence.]

IN the Chancery Division on Monday, Mr. Justice Warrington heard an application by Robin Electric Lamp Co., Ltd., for particulars of the grounds of opposition to a petition by that company for the grant of a compulsory licence. The respondents to the application were the British Thomson-Houston Co., Ltd., and Siemens Bros. & Co, Ltd.

Mr. Cave, K.C., M.P., and Mr. Frost appeared for the applicants and petitioners; Mr. Walter, K.C., and Mr. J. H. Gray for the British Thomson-Houston, Ltd.; and Mr. Colefax, K.C., and Mr. Hume for Messrs. Siemens.

MR. CAVE said the petitioners were the makers of the Robin electric lamp, for which they held a patent. For the manufacture of that lamp they required to use a filament of drawn tungsten wire. The respondents, the British Thomson-Houston, Ltd., and Siemens Bros. & Co., Ltd., owned a number of patents for the manufacture of that particular wire; six were held by one respondent and three by the other. They had granted licences not to manufacture the wire, but to manufacture different lamps fitted with the wire; and they and their licensees had formed themselves into an association called the Tungsten Lamp Association, and by the terms under which they were united they fixed the price of the lamp and prevented the sale under a certain price, so that they sought to obtain a monopoly practically of the lamps fitted with this particular wire. The petitioners desired to use the wire, not of course to manufacture the lamps which the other people made, but to make their own lamps, and for that purpose to have the use of the patented wire. The petitioners did not desire to lay themselves open to any sort of action for infringement. They had applied to the respondents and to their licensees for a supply of the wire in question. All but one declined to supply it. One of the respondents, the British Thomson-Houston, Ltd., had offered to supply the wire to the petitioners at the price of 125s. per 1,000 ft. One point at the hearing of the petition would be whether that was not a wholly unreasonable price, and the evidence so far as the petitioners had got it was that they could buy abroad at 40s. per 1,000 ft. instead of 125s. Their evidence was that 125s. was an unreasonable price, and that they could not profitably make their lamp unless they could get a wire at a reasonable price. Their petition was for the grant of a licence to make the wire on reasonable terms. The respondents opposed the petition on the ground that the reasonable requirements of the public were already satisfied, and that they had granted licences on reasonable terms to manufacture and sell the patented article. The petitioners asked for particulars of the licences and the terms, and unless they had these particulars they would not be ready at the trial to prove that the licence had been granted on reasonable terms. Therefore they asked for particulars as to the licences granted, as to the alleged provision already made for a supply to the public, and as to the manufacturers who already supplied the lamps.

MR. WALTER, for the British Thomson-Houston Co., said he had never before heard of any such petition as this. It did not define for which one of the nine separate inventions the petitioners wanted a licence. They applied for a general licence in respect of nine patents, without saying which invention did not satisfy the reasonable requirements of the public. Before the petitioners had established a *prima facie* case to the Court, they asked that the respondents should give the particulars they wanted. They alleged that they were to set up as rivals, and they asked for particulars of the private business transactions and bargains between the respondents and the Osram Lamp Co., one of the licensees, and others.

His LORDSHIP said they did not ask for a roving inquiry.

MR. GRAY, also for the British Thomson-Houston Co., said the petitioners were not entitled to the particulars they asked in reference to a document that was not before the Court.

MR. COLEFAX, for Siemens Bros. & Co., Ltd., associated himself with Mr. Gray's argument, and deprecated incurring danger to trade by giving the particulars asked.

His LORDSHIP said this was no doubt a very important application, and if his decision had been the reverse of that which it was going to be, he would have reserved his judgment. By the Section of the Patents Act, 1907, under which the application was made, the onus was thrown on the petitioner to prove to the satisfaction of the Court that the reasonable requirements of the public with reference to the patented invention had not been satisfied. It seemed to him that the rules regulating procedure in these matters provided for optional delivery on the grounds of opposition — if the patentee chose to deliver them for the information of the Board of Trade, and for no other reason whatever. The petitioners here complained, among other things, that the patentees had made default in granting a licence on reasonable terms. If he were right, a complete answer to the application was that the ground of opposition was not a written proceeding requiring particulars at all. The ground of opposition was not a proceeding for the purposes of the rules of the Supreme Court. It was never properly before the Court at all. What the Court had to deal with was the petition. It would be extremely hard upon a patentee and other persons working a patent under him if he were to be required, before the petitioner had proved his case to the Court, to give such information as that which was asked for by these particulars. For these reasons his Lordship must refuse the application for particulars, and the costs of the application would be the respondents' in any event.

On the application of MR CAVE,

His LORDSHIP gave leave to appeal if he could appeal.

MARCONI AND MARCONI'S WIRELESS TELEGRAPH CO., LTD., *v.* HELSBY WIRELESS TELEGRAPH CO., LTD.

(*Continued from page* 8.)

Continuing the examination of Mr. Pletts, MR. GRAY said: I think you tested the coupling. What was the result of your test? —I reproduced the circuit. I did actually measure the coupling; and I made several variations to see how big it could be made; and I was convinced that it must have been certainly under 5 per cent.

How many waves do you think, from your calculations, the defendants got in their primary from one charging?—It is a very difficult thing to say. If one is dealing with the quenching point, the number of waves in the primary must be at least between 20 and 25 before the energy is handed over to the other circuit, and the primary can be stopped.

You inspected the apparatus and tested it; what do you estimate is the number of waves, assuming there is damping?—I think, if the damping were such as is shown by the curves, then there would be extremely little energy put into the aerial. There would probably not be a large number of swings. I can put it more clearly in this way. If the damping is so great that there are only three or four effective swings, then the whole installation is most inefficient.

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Would it be of any practical value where it was installed?—No, certainly not. You see that with these 2 per cent. couplings, only 2 per cent. of the energy is handed over each time. If you have six half waves and hand over 2 per cent., 12 per cent. of the total is the utmost which can be got out, and it is very much less than that, in fact.

MR. DUGALD CLERK was the next witness.

MR. HUNTER GRAY (to witness): You inspected the installation at Holyhead on board the *Cambria*; will you tell me what the result of your inspection was?—Mr. Swinburne and myself went with Mr. Pletts to the *Cambria* at Holyhead, and Mr. Chambers met us and explained the apparatus. It was at once obvious that there was an auto-transformer there, and that the mutual induction, the circuit common to both circuits, was small relative to the external induction. Without any calculation whatever we saw the big coil outside; that showed at once that there was loose coupling. We saw it work, and examined the spark gaps; they were very close together, like disks, with a flat surface; the object was obviously to damp, to cool the spark, if possible; there were other spark gaps which were adjustable. Mr. Pletts arranged his instrument for getting the wave length, and we tried it with various wave lengths.

What conclusion did you form as the result of your inspection?—My conclusion was that this was a Marconi instrument similar in essential respects to the installation on the *Nonsuch*, which I had studied before, and that the only difference I could see at the time was, while in the *Nonsuch* the transformer was a step-down transformer, in this it was a one-to-one transformer: that was the only difference, an auto-transformer. There was only one spark-gap in the *Nonsuch* arrangement; there were four spark-gaps here.

You heard Mr. Swinburne's evidence and Mr. Pletts'?—Yes.

Do you substantially agree with that?—I do, in so far as I understood it. Mr. Swinburne is a better electrician than I am.

MR. COURTNEY TERRELL (cross-examining): If you look at these gaps they are good solid blocks of copper; does that tend to conduct the heat away from the spark?—Yes, I believe that was the intention.

As far as the object of these gaps is concerned, it is the same as in Lodge?—Yes. Lodge's intention was to get his aerial charged rapidly by what he called the impulsive rush, and his notion was that the connection should be entirely cut off when charged between the induction coil and the Leyden jars, and that he would get a pure wave swinging in the aerial.

If you look at ours, if that spark goes out as quickly as possible, you get the aerial cut off from the capacity?—If you could do that, that is so, but then I understand as far as I have been able to follow it, and I believe it to be quite correct, you cannot get that spark out until you come to the period with less coupling. You must have that position between the two waves.

If you get the spark out as soon as possible, you get the aerial cut off from the primary circuit and the aerial oscillates in its own true wave?—That is quite so; if you cut it off very quickly as you suggest with a light coupling, you get a very small proportion of the condenser energy into the aerial.

Supposing you do find that the aerial with this decrement does go on for a good long wave train, then you have enough energy in it, have not you?—Yes, but you have not as much radiating energy as you could get in the case of the Marconi invention.

Supposing you tuned the secondary to the primary, you will get the energy through quicker, keeping the coupling exactly the same?—If you have loose coupling and tuning you get the energy through quicker, no doubt.

Therefore the primary oscillations will come to an end quicker?—Of course, on your hypothesis that you are taking the energy away quicker, that is so.

The Witness was cross-examined at some length with regard to the Oudin resonator, and the evidence for the plaintiffs was shortly afterwards concluded.

Opening the case for the defendants, MR. COURTNEY TERRELL said the action now resolved itself into a very simple and clear issue of fact, whether the defendants got the primary oscillating during the time that the secondary was sending out its waves. He thought he saw indications on the part of his friend Mr. Walter, went on Mr. Terrell, that he was preparing for a retreat. Whereas Mr. Walter had opened the case upon Mr. Justice Parker's construction of that patent, he was now going to retreat from that position and say it did not matter whether theirs was a quenched spark or not. He (counsel) did not know whether there would be any more litigation about this patent, but he would suggest that they should keep to the same construction as had been put upon it.

MR. JUSTICE EVE: Upon any question of construction I am bound by the judgment of Mr. Justice Parker?

COUNSEL: Yes, but if there is a question of any doubt, I suggest it will be resolved by the evidence given by Mr. Swinburne in the case.

It was somewhat curious that the defendants were licensed by the plaintiffs under Lodge in respect to the very system upon which the plaintiffs were now suing.

MR. WALTER dissented.

MR. TERRELL said his points were (1) that the defendants' apparatus was after Lodge, whether Mr. Swinburne was right or not; (2) that it was not Marconi's. Lastly, that Marconi, as a statement of a new manufacture was anticipated by the apparatus described in Tesla's paper of 1898, and by the apparatus described in connection with Ducretet and Oudin.

PROF. J. ERSKINE MURRAY, called for the defendants, examined by MR. JAFFE, said the electrical object of Mr. Marconi's invention was to radiate a slightly damped wave in order to obtain good selectivity, in order to make it possible for one station to communicate with a second station, while other communications were going on in the neighbourhood. There was a subsidiary object, and that was to put more energy into the aerial for each spark than could be put in by directly charging the aerial itself.

Marconi had made a previous invention in 1896?—Yes.

Did that attain the object?—No, the train was a very short one that was radiated from the vertical aerial with the spark gap in it, as the wave length was a very short one.

Was the defect of Marconi 1896 the same as Lodge had pointed out, that such a wave would affect any aerial that it came across, whether it was tuned to it or not?—Yes. Lodge solved the problem by using antennæ which had a low damping or a low decrement. Marconi took a good radiator, he coupled it loosely to a persistent oscillator; and instead of allowing his radiator to oscillate freely, he kept feeding it wave by wave with energy from the primary. He, therefore, obtained, radiated from the secondary, from the aerial, a somewhat similar train of waves to that radiated by Lodge. It was not absolutely similar, but somewhat similar, particularly as regarded the latter part of the train.

What is the difference between the two trains?—In the Marconi case the secondary wave train grows in amplitude rather slowly at the beginning. If Lodge charged his antennæ direct the amplitude of the radiated wave in his case would be the maximum at the beginning. If he used the primary circuit the amplitude of the waves radiated would grow in a somewhat similar manner to the Marconi case; but the growth would be more rapid and not continued so long.

In Marconi, 1900, the effect is a receiving aerial, with the same sort of waves, broadly speaking, as Lodge, but he caused his transmitting aerial to emit those waves by a different form of charging to Lodge, by the pat-pat effect on the transmitting aerial while it was transmitting?—Yes.

You have heard the theory of the Lodge system put forward by Mr. Swinburne. Will you please criticise that?—If, as Mr. Swinburne says, you have currents going out and in from the condensers of what I call the primary into the branches of the antennæ at a very high frequency, I cannot for the life of me see where the charging comes in at all, because practically as much will go out as comes in.

Will there be any energy left for the slower and active frequency, the telegraph train, through the inductance?—I do not see where the energy will come from; because if there are oscillations going to and fro in these high frequency circuits they will naturally leave a very minute charge when they are finished before these other oscillations are supposed to commence.

Supposing Mr. Swinburne's theory is a correct one, do you still get a short period of charging, and then a long period of radiation?—Most certainly you would.

Is that what the Helsby Co. do?—Certainly.

The only difference in effect between what Mr. Swinburne's theory would lead to and what you believe actually is the case, is that in Lodge-Swinburne, if I may call it so, the primary consists of very rapid oscillations; but for a very short space of time compared with the long train of secondary emitted waves which follows?—That is right.

What you believe represents Lodge-Helsby working, is the connection of a short primary and a very long secondary?—A short primary train of waves and a long secondary train of waves.

What is the best way of testing whether there is a short primary or a long primary?—There are two methods. The spark method, photography, or observations of the spark in a rotating mirror, is probably the most direct. The method of taking the resonance curve is very satisfactory, if you can be quite sure that you are getting your oscillation free from all interference by other oscillations.

MR. JUSTICE EVE: Can you check one method by the other?—You can.

MR. JAFFE: Is another interfering factor besides the antennæ the actual spark itself in the primary?—Most certainly. The form of the spark, or if you like to say so, of the spark gap, is absolutely essential, that is to say, it controls the decrement more than any other factor in the circuit, as circuits are ordinarily built.

I want to go into sundry matters connected with the coupling of the two circuits. I think the criticism was made by Mr. Pletts that the only time you could quench this spark was when all the energy had been transferred from the primary to the secondary, and I think it is agreed that that will take place at the half beat?—You must have your half beat from facts taken correctly, and not on the supposition that a highly quenched gap is acting like a continuous metallic circuit. Even if you assumed that a certain coupling needs a certain number of waves before the half beat, there is no reason why the effect of your gap and other arrangements, such as the Lodge three-charging coil, should not stop your primary long before that half beat without waves of energy, but simply with storage of energy in the primary, which will be used in the next spark.

Does the hissing spark appear in the defendants' apparatus?—One certainly hears the hissing.

Do you say that the three-charging coil has the effect, or has not the effect, while the oscillations are going on, of quenching?—"Arcing" would be entirely cut off by the Lodge three-charging coil.

That negatives Mr. Swinburne's idea that it is no use at all during the oscillation?—It does negative it.

I think you have already said the way the Helsby plant works is to stop the energy in a comparatively few swings?—Yes.

What is the effect of tuning in getting such energy as you do get across?—It increases the rapidity of the transference of the energy.

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Do you agree with Mr. Pletts that the amount of energy transferred in each oscillation is directly proportional to the coupling?—No, I think the actual coupling is probably a variable function, but, as far as I know, the question has not been worked out in detail anywhere.

The Witness: May I point out that one way of obtaining quenching is to loosen the coupling, for the very obvious reason that if you have too close a coupling, the energy will go quickly into the antenna, more than it can radiate, and will, therefore, come back, and there will not be quenching. You must have certain couplings, and sometimes you have to increase and sometimes to loosen it. As a matter of fact, recent experiments show that there are a large number of optimi, best points for coupling—you can couple at 2 per cent., at 5 per cent., and at 9 per cent.; but in between it is bad.

What do you deduce as to the selectivity of the apparatus when worked according to the Helsby method and when the spark gaps are shorted?—The Helsby method is much more selective than the arrangement with the gaps shorted.

Have you the slightest doubt that in both the *Cambria* and the *Scotia* the primary oscillations came to an end almost before the secondary came to an end?—I have no doubt whatever that that is the case, and that the effective wave emitted by the secondary is a free wave.

(*To be continued.*)

COAL-HANDLING PLANT AT SOUTHEND-ON-SEA.

In our issue of May 15th, page 813, we illustrated and described the new Niclausse boiler plant which has been installed at the Southend-on Sea electricity works. A modern coal-handling plant has also been installed to serve the complete range of five boilers, and supersede the hand trimming formerly practised. This has been supplied by Messrs. Edward Bennis & Co., whose accepted scheme included overhead coal storage bunkers, for 500 tons of coal, and a bucket elevator and distributing conveyor.

The coal is brought up in carts or trucks and dumped into a receiving hopper below the ground level outside the boiler house, falling by gravity from this hopper into the elevator through a Bennis rotary safety feeder, which ensures a regular supply of coal to the buckets, and at the same time prevents any sudden rush of coal which would choke the elevator.

The elevator, about 70 ft. long, will raise the coal at the rate of 20 tons per hour, and is driven by a separate electric motor and is entirely enclosed. The full buckets and empty buckets are encased in separate trunks, the elevator being practically dust-proof. The whole of the gearing and shoots, &c., are carried on the elevator framework, thus avoiding the necessity for any external bearings or supports, and forming an entirely self-contained machine, neat in appearance and occupying a minimum of room.

The coal is delivered by the elevator into a Bennis U-link endless steel chain conveyor, from which it falls through openings into the bunkers beneath.

The conveyor, which is of 20 tons per hour capacity, is driven through substantial gearing by a separate motor, and access is obtained to all parts of the elevator and conveyor from a gangway carried on the same supports.

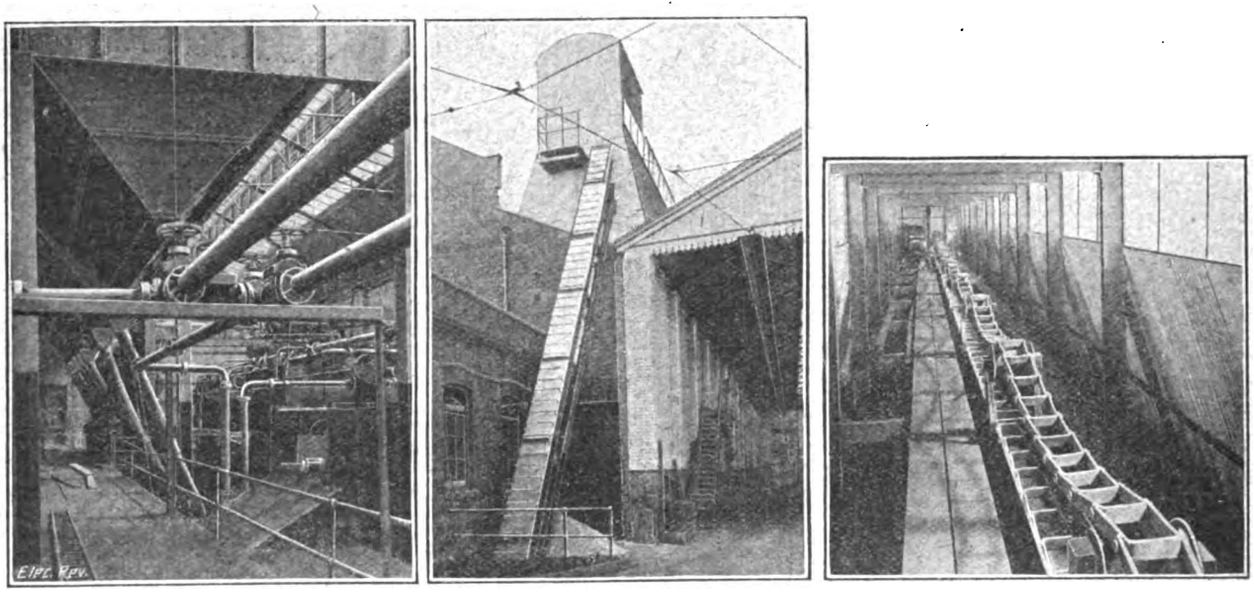
The bunkers form a series of rectangular bins with hoppered bottoms, having a number of openings, each opening being provided with an outlet shoot and radial cut-off valve operated by chains from the firing floor.

A swing shoot, with hoppered top and bell mouth delivery, is suspended beneath each outlet for guiding the coal from the bunkers to the stoker hoppers. These shoots are made to swing back out of the way when the boiler tubes are being cleaned.

The total length of the bunkers is about 106 ft., and they are carried on 12 stanchions resting on concrete pillars built level with the firing floor.

A superstructure is built on the top of the bunkers forming a conveyor chamber, extending the whole length of the bunkers.

The bunker sides were specially strengthened to sustain the weight of the roof, and special attachments were made for connecting the modified roof principals to the bunker, the stanchions having to sustain the weight of a considerable portion of the boiler house roof. The whole of the coal-handling plant and structural work connected with it was carried out by Messrs. Bennis.



Bennis Coal Handling and Storage Plant, Southend-on-Sea Electricity Works.

NOTES FROM CANADA.

[From our special correspondent.]

The Nova Scotia Tramways and Power Company is the name of a concern which has just been incorporated. Actual operations are promised within the next two years and the expenditure of at least $500,000 within four years. In this province (Nova Scotia), the town of Canso intends to put in a small electric lighting plant to be driven by a gas engine, and the Electric Tramway Co., of Halifax, N.S., proposes to put in a 2,000 kw. turbo-generator.

In Ontario, the Algoma Steel Corporation, in conjunction with the Michigan Northern Power Co., has just been granted rights to utilise water powers on the St. Mary's River at Sault Ste. Marie, 30,000 feet of water per second is allowed on each side of the river, the total amount being capable of furnishing some 100,000 h.p. The City of London (Ontario) has recently been authorised to spend $700,000 on the electrification of its existing steam railway which runs to Port Stanley; the Hydro-Electric Power Commission of Ontario is in charge of the work.

Readers of these "Notes" will be aware that the "H.E.P.C." has also been working on several proposed "radial" lines to be supplied with power from the Commission's transmission system; in connection with this matter various municipalities will vote on September 21st next as to whether actual construction of some of the lines is to be begun. It is anticipated that, by that date, some news will have been received from Ottawa as to the extent to which the Dominion Government is prepared to assist, financially, this project of municipally-owned lines. If the first trial line proves successful there is no doubt whatever that in the southern portion of the province, at least, many other lines will soon make their appearance and the already extensive operations of this Commission will be increased.

The H.E.P.C. has just let the contracts for the building of a large dam on the Beaver River, at Eugenia Falls, near Owen Sound, a town on the southern shore of Georgian Bay, about 110 miles N.W. of Toronto. The Ambursen Hydraulic Construction Co., of Montreal, were the successful tenderers for this dam which is to be 2,000 ft. long and from 40 to 50 ft. high. Tenders are being called for the plant, to develop 8,000 h.p., to supply the requirements of Owen Sound, Marlsdale,

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Meaford, Thornbury, Wallserton, Chesley, Hanover, Mount Forest, Flesherton, Durham and Chatsworth. A plant on the Severn River until recently owned by the Simcre Railway and Power Co., is said to have been purchased recently by the Commission, and this together with a power plant now under construction at Wasdell's Falls will be linked up with the Eugenia Falls plant so that each can help the other if required.

A duplicate line on the main 110,000-volt transmission system from Niagara Falls to Dundas is being erected, as is also the long extension from St. Thomas to Windsor, this being 100 miles long, the total distance from Niagara Falls being no less than about 220 miles, which would be about equivalent to London supplying Liverpool with power at home. When these works are finished the H.E.P.C. will be supplying power through about 3,000 miles of trunk lines (presumably wire miles) and several thousand miles of low-tension wires.

THE CHICAGO UNDERWRITERS' CODE.

IN our issue of June 19th we considered editorially the bearing of the National Electrical Code on our trade with Canada. We have now received from the Secretary of the B.E.A.M A. the following copy of a letter on this subject which had been addressed to that Association by Mr. Dana Pierce, Electrical Engineer of the Underwriters' Laboratories, Inc. (Chicago), who, as already stated in our columns, has been on a visit to this country :—

COPY.

48, Westminster Palace Gardens,
Victoria Street, S.W.,
June 12th, 1914.

D. N. Dunlop, Esq.,
The British Electrical and Allied Manufacturers' Association,
Kingsway, W.C.

Dear Sir,—During the past few weeks I have had the pleasure of considering with you and with various members of your Association some of the questions which, for the past two years, have been discussed by British electrical manufacturers, with reference to the requirements of the National Electrical Code and the examination, test and approval of devices under that code by Underwriters' Laboratories. To British manufacturers these subjects have been of interest chiefly, if not wholly, as they concern goods of British make destined for the Canadian market. It is, therefore, from this point of view that I write to you with the thought that a brief review of the present situation, and a suggestion as to what appears to me a practicable and desirable development of it, may be of interest at this time to you and your members.

I desire first to express both for myself and for Underwriters' Laboratories, which I represent, my sincere appreciation of the fair and generous spirit with which I have been met, a spirit which should make it possible to continue with profit to all the discussion of the technical, engineering and business problems involved.

A year or more ago Messrs. Heap & Digby, of 48, Westminster Palace Gardens, Victoria Street, were appointed by Underwriters' Laboratories as its representatives and engineers in Great Britain. They have made for us the necessary examinations, tests and reports on a considerable number of British devices of different types upon the basis of which approvals have been given on the same terms as in the case of American makers. This work is being continued in response to further applications from other makers, and it has been found possible thus far, to arrive at conclusions satisfactory to all concerned even when changes in the products were required to bring them into conformity with American practice and rules.

That American practice in electrical installations and design of appliances is in many particulars different from British practice, is, of course, generally recognised. The requirements of the National Electrical Code have of necessity followed this practice and developed with it. Radical changes in practice cannot be expected, and are no more necessary nor desirable in Canada or the United States than they are in Great Britain. It, therefore, appears that British manufacturers must expect to adapt their wares to some extent to the special conditions existing in Canada, conditions not primarily created by the requirements of the Code or the work of Underwriters' Laboratories, but inherent in the electrical practice and habits of the country.

While this general principle is almost beyond question, it already is being proved by open discussion and a full and correct understanding of the conditions and the requirements between British manufacturers and the Laboratories, that the differences are less fundamental than they had appeared. The most salient difference in the method of judging appliances lies in the emphasis placed upon tests by Underwriters' Laboratories. The value of such tests as distinguished from a mere assumption that appliances are of a given quality or capacity has already been proven, and a more general practice of testing their own wares should be of the greatest assistance to British manufacturers.

The appointment of English representatives of Underwriters' Laboratories has, I believe, removed wholly the objection, quite properly made heretofore, that the difficulty of conducting the necessary discussions by correspondence with the laboratories in Chicago and the necessity of sending samples to New York or Chicago for test, placed British manufacturers at so great a disadvantage as almost to preclude their submitting their products. The results of this step have been highly satisfactory, and indicate how further progress may be made.

To undertake a general discussion of the entire National Electrical Code from the point of view of the British manufacturers is neither practicable nor useful. Neither we nor your Association can accomplish anything by such an effort. The problems are those of details not of generalities. Whenever an individual manufacturer or a group of manufacturers desires to discuss a specific topic or to submit a particular device, Underwriters' Laboratories, through its British engineers and its organisation in the United States, is desirous of working with your members in a common effort to uphold and improve the quality of electrical goods as affecting safety to property and life. The National Electrical Code grew from such efforts. The work of Underwriters' Laboratories has always depended upon the invaluable co-operation of manufacturers in developing and maintaining standards of construction and test.

In the work so far done by us in response to requests from British manufacturers for opinions on their goods for Canadian use we have already profited by such co-operation.

In conclusion, therefore, may I venture to express the opinion that further progress toward results desired by members of your Association will be attained by following a similar course, namely, to discuss each class of device by itself as occasion arises rather than attempt a general review of all at once, a method seldom productive of useful results in any field and peculiarly ill-suited to the problems of engineering.

I trust that, through you, we and our English representatives, Messrs. Heap & Digby, may have still further occasion and opportunity to consider the many and important questions in which we have a common interest.

With the most sincere expression of my appreciation of the courtesies extended to me during my visit to England, I have the honour to remain,

Yours very sincerely,
DANA PIERCE,
Electrical Engineer
of Underwriters' Laboratories, Inc.

BUSINESS NOTES.

Rubber Wires and Cables.—Prices Reduced.—THE INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS CO., LTD., announce that owing to the fall in the market price of materials they are enabled to make a reduction in the prices of rubber-insulated wires and cables. Price lists No. 40, dated October, 1910, and No. 40A, dated September 1st, 1911, will accordingly be subject to altered discounts, of which particulars have been issued by circular.

MESSRS. SIEMENS BROS. & CO., LTD., of Woolwich, also announce reductions of prices in these manufactures, owing to the reduction in the market prices of materials.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., also announce reduction in the price of rubber-insulated wires and cables, with altered trade discounts for their May, 1913, list, and for their Henley wiring system list.

Patent Applications.—Applications have been made for the restoration of the following patents :—

C. E. Hunter, No. 27,196 of 1903, for "Improvements in electric switches."

Salamander Fire Bar and Smoke Preventer Co., Ltd. (applicants), No. 18,273 of 1906, for "Improvements in fire bars for steam boiler and other furnaces", and No. 10,432 of 1097, for "Improvements in furnace or fire bars," granted to G. A. Newton and J. Smalley.

London Railway Electrification Contracts.—In regard to the London and North-Western Railway switchgear contracts, to which we have recently made several references, the BRITISH THOMSON-HOUSTON CO., LTD., have secured the order for the main station switchgear for controlling the turbo-alternator plant in the railway company's new Wembley power station. The contract of the rotary converters has also been placed with the British Thomson-Houston Co., Ltd., who are supplying six 1,000-KW. and 25 750-KW. rotary converters which are to be used in the various sub-stations. In fact, the whole of the rotary converter plant for this electrification scheme is being supplied by the British Thomson-Houston Co., Ltd.

The London and South-Western Railway have placed with the same company an order for the whole of their rotary converter plant for their electrification scheme, which will consist of eight 1,000-KW. and 15 1,500-KW. rotary converters. The British Thomson-Houston Co., Ltd., have also the order for the main station switchgear for controlling the turbo-alternator plant in their Durnsford Road power station at Wimbledon, and, in addition, have the order for the whole of their sub-station switchgear.

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Exhibition at Mansfield.—The Mansfield Borough Electricity Department proposes to hold an electrical exhibition in the early autumn, and Mr. E. Holcombe Hewlett, the engineer, would be pleased to hear from firms or individuals willing to take part, either by exhibiting their manufactures, lending apparatus or giving demonstrations.

Bankruptcy Proceedings.—Before Judge Sturges, K.C., at Blackburn County Court, JOHN W. GARSDEN, an electrical engineer, of Hope Terrace, Dukes Brow, applied for his discharge from bankruptcy. He formerly carried on business as an electrical engineer at 24, Preston New Road, trading as J. W. Garsden & Co.

Mr. Plant, junr., on behalf of the Official Receiver, said debtor's liabilities were estimated at £5,038, and the trustee had admitted proofs amounting to £1,706. The difference between the estimated and actual liabilities was mainly due to the rejection of proofs, amounting to £3,279 on the separate estate, in respect of claims against a partnership of which debtor was a member. The assets were estimated to produce £953, but they had only realised £742. A first and final dividend of 6s. 2d. in the £ had been paid. Detailing the facts, Mr. Plant said about 1903 debtor purchased a partnership in the Hove Electrical Engineering Co. with £700 given to him by his father. The business was not successful, and at the end of 1909 the concern was turned into a limited company. This, however, was wound up in February, 1911. The company had a branch at Blackburn, and this was taken over by bankrupt for £155 for goodwill and stock, the money being guaranteed by his father. The business apparently paid debtor, who attributed his insolvency to a judgment for £1,183 obtained in June, 1912, by a lady who contended she had lent this sum to the partnership—a sum for which bankrupt never considered himself responsible. He had stated he was not insolvent until this judgment was obtained against him, but the Official Receiver was of opinion that he must have known he was insolvent, though he was not of the opinion that bankrupt contracted debts without having any reasonable hope of being able to pay them. Debtor had kept proper books of account, and he had to report that his assets were not of the value of 10s. in the £.

Mr. Haworth, on behalf of debtor, asked the Judge not to find that bankrupt continued to trade knowing he was insolvent. The Official Receiver's report itself hardly justified that conclusion. Mr. Haworth went on to give details of the partnership business, and said debtor's father found £1,000 for this concern, whilst the lady, who afterwards obtained judgment, put between £700 and £800 into the concern. In the books these sums were entered as loans, and not as share capital. When starting on his own account, debtor was doing very nicely, and it was a great surprise to him to learn that he was liable for the amount advanced by the lady named in the case. It was not until this claim was made that debtor found he was insolvent. Evidently the lady had thought that if sufficient pressure was brought to bear, Mr. Garsden's father would come forward and pay the money. As a matter of fact, Mr. Garsden, sen., did offer £800, but this was not accepted, and debtor decided to file his petition. His Honour had also to consider the effect of a forced realisation of debtor's business. He assured the Judge that immediately debtor discovered his position he filed his petition. In the new Bankruptcy Act there was an enabling section which provided that if the only offence against a debtor was the one of not paying a sum equal to 10s. in the £, then it was within the discretion of the judge to grant a discharge, suspending it for the short period of one day. He asked for that step to be taken in order that it might go forward to the world that bankrupt had been put into the Court through reasons over which he had no control.

The Judge said, under these particular circumstances, he would like to know whether the Official Receiver would be willing to withdraw that portion of the report regarding debtor trading whilst insolvent. Debtor seemed to have had great misfortunes, and no one suggested that he had been guilty of dishonesty or of negligence. He relied upon the report of the Official Receiver in such cases, and he would like to have his view on this suggestion.

Mr. Plant said under the circumstances he would withdraw this part of the report.

His Honour said in that case there was only one complaint against the debtor—that his assets did not amount to a sum equal to 10s. in the £. He had come to the conclusion that debtor had been the victim of misfortune. There was no suggestion that he had been either careless or dishonest, and, therefore, he granted him his discharge, and suspended it for one month.

H. H. OXLEY (otherwise known as Oliver Huxley), consulting engineer, Hanwell.—Application for discharge. Bankrupt's assets are not equal to 10s. in the £ on the amount of the unsecured liabilities. His discharge was granted subject to his consenting to judgment being entered against him in the Brentford County Court by the Official Receiver for £310 1s. 3d. and £1 10s. costs of judgment.

Liquidations and Dissolutions.—DIESEL ENGINE CO., LTD.—This company is winding up voluntarily, with Sir W. B. Peat, of 11, Ironmonger Lane, E.C., as liquidator. A meeting of creditors is called for July 15th.

NO CELL, LTD.—This company is winding up voluntarily, with Mr. A. H. Partridge, of 2, Gresham Buildings, Basinghall Street, E.C., as liquidator. A meeting of creditors is called for July 16th.

THE PUMP AND POWER CO., LTD.—This company is winding up voluntarily, with Mr. L. R. Sankey, of 5, Coleman Street, E.C., as liquidator. A meeting of creditors is called for July 14th.

ISAAC STOREY & SONS, LTD.—A meeting will be held at 42, Spring Gardens, Manchester, on August 5th, to hear an account of the winding up from the liquidator, Mr. A. H. Pownall.

CAMBRIDGE ELECTRIC TRAMWAYS SYNDICATE, LTD.—A meeting will be held at 66, Victoria Street, S.W., on August 8th, to hear an account of the winding up from the liquidator, Mr. A. W. Langley.

CONSOLIDATED DIESEL ENGINE MANUFACTURERS, LTD.—On the petition of W. Lawrence & Son, creditors, Mr. Justice Astbury made an order for the compulsory winding up of this company. Counsel for the directors said they welcomed an investigation by an officer of the Court.

KENT ELECTRIC POWER SYNDICATE, LTD. — Particulars of claims must be sent by July 11th to the liquidator, Mr. F. A. H. Walker, of 2A, Railway Street, Chatham.

H. C. BARLOW & CO., electrical engineers, 52, Chapel Street, Salford.—Messrs. H. C. Barlow and H. A. Jackson have dissolved partnership. Mr. H. C. Barlow will attend to debts and carry on the business under the same style.

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. LII, No. 236. June 15th. With Index to Vol. LII. London: E. & F. N. Spon, Ltd. Price 3s. 6d.—This issue completes Vol. LII, and there will be no further issue of the *Journal* until next Session. The annual List of Members (revised to September 30th) will be posted in October. The contents of the present issue include the following papers:—"Predetermination of the Current and Voltage at the Receiving End of a Telephone or other A.C. Line," by Prof. J. A. Fleming; "The Bonecourt Boiler," by C. D. McCourt; "The Construction of a Wireless Station," by C. G. Roach; "Tests on Single-phase A.C. Commutator Motors," by E. A. Richards and D. Dunham; "Electrical Equipment of Collieries," by J. L. Thompson; "The Possibilities of Electric Traction on Railways," by J. L. Moffet; "The Laws of Dielectrics," by W. S. Flight; "Automatic Pressure Regulators," by E. L. M. Emtage and A. Arnold; and "Cascade Connections," by H. V. Henniker.

"Electrical Practice in Collieries." By D. Burns. Fourth edition. London: Charles Griffin & Co., Ltd. Price 7s. 6d. net.

"High-Power Gas Engines." By H. Dubbel and F. Weinreb. London: Constable & Co., Ltd. Price 18s. net.

"Reports for the year 1913 on the Science Museum, the Geological Survey and the Museum of Practical Geology." London: Wyman & Sons, Ltd. Price 5½d.

"Annales des Postes, Télégraphes et Téléphones." June. Paris: A. Dumas. Price 10 fr.

"Manual of Electrical Undertakings and Directory of Officials." By E. Garcke. Vol. 18, 1914-15. London: The Electrical Press, Ltd. 21s. net.—The new edition of this very bulky and comprehensive electrical *Manual* is now published, and as our copy lies before us awaiting review, we tremulously hesitate, wondering whether we could better sing its praises by breaking out into verse or by writing calmly about its bulky proportions, the completeness and variety of its contents concerning the electrical industry and its *personnel*, and so forth. Our rhymster being out of town, we adopt the latter course and proceed at once to say quite prosaically that the progress of the year dealt with statistically and in article form is a regular feature, and Home and Colonial electrical undertakings of all kinds, lighting and power, tramway and railway, telegraph and telephone, manufacturing and miscellaneous are detailed in the various sections. On the personal side there are given names and addresses of 12,000 chief officials, &c., of electrical undertakings, and members of institutions, also of members of electric lighting and tramway committees, and electrical contracting firms. Numerous maps of electrical systems are inset, and there is a host of other contents, making the book essential to everybody who requires conveniently at hand financial, general and personal information concerning the vast number of interests that go to make up what we call the electrical industry. We have nothing but praise for the book, unless it be a regret that it is apparently inevitable for some of the financial returns to be belated, and that it cannot somehow stop growing. The electrical industry is hardly likely to grow less as the years pass by, and we tremble to think what our *Garcke* will measure in thickness and weigh in pounds 10 years hence.

"Albalux" Shop Lighting.—MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Dalston, have sent us an illustration which graphically depicts the artistic effect that is obtainable by the use of Wotan drawn-wire lamps in semi-indirect fittings. The photograph illustrates one of the entrances of the large drapery and general establishment under the proprietorship of Messrs. Peppercorns, Ltd., Broadway, Deptford. The fitting used is of the Albalux design. Albalux fittings in most cases consist of opal glass reflecting and diffusing media, whilst white vitreous enamelled iron reflectors are used where necessary. We understand that the Albalux system is now being very extensively used for the lighting of large emporiums.

Trade Announcements.—MESSRS. DRAKE & GORHAM, LTD., have accepted the sole agency for Lancashire and Cheshire for commercial electrics for Edison Accumulators, Ltd., and have taken over the services of Mr. T. H. Rigg, of the Edison Co., as departmental manager.

MESSRS. H. R. WILLIAMS & CO., electrical engineers, of 100, High Street, Barnstaple, have disposed of the business to Mr. T. B. Jones, who has been with the firm for the past 15 years.

THE INTERNATIONAL TIME RECORDING CO., LTD., owing to greatly increased business, are giving up their premises in City Road, E.C., and have taken the entire five-storey building at 30-32, Farringdon Road, E.C., where their automatic recorders for time-keeping and job-costing can be seen.

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Annual Outings. — The employés of the WESTERN ELECTRIC CO., LTD., travelled by special boat or special train to Clacton-on-Sea on Saturday, June 27th, on the occasion of their annual outing. The large gathering of over 1,500 spent a most enjoyable day in splendid weather. A sports meeting was held on the Clacton Football Ground.

The staff of MESSRS. J. H. BUTCHER & CO., transfer printers, Birmingham, went for their annual outing on Saturday, June 27th. The party, 60 strong, journeyed by train to Worcester, and thence by steamer to the ancient town of Tewkesbury, where they were joined by Mr. J. H. Butcher and party, who had motored down. Dinner was served at the Bell Hotel. The toast of "The Firm" was proposed by Mr. J. Dalton, the works manager, who referred to the rapid strides that the business had made since they took possession of the present works five years ago, progress which was due to the enterprise and energy of the principal. Mr. Butcher responded. A vote of thanks was accorded to the Committee.

Accrington Corporation tramwaymen and their wives had their annual picnic on Thursday last week. They went to Liverpool, then crossed the Mersey to Birkenhead, and proceeded by motor to Chester.

The staff and employés of MESSRS. GENT & CO., LTD., Leicester, held their annual works outing on Saturday, June 27th. Accompanied by Mr. I. Hardy Parsons, a director, and Mr. H. Waddington, the works manager, the party spent an enjoyable day at Cleethorpes. After dinner, served on the Auckland Colonnade, members of the Committee expressed the thanks of all to the firm for their continued generous support of the outing. In the regretted absence of Mr. A. W. Staveley, the thanks were acknowledged by Mr. Hardy Parsons.

The second annual picnic of the electrical department of the Calico Printers' Association was held on Saturday, June 20th. The party, numbering upwards of 70, journeyed by train to Llandudno. On arrival breakfast was served, and afterwards a trip was made by steamer up the Menai Straits. Dinner was partaken of on the return. The weather was ideal and the day was a thoroughly enjoyable one.

The employés of MESSRS. PAGE & MILES, LTD., electrical engineers, of Brighton, Worthing and Eastbourne, numbering nearly 80, held their twenty-fourth annual outing on Saturday last, at Windsor. They were accompanied by the directors, Councillor J. W. Penfold (chairman), Mr. H. J. Miles, Mr. J. T. Baker, managing director, and Mr. A. C. Ganson, secretary. The Star and Garter Hotel was made the headquarters, and here a few friends from the city joined the party. A visit was made to the Castle. Among the toasts was that of "The Firm," proposed by Mr. F. Patching, and the chairman, in responding, mentioned that the Eastbourne branch was fully established, and that the past year had been one of great success owing to the good relations existing between the directors and their employés. They had added Mr. J. T. Baker to the list of directors. He also expressed regret at the enforced absence of Mr. E. J. Page, one of the managing directors, through the serious illness of his eldest son. The toast of "The Visitors" was proposed by Mr. H. J. Miles in humorous vein. He spoke of the exceedingly good feeling which existed among the firm and the manufacturers with whom they dealt, some of whose representatives were with them that day, viz., Mr. Laringer, Mr. H. Bonthorpe, of the General Electric Co., Ltd.; Mr. Hudson, of Messrs. Henley; and Mr. Loscombe Wallis, of Messrs. Jas. Fraser & Sons. Mr. Bonthorpe responded on behalf of the visitors. Subsequently a move was made for the launch trip to Boulter's Lock, the expenses of which had been generously defrayed by one of the visitors. On the return a smoking concert was organised. The arrangements of the day were made by Mr. J. T. Baker, one of the directors.

Catalogues and Lists.—MESSRS. J. M. DOUGHTY & SONS, LTD., 214/222, St. John Street, Clerkenwell, London.—76-page catalogue illustrating a great variety of electric light fittings—electroliers, coronas, dish pendants, hall and bracket lamps, French brackets, bedroom pendants, table standards, in many styles and finishes. Prices are stated.

MESSRS. G. M'CARTNEY & CO., Burnside Works, Cumnock.—Small 16-page illustrated pocket price list of "Orb" switches, fuse-boxes, power fuseboards, &c.

ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, London, S.W.—Folder giving illustrations of and brief references to their various meters, motor starters, motor control panels, and switchgear, &c.

MESSRS. EHRICH & GRAETZ, Berlin.—Illustrated priced circulars of half-watt lamp fittings and "Triumph" electric fans.

MESSRS. FALK, STADELMANN & CO., LTD., 83-87, Farringdon Road, London, E.C.—Catalogue No. 364 of 24 pages, giving full particulars, code-words and reduced prices of "Efesca" wire lamps for private and street lighting, traction service, also for candle fittings, battery lamps; also English "Electra" carbon-filament lamps.

MESSRS. J. H. HOLMES & CO., Newcastle-on-Tyne.—Pamphlet No. 26 contains illustrated particulars, dimensions and prices of oil break switches for A.C. control.

MESSRS. SMART & BROWN, Erith, Kent.—A batch of lists and large illustrated sheets, setting forth information relating to the firm's paraffin electric sets, motor pumping sets, oil motor cranes, motor boats, milling and wheel-cutting attachment for lathes and motor winches.

MESSRS. E. BROOK, LTD., Colne Road, Huddersfield.—Eight-page pamphlet tabulating particulars and prices of single, two and three-phase motors and motor-generator sets held in stock at Huddersfield.

THE GENERAL ELECTRIC CO, LTD., 67, Queen Victoria Street, London, E.C.—36-page catalogue of electrical accessories for motor-cars. It is a revised list of such manufactures and briefly describes and tabulates very clearly the prices of a range of sparking plugs, including the "Geeko" and the "Lodge"; switches for ignition control, and for car lighting; measuring instruments; interior lighting fittings for roof, bracket and other lighting; motor-boat lanterns, head-lights, rear-lights, &c.; car-lighting dynamos and equipments; "Geeko" ignition accumulators; motor generators; charging dynamos; Victor battery fans; "Klaxon" and "Dean" hooters, Osram lamps, &c.

MESSRS. CROMPTON & CO., LTD., Chelmsford.—12-page list (No. A600) containing a fully-illustrated general description of their C.M.B. system of control applied to main winding engines, and a list of some of the collieries where it is employed.

MESSRS. PITTER'S VENTILATING AND ENGINEERING CO., LTD., 20, Bishopsgate, London, E.C.—Card giving prices of 12-in. desk fans fitted with Pitter multiblade.

MESSRS. ALFRED HERBERT, LTD., Coventry.—Three new publications of 18, 22 and 32 pages respectively, all excellently illustrated, and containing full descriptive information regarding the following:—Automatic screw machines with self-selecting feeds; No. 4 Universal cutter and tool-grinding machine; No. 9 combination turret lathe.

MESSRS. CREDENDA CONDUITS CO., LTD., Chester Street, Aston, Birmingham.—Sixteen-page pamphlet containing full illustrated particulars of their electric fires. The new patent bar unit used in these is shown, and a number of different designs appear. Prices, dimensions, weights, consumption, &c., are given.

Veritas Sports.—The sixth annual athletic meeting of the Veritas Athletic and Social Club (FALK, STADELMANN & CO., LTD.), was held last Saturday, at the King's Oak track, High Beech. A goodly company was present, and the large number of events was followed with sustained interest. Running, potato, slow cycle, egg-and-spoon and skipping, wheelbarrow, hurdle and three-legged races, also tug-o'-war (warehouse *v.* office), and many other contests were included in the programme. Inter-business house events were arranged between the Veritas staff and Robert Dyas, Ltd., Kearley & Tonge, and Osmond & Matthews. After tea Mrs. L. Thurnauer presented the prizes.

Holidays.—MESSRS. T. W. BROADBENT, LTD., of Victoria Electrical Works, Huddersfield, announce that their works will be closed from Friday, July 24th, to the morning of August 4th, for the annual works holiday. An office staff will be in attendance.

The Leigh holidays are taking place this week, and the ANCHOR CABLE WORKS there are closed down until July 13th.

The climate and resources of Deal and its attractions as a holiday resort are very fully set forth, with numerous appropriate pictures, in a booklet issued by the Corporation. Copies may be obtained from the Town Clerk in return for a postcard.

"Freezor" Fans.—As illustrating the ability of the GENERAL ELECTRIC CO., LTD., to give prompt delivery of "Freezor" fans, it is interesting to note that over 1,200 "Freezor" fans were supplied for use in this country from June 29th to July 4th. Large stocks of every kind of "Freezor" fans are held in the company's central stores. The company delivered by their own service, or dispatched by carrier on receipt of order, the whole of the 1,200 fans mentioned, with the exception of a few orders delayed owing to the heavy storms at Birmingham on Wednesday last week.

France.—Under the style of Société de l'Electro-Policeman, a company, with a capital of 700,000 fr., has been formed at Paris (5, Avenue Constant-Coquelin) for the manufacture, sale, and installation of the burglar, fire and thief alarms "Auto-Policeman," "Auto-Gardien," and "Electro-Policeman."

Australia.—The Australian Customs authorities have recently given a decision to the effect that "Lamps for Electric Radiator" when imported separately are to be classified under No. 177 (E) of the Tariff, the duty being 15 per cent. on foreign, and 10 per cent. *ad valorem* on British goods.

LIGHTING and POWER NOTES.

Ammanford. — PROPOSED E.L. PURCHASE. — The U.D.C. at its last meeting decided to enter into negotiations with Mr. W. Herbert, with a view to the purchase from him of the electrical supply works in the town.

Australia.—The Northcote (Vic.) Council has decided to obtain a loan of £6,000 for an E.L. installation.—*Tenders.*

Bacup.—STREET LIGHTING.—The T.C. has decided to apply to the B. of T. for sanction to a scheme of street lighting by electricity.

Bexhill.—STREET LIGHTING; MAINS EXTENSION.—The T.C. has reduced the charge to the Highways Committee for public lighting from £4 14s. 8d. to £4 5s. per lamp per annum, for the 429 electric lamps in use.

The L.G.B. has consented to the extension of the electricity mains to the Little Common district, and the work is in progress.

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Batley.—The T.C. has approved a recommendation of the Electricity Committee that an additional boiler be provided at the electricity works, and has accepted the tender of the Stirling Boiler Co., Ltd. The Council has also approved the following scale of charges for current supplied for working lanterns in picture palaces: — For working through motor-generators, 2½d. per unit; for lighting, the usual charge of 4½d. per unit.

Brighton.—Year's Working.—The income of the Corporation electricity department for the year ended March last amounted to £98,093, against £96,196 in the previous year, and the expenditure to £50,873, against £48,649. After paying interest, £18,291, and sinking fund, £26,586, there was a net balance of £2,342, against £1,406. The reserve fund now stands at £14,196. The average total cost per unit was 2·02d., against 2·07d., while the generating costs remained the same, at ·74d. per unit. The units sold totalled 10,713,110, against 10,405,711, and the average price received for energy was 2d. per unit.

Cheshunt.—Proposed E.L.—The Council has formed itself into a Committee to consider the scheme of the North Metropolitan E.P.S. Co. and the Waltham Abbey and Cheshunt Gas Co. for the E.L. of the district.

Chipstead.—Prov. Order.—The Reigate R.D.C. has been notified that Mr. Gilbert Allom intends applying to the B. of T. for a prov. order for E.L. in an area which will include the Parish of Chipstead.

Clones.—Workhouse Lighting.—The B. of G., after receiving tenders for both electric and gas lighting, has decided in favour of the former.

Continental Notes.—Germany.—Kommunales Kraftwerk Oppeln is the name of a joint stock company which is being formed by a number of rural district councils in Silesia to construct an electric supply system.

On the 5th inst. a 1,500-volt transmission line from the Spandau overland electricity works broke on a farm near Potsdam, which is fed from it. Ten Russian and Polish farm labourers were persuaded by one of their number to join hands to be "electrified" by touching one of the fallen wires, with the result that all were injured, and five were killed outright.

Russia.—A scheme is at present under consideration for the establishment of a plant to utilise the power of the falls of the River Dnieper, between Ekaterinoslav and Alexandrowsk, in the generation of electrical energy for lighting and power purposes.

Switzerland.—According to a recent report, 80 per cent. of the railway carriages on the standard-gauge railways in Switzerland are now lighted by electricity, only 12·3 per cent. being lit by gas, and 7·45 per cent. by petroleum lamps.

Coxhoe (Co. Durham).—Street Lighting.—The East Hetton Colliery Co., having intimated its willingness to light the streets and roads in the district by electricity, on the same terms as have been accepted by Trimdon P.C., the P.C. has decided to apply to the Trimdon Council for full information regarding its plant, with a view to pushing on the work and having the district lit up this year, if possible. It was suggested that the Colliery Co. might light East Hetton village and the Electric Power Co. Coxhoe and Quarrington Hill.

Crewe.—Street Lighting.—The T.C. has confirmed a proposal to substitute new metal-filament lamps for the present arc lights in Victoria Street, High Street and Mill Street. The Council has also permitted the General Post Office to arrange for an alternative stand-by supply of electricity to the postal sorting office, Weston Lane, from the L. & N.W. Railway Co.'s generating station, such supply only to be used on the failure of the Corporation's supply.

Criccieth.—Public Lighting.—A special meeting of the Council is to be held to consider a recommendation by the Lighting Committee that the question of lighting the district by gas be entirely excluded, and that the Council confine itself to a scheme of electric lighting, and that the views of the ratepayers be sought at a public meeting.

The Council decided to notify the Lleyn R.D.C. of its intention to apply for statutory powers to supply electricity to Penllyn and Llanystumdwy parishes.

Croydon.—The T.C. on the report from the borough electrical engineer as to the considerable reduction in the number of consumers taking current on the maximum-demand system, recommends that notices be served upon the occupiers of premises other than shops, stating that the charge on the maximum-demand system will cease, and that the price charged from the September quarter will be at the present flat rate of 3½d. per unit.

Dartford.—Loan Amendment.—Owing to the provision of a 1,000-kw. turbo-alternator in place of a 500-kw. set, as originally decided upon, the U.D.C. has applied to the L.G.B. for the loan of £15,500 for additional plant, &c., to be amended to £16,500.

Durham.—Colliery Electrification.—The North Bitchburn Coal Co., of Darlington, has recently decided to install at the Randolph Colliery, Evenwood, Co. Durham, a mixed pressure turbo-generator, and to drive the underground and surface machinery at this pit by electricity, and also to convey the current by overhead cables to the Gordon House Colliery, and subsequently to the Hylton Sinkings.

Ely (Cambs.).—Prov. Order.—The Gas Co. has informed the U.D.C. that it intends applying for a prov. order for E.L. in the parishes of Ely St. Mary, Holy Trinity, the College, and the hamlets of Stuntney and Chettisham.

Fairlie (Ayrshire).—Proposed E.L.—A poll is to be taken on the question of an offer of the Earl of Glasgow to supply the land and provide the capital for an E.L. undertaking for the district, providing that one-third of the property owners promise to use the same.

Glasgow.—Hospital Lighting.—At the Sick Children's Hospital at Yorkhill, now nearing completion, nearly 2,000 electric lamps are installed. Thirteen lifts, and the whole of the laundry, kitchen, and other machinery, are operated by electric motors, of which there are, in all, upwards of 40; the ventilation is also entirely by electrically-driven fans. An automatic intercommunication telephone system having 30 stations; electrically-operated clock and bell systems and electro-medical and surgical apparatus are also installed. The electrical supply from the Glasgow Corporation mains is by duplicate cables. Messrs. Telford, Grier & MacKay, Ltd., carried through the lighting and general electrical installation work; Messrs. Waygood, Ltd., the lifts; and Messrs. D. & J. Tullis, Ltd., the laundry machinery. The electric clock and telephone systems are by the Magneta Time Co. and the Sterling Telephone Co. respectively. Expert service on behalf of the Hospital Board has been rendered by Messrs. James E. Sayers & Caldwell, consulting engineers.

Golcar.—Proposed E.L.—The Huddersfield T.C. has informed the U.D.C. that owing largely to the fact that it would be very difficult to check the energy supplied, it is unable to provide a bulk supply of electricity to the U.D.C.

Hornsey.—L.G.B. Inquiry.—The scheme approved by the B.C. for the erection and equipment of an electricity substation at Muswell Hill was the subject of a L.G.B. inquiry on July 2nd; the loan asked for was £13,744. The extension of the electricity undertaking has been necessitated by the growth of the Muswell Hill and Highgate Woods areas. The sub-station buildings will comprise a transformer room, showroom, offices, &c. There was no opposition to the application.

Ipswich.—Annual Report.—In his report on the working of the Corporation electricity department for the past year, Mr. F. Ayton, chief engineer, states that the result might be considered satisfactory. In spite of the increased cost of coal, the comparatively uneconomical working of the new turbine plant during the earlier part of the year, and heavy building repairs, the result was a net profit of £1,351. The total income was £27,453, and the working expenses £17,143. Capital charges absorbed £3,854, and repayment of loans £5,103. Of the net profit, £904 was allocated to capital expenditure, and the balance to the reserve and renewals fund, which stands at £1,152. 3,399,972 units were generated, against 3,069,302 in the previous year. The revenue of the installation department amounted to £4,919, and the expenditure to £4,750.

Irlam.—Prov. Order.—The D.C. has been informed that the Lancashire E.P. Co. intends to apply to Parliament next year for a prov. order to supply electricity in this district.

Japan.—A considerable amount of electric power remains idle during the daytime, reports the chief of the Tokio Municipal Electric Board. Means of utilising it for motive power were lately discussed among the officials in the Japan Department of Communications, but the result of the discussion was not encouraging. It is considered that it is most necessary that all the electric companies which are able to supply power should reduce the charges when their business has reached a paying basis. Unless such steps are taken, the time when the available power can be used freely for industries must be said to be far distant.

Kendal.—Year's Working.—The working of the electricity department during the year ended March 31st last has resulted in a deficiency of £593. The output of current sold for lighting amounted to 63,179 and for power 32,555 units, a total of 95,734 units, being an increase of 20,888 units.

Lathom and Burscough.—Prov. Order.—The Ormskirk Electric Supply Co., Ltd., has notified the Ormskirk U.D.C. of its intention to apply for provisional orders to supply electricity within the urban district.

Leeds.—Half-watt Lamps.—The City Square has been lighted by means of 16 500-watt 100 volt-Mazda half-watt lamps, each in an ornamental lantern; these lanterns were formerly used for 16 750-watt arc lamps, which have been displaced. The half-watt lamps only consume two-thirds as much energy as the arc lamps, and, of course, they will cost considerably less than the latter for repairs and attention. We understand from the B.T.H. Co., who supplied the lamps, that the effect of the new lighting is very satisfactory.

Llantrisant.—The South Wales E.P. Distribution Co. has applied to the B. of T. for consent to run 11,000-volt overhead transmission lines in the area of the R.D.C.

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London.—WESTMINSTER.—INCREASED CHARGES.—A few months ago the City Council decided to renew, for a further period of 12 months from June 24th, the existing contracts with the Charing Cross E.S. Co., the Metropolitan E.S. Co., and the St. James's and Pall Mall E.L. Co. for the supply of electricity to the Council's buildings. All three companies have now intimated that, owing to the increased cost of coal, oil and materials, they are compelled to increase the charge from 2½d. to 3d. per unit for lighting purposes. The Charing Cross Co. proposes to increase the charge for power purposes from 2d. per unit to 10s. per KW. of connected demand, plus 1d. per unit consumed, while the Metropolitan Co. will not supply for this purpose. The St. James's Co. is making no change, at 1d. per unit consumed and a fixed charge of 7s. 6d. per rated H.P. The City Council is recommended to accept the amended terms.

POPLAR.—NEW LOANS.—Application is to be made to the L.C.C. for sanction to the following loans in respect of the electricity undertaking :—Purchase of site of coal conveyor wharf, £1,000 ; extension to generating station, £2,701 ; mains extensions, £4,303 ; for new distributors and minor mains extensions, £2,500.

STEPNEY.—The Electricity Committee recommends the Council to obtain statutory protection for the Limehouse generating station in order to avoid actions or other proceedings for nuisance, and that the Council promote a Bill for the amendment of the Electric Lighting Orders Confirmation (No. 6) Act, 1892, to render Sec. 76 inapplicable to the Limehouse station.

WOOLWICH.—The L.C.C. has asked for details of the work proposed in connection with a further loan on account of £15,000. The borough electrical engineer reports that the existing terms, with possible future restrictions, are such as to practically nullify the benefit expected from closing down the Plumstead works ; he also advises the Council to obtain the support of Sir John Snell in its proposals.

BERMONDSEY.—The income of the electricity department for the year ended March 31st last was £30,329 ; the net surplus was £315. The units sold were 5,286,844, an increase of 704,689, and the maximum load was 2,279 KW. The gross profit was equal to 6·75 per cent. on capital outlay. The estimates for 1915 are based on 5,550,000 units being sold.

CITY E.L. PURCHASE.—The Streets Committee is advising the City Corporation that it would be inexpedient to purchase the City E.L. undertakings, either this or next year.

Luton.—YEAR'S WORKING.—The total working expenses of the electricity undertaking during the year ended March 31st last amounted to £15,692, as against £13,485 the previous 12 months ; the income amounted to £27,360, as compared with £23,039 ; the revenue account shows a gross profit of £11,668, or £2,114 more than last year, and equal to 11·42 per cent. of the capital expenditure. The expenditure on capital account during the year was £12,879, making the total capital expenditure at the end of the year £102,139. New loans amounting to £37,800 were sanctioned during the year, bringing the total amount sanctioned at March 31st, 1914, up to £124,414. The Electricity Committee has recommended the appropriation of the balance in defraying the cost of certain portions of the works now in progress.

Manchester.—L.G.B. INQUIRY.—An inquiry was held on Tuesday relative to the application of the T.C. for powers to borrow £10,000 for motors, £19,000 for consumers' distributing stations, and £29,000 for boiler plant. Mr. Hooper, the inspector, criticised the borrowing of money for motors, a practice which smaller towns were giving up, and pointed out that by not borrowing the city would save money ; he knew of no undertaking which could afford to pay money for the relief of the rates. It was mentioned that the department had contributed nearly £180,000 to rate relief. There was no opposition.

Newcastle-under-Lyme.—COTTAGE LIGHTING.—The Electricity Committee is considering the question of supplying electricity to small houses on the hire-purchase system.

For the year ended March 31st last, the income from the electricity undertaking was £2,969, and the expenditure £1,496, the net profit being £204.

Newtown.—PROV. ORDER.—Mr. H. Edwards has notified his intention to apply for a prov. order to supply electricity in the area.

Oldham.—Messrs. James Collinge & Sons, of Commercial Mills, Glodwick, are contemplating the electrification of the driving power for a part of their manufacturing plant.

PROPOSED LOAN.—The T.C. has sanctioned an expenditure of £40,000 for new machinery and extensions at the electricity works, on the recommendation of the E.L. Committee, and as the result of the report by Mr. Blackmore, of Stalybridge. The report has not been disclosed to the Council, according to the *Oldham Standard*, and no details are available.

Portaferry.—E.L. SCHEME.—A public meeting is to be held at an early date to take the necessary steps to provide an E.L. scheme, and to enlist the support of the Rural District and County Councils in its favour.

Redditch.—L.G.B. INQUIRY.—An inquiry was held last week, by Mr. T. C. Ekin, into the application of the T.C. for sanction to a loan of £18,000, for electricity purposes, and the inquiry was adjourned for the works manager to give more particulars of the scheme.

Reigate.—YEAR'S WORKING.—The gross profit on the electric light undertaking for the year ended March 31st last amounted to £4,071. The net balance was £272, and this has been carried to the renewals fund, which now stands at £1,818.

Salford.—PUBLIC LIGHTING.—The Corporation Tramways Committee has granted the application of the Swinton and Pendlebury Council for the use of tramway standards for public lighting.

Sheffield.—YEAR'S WORKING.—There is a net surplus on the working of the electricity undertaking for the year ended March 25th last of £14,449. The total income for the 12 months amounts to £149,891, as against an expenditure of £69,172. The expenditure on capital account to March 25th amounted to £2,353,305. Out of the above surplus it is recommended that £10,000 should be transferred to the renewals fund (making the total transferred to date £45,000), and that a further sum of £500 should be transferred to the fund for the purchase of motors for hire. The number of units sold during the period under review amounted to 26,546,718. The percentage of working expenses in proportion to total revenue worked out at 38·68.

Shipley.—YEAR'S WORKING.—The annual accounts in connection with the electricity department were submitted to a meeting of the Council last week. The profit on the year's working was £1,229 ; the reserve fund, including £990 brought forward from the previous year and £500 from other sources, totalled £2,700, and after allowing the costs of extensions and alterations at Dock Mill out of this fund, a balance was left to carry forward of £1,123.

Swansea.—The Assessment Committee has reduced the rateable value of the electricity undertaking from £3,900 to £3,650 net, which is equivalent to a saving in rates of £108 per annum.

Torpoint.—E.L. SCHEME.—The E.L. question has been definitely settled by the U.D.C. on July 2nd sealing the agreement with the E.L. Co.

Tunbridge Wells.—PROV. ORDER AND LOAN SANCTION.—The T.C. has decided to apply for a prov. order for the supply of electricity in the districts of Speldhurst, Bidborough, Langton, Pembury, Frant, &c., thus increasing the area of supply from 6·25 square miles to 28·5.

Sanction has been received from the L.G.B., without an inquiry, for a loan of £3,500 for machinery.

It has been decided during the Cricket Week to illuminate the town throughout by electricity, requiring 6,000 lamps in the roads, 1,000 in the Grove Recreation Ground and 1,000 on the Pantiles. Prizes are being offered for the most effective displays.

Walmer.—PROPOSED E.L.—The U.D.C. has appointed a Committee to co-operate with the Deal T.C. in the matter of electric lighting. It is understood that the Deal Council is disposed to entertain the question of applying for powers to supply electricity, and that it will be advantageous for the two local authorities to act together.

Warrington.—PROV. ORDER.—The Corporation is to make application to the B. of T. for a prov. order to supply current to Penketh and Great Sankey.

West Bromwich.—NEW PLANT, &C.—The Electricity Committee has entered into an arrangement to supply energy to the Steel Castings (Giles Foundry), Ltd., and additional generating plant and mains, estimated to cost £2,080, will be required. The Committee recommends that the installation of a battery be deferred for the present, and that the boiler house be extended, and a new boiler installed, at an estimated cost of £4,423.

Worcester.—At the June meeting of the City Council, Ald. Parker suggested that he could find a customer who would be glad to take over the electricity undertaking at a price of £150,000. For the next meeting of the Council, Mr. Maund has given notice that he will move that Ald. Parker's offer be accepted, and that the Electricity Committee be authorised to give effect to the resolution.

Application is to be made to the B. of T. for permission to supply energy in Claines, which is outside the city.

Wrexham.—PROPOSED LOANS.—The T.C. has directed application to be made to the L.G.B. for sanction to borrow £3,025 for extensions at the electricity works, and has accepted tenders amounting to £2,056 for new machinery.

TRAMWAY and RAILWAY NOTES.

Accrington.—It has been decided by the Accrington Corporation to make formal objection to the proposal now before the Light Railway Commissioners for the extension of the Accrington tramways at Clayton-le-Moors.

Baildon.—In connection with the prospective continuation to Baildon, of the Bradford Corporation's tramways, the Shipley Council last week decided to supply electricity for this purpose to the Baildon Council on the same terms as are granted to the Bradford Corporation.

Blackpool.—NEW CARS, &c.—The Corporation has decided to seek power to borrow £6,000 for additions to the Blundell Street depôt, for the supply of six open-type cars and electrical equipment, and for top-deck cars.

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Bradford.—STORM DAMAGE.—A terrific thunderstorm and flood caused many thousands of pounds' worth of damage at Bradford on Wednesday, last week. The sewers and the Bradford Beck, a natural stream running under the city, burst, and the streets in the centre of the city were broken open and were quickly many inches deep in running water. For a time traffic, including the tramways, was stopped. Valley Road, in which are situated the electricity works, was flooded and a foot or more of water occupied the lower parts of the works. Fortunately, however, the plant was not affected. At Shipley the overhead equipment of the tramways was affected, and traffic had to be stopped; as a general result the tramway system was thrown completely out of organisation for the remainder of the day. Telephonic communication in the city was stopped during part of the afternoon. At the height of the storm lightning struck and fired a drapery establishment and the place was quickly gutted.

Burnley.—PROPOSED EXTENSIONS AND 'BUS SERVICE.—The T.C. has decided to secure powers to construct a tramway from the boundary to the Rawtenstall Corporation tramways, at Loveclough. It has also decided to run motor-'buses generally throughout the borough.

Colne.—The T.C. has decided to re-lay the permanent way in Burnley Road, from Primet Bridge to Philip Lane, at an estimated cost of £2,000, and to convert one car truck to the Peckham pendulum type at a cost of £25.

Continental Notes. — GERMANY. — ELECTRIC F.B. VEHICLES.—Out of a required total of 145 motor-vehicles, the Berlin Fire Brigade has already 74, of which 48 are electrically driven. The latter have covered 100,000 km. without a single failure, and the average cost over a period of six years has been found to be about £70 per annum, or about one-quarter that of a horse vehicle; this is in spite of a charge of 1·8d. per unit for energy, and the contracting out of repairs to private firms, in both of which items rearrangements now in progress are expected to produce substantial savings.

A concession has just been granted for the construction of an electric light railway of standard gauge among the foot-hills of the Riesengebirge between Hermsdorf, Schmiedeberg, and Brückenberg.

SPAIN.—A scheme for the construction of four lines of underground electric railways in the City of Madrid has been submitted to the Spanish Ministry of Public Works.

Doncaster.—The T.C., in Committee last week, decided that no present action be taken with regard to laying the line in Silver Street, or doubling the lines in the Market Place and St. Sepulchre Gate, and that all previous resolutions inconsistent with this recommendation when confirmed, shall be deemed to be rescinded.

The Tramways Committee has decided to ask the County Council what sum it would contribute towards the cost of relaying and paving the track to the original terminus at Bentley.

Dover.—LIGHT RAILWAY PROPOSALS.—The T.C. has decided to oppose the application of the Light Railway Co. for a five years' extension of time for the completion of the Dover, St. Margaret's and Martin Mill Light Railway, unless an undertaking is given that the system will not be used for the conveyance of coal, nor for any purpose other than the conveyance of passengers and small parcels.

Edinburgh.—PROPOSED PURCHASE.—The Tramway Committee has received a memorandum of the terms proposed by the Colinton Tramway Co. as to the proposed transfer of its undertaking to the T.C. The proposed terms include the taking over of the obligations of the company to the War Office, landowners, &c. An alternative suggestion was that there should be a joint working agreement. The Committee recommended that the terms be declined.

Proposed extensions of the Leith tramway system have been before a meeting of representatives from the Leith and Edinburgh Tramway Committees. It was suggested that Edinburgh should permit the construction of a tramway along the Seafield Road to King's Road, Portobello. An alternative scheme was a route from Blackhall *viâ* Seafield Road to King's Road, Portobello, a total mileage of about 6½, about one-third of which is in Leith. No decision was arrived at by the conference.

Halifax.—YEAR'S WORKING.—The Corporation tramways accounts for the year ended March 31st, show passenger receipts £106,385; advertising on cars, £957; and parcel receipts, £2,147. The net profit for the year was £13,643, against £12,681 in the previous year.

Ipswich.—ANNUAL REPORT.—The report of Mr. F. Ayton, manager of the Corporation tramways department, on the past year's working of the tramways, shows that the revenue amounted to £23,825, an increase of £421 on the previous year; and the expenditure to £25,654, including working expenses, £19,888; capital charges, £3,623; and debt redemption, £2,142, a total increase of £2,472. There was, therefore, a net deficit of £1,828, against a profit of £268 in the previous year. This was partly met by £1,322, surplus from last year, and the remaining £506 was debited to the present year's working. Special attention is drawn to the slowness of the cars, which, owing to the narrow and congested streets, only average 5·51 miles per hour.

Leicester.—The T.C. has sanctioned the expenditure of £4,770 for the provision of canopy tops to 87 cars, which, it is estimated, will earn £7,000 more per year.

London.—S.W. RAILWAY ELECTRIFICATION. — On Saturday morning last a trial trip was made between Wimbledon and East Putney with one of the new electric trains to be used by the L. and S.W. Railway. The new coaches will carry each about 200 passengers, and are to be used on the Kingston Loop from Waterloo, *via* Wimbledon to Richmond and back to Waterloo.

The House of Lords Committee has rejected the L.C.C. proposal to construct a double line of tramways from the present Aldgate terminus along Mansell Street, with a single loop line round Trinity Square; the Bill containing the above proposal has passed a Commons Committee.

Yesterday morning a trial run was to be made in London with the new Edison battery 'bus for the South Shields Corporation.

Northampton.—The Tramways Committee of the T.C. has had under consideration, and recommends, the doubling of further portions of the Kingsthorpe section of the tramway track, thus completing the double line from Regent's Square to Kingsthorpe.

Rochdale.—STREET SWEEPER.—The Tramways Committee has decided to charge the Cleaning Committee 10d. per car-mile for working the tram-hauled street sweeper.

Sheffield.—ROAD TAX FOR 'BUSES.—The Corporation Bill, which has been before a House of Commons Committee, has been sanctioned the running of 'buses on four routes; the Corporation is to contribute ⅜d. per car-mile to the road authorities in respect of wear and tear, but this is subject to revision by agreement or arbitration, and may be dropped in the event of a new Imperial grant. New road construction is not to be taken into account in calculating maintenance, and the 'buses are not to be charged with road widening.

Tunis.—La Compagnie des Tramways de Tunis has just placed a contract with the Thomson-Houston Co., of Paris, for two new steam turbines and alternators, each of 2,000-KW. capacity, for the power station at La Goulette.

United States.—The contract for the construction of the subway in Lexington Avenue, New York, has been awarded by the New York Public Service Commission, to the Rapid Transit Subway Construction Co., at $1,915,164. Bids for the construction of Section 1 of the Eastern Parkway Subway, Brooklyn, were opened. There will be four tracks for operation by the Interborough Rapid Transit Co. and the Brooklyn Rapid Transit Co. The lowest tender is that of the Crandford Co. at $2,195,000.—*Railway Review.*

Wigan. — MANAGEMENT CHANGES.— The T.C. has adopted a motion that the time has arrived for the electrical engineer to devote the whole of his time to the electricity department, and that he be relieved of the responsibility of the managership of the tramways. Another motion was passed that the appointment be considered of a general manager for the tramway apart from the permanent way.

YEAR'S WORKING.—The receipts of the Corporation tramways department for the past year amounted to £77,973, against £71,268 in the previous year, and the surplus was £4,690, against £1,178.

TELEGRAPH and TELEPHONE NOTES.

Wireless Telephony.—At a meeting of the Dominions Royal Commission last week, Mr. Godfrey Isaacs, managing director of the Marconi Wireless Telegraph Co., gave evidence. He said that the company was constructing stations at Carnarvon and New York that would be far superior to any in existence, and could send 100 words a minute by wireless. He anticipated that the service would be able to undertake the whole of the work of the Pacific cable. The company also contemplated the establishment of services between this country and the Argentine and Brazil, between France and New York, and between Norway and New York. He thought that atmospheric troubles would shortly be entirely overcome, and that the future of long-distance telegraphy, at greatly reduced rates, lay with wireless telegraphy. Mr. Marconi would probably be able to telephone to New York before the end of this year. Proposals were under consideration for the establishment of a Press service, to supply Canadian news to this country and *vice versâ* at ½d. per word. He anticipated a large reduction in telegraphic rates all over the world in the near future, especially in the British Empire, due to the development of wireless telegraphy.

China.—A wireless station has been erected in the French Concession at Shanghai. It will work in conjunction with the observatory at Siccawei, and is expected to have a range of 1,800 miles.

Germany.—The German Emperor recently visited the trans-Atlantic wireless station at Eilvese, under the auspices of the Hochfrequenzmaschinen-A.G. für drahtlose Telegraphie, and exchanged messages of greeting, *via* Tuckerton, N.Y., with the President of the United States and other dignitaries.

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Orders by Wireless.—Wireless telegraphy, says the *Standard*, is used for transmitting orders by the commercial travellers of a well-known firm of tobacco merchants. A van accompanies them on their round, and inside it is a "wireless" operator, who sends out all urgent messages. Goods have been in certain cases delivered within one hour of the order being received, while messages have been sent from as great a distance as 20 miles from the central office.

The Telephone Service.—On Friday last the discussion on the Post Office Estimates was resumed in the House of Commons. The administration of the telephone system was attacked, but the Postmaster-General stated that in London last year 16,000 new subscribers were connected, and up to date this year 14,500 more, and denied that the service was so bad as it was made out to be. Inquiries addressed to 135,000 telephone users in London, of whom 128,000 replied, showed that 87 per cent. were "perfectly satisfied," 4½ per cent. "totally dissatisfied," and the remainder neutral. The proposed new rates were all based upon the measured-rate system, and he held out no prospect of any considerable reduction in the total payments by telephone users. The results obtained from the experimental check-meters had been satisfactory. He proposed to institute a Committee of Inquiry into the telegraph system, consisting of Sir A. Williamson (chairman), Sir W. Plender, Sir C. Stewart-Wilson, and a member of the staff.

Wireless on Board Ship.—In reply to questions in the House of Commons, Mr. Burns recently stated that an agreement was in preparation between the Board of Trade and the Marconi Co., to enable shipowners to obtain wireless installations on reasonable terms. Shipowners, however, would be under no obligation to obtain their apparatus from the company.

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—August 4th. U.D.C. One natural-draught chimney-type cooling tower. See "Official Notices" to-day.

Argentina.—July 15th. E.L. installation (public and private lighting) for the Dean Funes (Cordoba) Municipality.—*Review of the River Plate.*

Ashton-under-Lyne.—Corporation. July 29th. Arc lamp globes, lamp carbons, D.C. motors and D.C. motor starters. See "Official Notices" to-day.

Australia.—SYDNEY.—August 31st. Sydney Harbour Trust. Four electrically-operated semi-portable travelling cranes. Forms of tender from Mr. H. F. Norrie, Secretary to the Trust, Sydney.

PERTH.—August 19th. Electric lamps and fittings, for P.M.G. See "Official Notices" to-day.

August 19th. Telephone switchboards, galvanised iron and steel stranded wire, for Postmaster-General. See "Official Notices" to-day.

September 2nd. Telephone instruments and parts, glassware, battery material, chemicals for batteries, wire—cotton, silk or wool covered—telegraph and telephone insulators, for Postmaster-General. See "Official Notices" to-day.

MELBOURNE.—October 7th. Victorian Railway Commissioners. Four motor-driven air compressors and electrical equipment (motors, &c.) for the new workshops at Ballarat and Bendigo. Specification may be seen at the Board of Trade Commercial Intelligence Department in London.

Belgium.—NALINNES.—July 18th. Concession for supply of light and power for all uses. Particulars at the Maison Communale, à Nalinnes, Hainaut, Belgium.

BRUSSELS.—Shortly. Supply and installation of 11 dismountable telephone cabins, after the system of Grüsenmayer, for the Brussels central telegraph office. Cahier des charges spécial, No. 267. Particulars, Salle de la Madeleine, Brussels.

Blackrock.—July 13th. U.D.C. Underground mains, overhead mains, feeder pillars and public lighting. See "Official Notices" June 26th.

Bolton.—July 19th. Corporation. Converting plant, sub-station E.H.T. and H.T. switchgear. See "Official Notices" June 12th

Dartford (Kent).—July 20th. Telephones, extension bells, &c., at Joyce Green Hospital, for Metropolitan Asylums Board. See "Official Notices" to-day.

Edinburgh.—July 20th. Corporation Electricity Supply Department. Extension steam and exhaust pipe work at McDonald Road Station. Town Clerk, City Chambers.

France.—August 18th. French State Railway authorities (Bureaux du Service Electrique) in Paris (43, Rue de Rome). 17 electrically-operated travelling cranes for the new railway works at Sotteville, near Rouen.

PARIS.—July 17th. The French State Railway Administration intends to acquire 100 continuous-current electric motors for the suburban railway network. Particulars, Bureaux du Service Electrique, 3e Division, 72, Rue de Rome, Paris.

Gillingham (Kent).—July 17th. B.C. 12 months' supply of coal for the Electricity Department. Specification from the Borough Electrical Engineer, Gillingham Road.

Greenock.—July 23rd. School Board. Electrical installation at the Greenock Academy. Specification from Mr. A. F. Neven, Clerk, Municipal Buildings, Wallace Square.

Grimsby.—July 23rd. Corporation. 790 ampere-hour battery, reversible booster and switchgear. See "Official Notices" to-day.

Lancaster.—July 13th. Coal and slack for 6, 9 and 12 months respectively for the Corporation Electricity Works. Mr. G. C. Milnes, Marton St. Works.

London.—L.C.C. July 13th. One, two or three electrically-driven chassis, for Fire Brigade. See "Official Notices" June 19th.

July 14th. Five rotary converters of 1,500 KW. each, 15 main static transformers, two starting static transformers, and re-erection, &c., of existing motor-generators. See "Official Notices" June 19th.

July 30th. 10,000 or 5,000 driving and pony wheel tramcar tires, 300 axle forgings for tramcars. Chief Officer, Tramways Department, 62, Finsbury Pavement, E.C.

The Highways Committee recommends that tenders be invited for the supply of 125,000 metal-filament traction lamps, 22 British C.P., 115 volts, for use on the Council's cars.

Manchester.—July 21st. Corporation. Two steam boilers, for the Tramways Department. Specifications from Mr. J. McElroy, General Manager, 55, Piccadilly.

July 24th. Corporation sub-station. 6,600-volt switchgear (one year's requirements); fuse boxes (two years' requirements). See "Official Notices" to-day.

Montenegro.—July 13th. Montenegrin Department of Posts and Telegraphs. Various telegraph stores and instruments. Some particulars may be seen at the Commercial Intelligence Branch of the Board of Trade, London, E.C.

Pittington (Durham).—July 11th. Poles, lamps, cables, &c, for the Parish Council. Specification from Mr. T. Carson, Clerk.

Ramsbottom.—July 16th. One electrically-driven sludge pump, with motor, wiring, countershafts, gearing, &c., complete. Specifications, &c. (£2 returnable), Messrs. Jas. Diggle and Son, Civil Engineers, Hind Hill Street, Heywood, Lancs.

Salford.—July 13th. Coal for the Electricity Department. Borough Electrical Engineer, Electricity Works, Frederick Road, Pendleton.

July 13th. Steel and concrete foundations for 5,000-KW. turbo-alternator. Borough Electrical Engineer.

South Africa.—BEAUFORT WEST (CAPE PROVINCE). August 19th. Proposed electric lighting scheme. Contract No. 1 comprises two 70-B.H.P. suction gas engines, two 48-KW. dynamos with static balancers, one motor booster, one switchboard and one battery of 250 cells. Contract No. 2 comprises overhead equipment, underground mains, and material for house connections. Specifications from Mr. C. G. Trevett, 70, Fletcher's Chambers, Cape Town. Tenders to Town Clerk.

Southampton.—July 13th. Corporation. Supply and erection of coal conveyers at the electricity works. Specification from the Borough Electrical Engineer.

Spain.—July 15th. Municipal authorities of Agreda (province of Soria). Concession for the electric lighting of the town during a period of 15 years.

July 20th. The municipal authories of Chillon (province of Ciudad Real) are inviting tenders for the concession for the electric lighting of the town during a period of 30 years.

Stockton-on-Tees.—July 24th. Corporation. Coal for use on mechanical stokers, for the Electricity Department. Forms of tender from Mr. J. J. Smith, Borough Electrical Engineer.

Turton.—July 23rd. U.D.C. Overhead lines and underground cables. See "Official Notices" to-day.

Walsall.—July 14th. Corporation. Four water-tube boilers, superheaters, economisers, pumps, pipes, &c. See "Official Notices" June 19th.

July 14th. Corporation. Two 3,000-KW. turbo-alternators with surface condensers, and motor-generator. See "Official Notices" June 19th.

Warrington.—July 21st. Extra-high-tension switchboard feeder panel and low-tension switchboard feeder panel, for Borough Electricity Dept. See "Official Notices" to-day.

West Ham.—July 20th. Lighting installation at Rosetta Road School, for Education Committee. See "Official Notices" June 26th.

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Whitstable.—July 17th. U.D.C. Electric motors, switches, &c., at the sewage pumping station. Specifications from Messrs. Strachan & Weekes, 9, Victoria Street, S.W.

Wrexham.—The T.C. has instructed the electrical engineer to obtain tenders for a motor required in connection with the new generating set.

York.—July 13th. Corporation. 500-KW. rotary converter, with transformers and switchgear. See "Official Notices" July 3rd.

CLOSED.

Accrington.—The T.C. has entered into a contract with the Chloride Electrical Storage Co., for the cleaning and maintenance of the battery at the works for 8½ years, at an annual charge of £166.

Australia.—Commonwealth Home Affairs Dept. :—
Telephone exchange at Lidcombe, £976.—John Bright & Son.
Post and telegraph office at Bondi Junction, £1,825.—Beat Bros.

Barrow.—For the T.C. :—
Re-tubing of No. 1 economiser.—Green & Son, £280.
Coal.—O. M. Huartson, 18s. 9d. per ton.

Batley.—The T.C. has accepted the tender of the Stirling Boiler Co., Ltd., for supply of a multitubular boiler, with pipework, for the electricity works.

Blackpool.—The Corporation has accepted the tender of Messrs. Mather & Platt, Ltd., for a new electrically-driven sewage pumping plant to be put down at Layton.

Brighton.—The T.C. has accepted the tender of Messrs. Geo. Lynn & Sons for alterations, &c, at North Road electricity works, at £1,834.

Burnley.—The E.L. Committee has accepted the tender of the B.I. & Helsby Cables, Ltd., for 2,160 yds. of ·1-in. cable, 1,080 yds. of ·05-in. cable, and 3,410 yds. of ·25-in. traction cable, for £1,008.

Calcutta.—Messrs. George Anderson & Co., Ltd., of Carnoustie, have received the order for the first batch of 11 electric travelling wharf cranes out of 58 required by the Port Commissioners in Calcutta, the present contract figure being approximately £10,000. The order was obtained in competition.

Canterbury.—The T.C. has appointed Mr. G. E. Dashwood to carry out electrical engineer's work for the next half-year.

The T.C. has also accepted the offer of Messrs. Pritchetts & Gold to renew their contract for battery maintenance for a term of 10 years at £80 per annum, and the tender of Mr. Chas. Mount, for extensions to the coal bunkers at the electricity works, at £52.

Clacton-on-Sea.—The U.D.C. has sealed a contract with Messrs. Johnson & Phillips, Ltd., for the supply of cable, &c.

Colne.—The following tenders have been accepted by the T.C. :—
United Car Co.—Car and truck, £516.
B.T.H. Co.—Electrical equipment and gears, £254.

Dartford.—The U.D.C. has accepted the tender of Messrs. E. J. & W. Goldsmith, Ltd., for 3,000 tons of Aberpergwym rubly culm coal, for the electricity works, at 13s. 1d. per ton.

The Council has also accepted the tender of Messrs. Fraser and Chalmers, Ltd., for a 1,000-KW. turbo-alternator, at £4,554, in lieu of the 500-KW. set provided for in the original scheme; and the tender of Mr. J. W. Ellingham for an annexe to the generating station, at £290.

Darwen.—Orders for two new electric tramcars were given by the Tramways Committee last week at over £900 per car. The bodies will be built by the United Electric Car Co., the electrical equipments supplied by Messrs. Dick, Kerr & Co., Ltd., and the trucks by the Brush Co.

Doncaster.—The Tramways Committee has accepted the following tenders for the extension of the tramways to Warmsworth and Woodlands :—
Contract No. 1.—Warmsworth. J. W. Pearce & Co., Ltd., permanent-way construction, £7,000.
Contract No. 2.—Brodsworth. Edwards & Co., permanent-way construction, £10,433.
Contract No. 3.—B.I. & Helsby Cables, Ltd., copper bonds, £341.
Contract No. 4.—Guest, Keen & Nettlefolds, Ltd., tie-bars, bolts, nuts, &c., £896.
Contract No. 5.—Hadfield's, Ltd., points and crossings, £1,457.
Contract No. 6.—Mr. Wilson, casting tramway rails, £150.

The Education Committee has accepted a revised tender by Messrs. Dixon & Sons, of Leeds, for the installation of electric lighting at the new Doncaster Technical School, at £820,

Eccles.—The Public Lighting and Electricity Supply Committee has accepted the following tenders :—
Earl of Ellesmere.—Screened washed nuts, 18s. 6d. per ton; best selected house coal, 18s. 9d. per ton.
J. Aldred.—Screened ordinary quality house coal, 14s. 2d. per ton.
Salford Gas Department.—Best gas coke, 11s. 8d. per ton.

Edinburgh.—The contract for the electrical installation at Redford Barracks, Edinburgh, has been placed with Messrs. Lowdon Bros.

Felixstowe.—The U.D.C. has accepted the tender of Messrs. W. Simms & Co., at £554, for the erection of overhead lines, &c., in connection with the change over from two-wire to three-wire system.

Folkestone.—The T.C. has accepted the tender of the Electric Street Lighting Apparatus Co., for standards for public lamps, with harps and canopies for lamps, at £5 11s. each.

Grimsby.—The Public Lighting Committee has accepted the offer of Opel Motors, Ltd., to supply an electric chassis, including motor and a new battery of accumulators, &c., at a cost not exceeding £200.

London.—L.C.C.—The Highway Committee reports having received the undermentioned tenders for the supply of trailer cars, and the equipment of a number of electric cars with couplers and traction gear for drawing trailers on the Council's southern tramways :

	50 trailer cars and equipment of 200 cars as tractor cars.	100 trailer cars and equipment of 200 cars as tractor cars.	150 trailer cars and equipment of 200 cars as tractor cars.
Brush Elec. Eng. Co., Ltd.	£29,500	£51,900	£74,200
Hurst, Nelson & Co., Ltd. ..	31,900	56,200	80,750
United Electric Car Co., Ltd.	33,350	58,600	83,750
Norddeutsche Waggonfabrik A.-G.	35,500	65,000	93,500

The Committee recommends the acceptance of the tender of the Brush Elec. Eng. Co., Ltd., for the supply of 150 trailer cars and the equipment of 200 cars as tractor cars, for £74,200.

The Committee recommends the termination of the tender of Messrs. Howarth & Houson for 12 months' supply of tramway fittings, equipment, &c, accepted on March 25th, the firm having gone into bankruptcy.

The Great Northern Railway Co. has placed the contract for the supply of carbon filament lamps and station lighting reflectors for the ensuing 12 months with Messrs. Siemens Bros. Dynamo Works, Ltd.

FULHAM.—The B.C. Electricity Committee recommends the acceptance of the following tenders for coal for the electricity undertaking :—
Messrs. Gilman & Co., 5,000 tons of ⅝-in. Mapperley Smitham nutty slack, at 12s. 6d. per ton; Messrs. Usher & Co., 2,000 tons of ⅝-in. Bedworth peas, at 11s. 0½d. per ton (subject to a trial barge-load proving thoroughly satisfactory); Messrs. Cory Bros., 2,000 tons of Gedlings High Hazel ½-in., at 10s. 11d. per ton.

HAMMERSMITH.—The B.C. Electricity Committee reports the receipt of the following tenders for two cast-iron transformer pillars :—

Hardy & Padmore	(recommended)	£46
B.I. & Helsby Cables, Ltd.		66

POPLAR.—The Borough Council has been recommended to accept the tenders of the New Conveyor Co., at £519, and Messrs. Fraser and Fraser, at £115, for the extension of the coal conveyor and for the provision of two ash-bins respectively at the electricity works.

Lowestoft.—The tender of the B.I. & Helsby Cables, Ltd., for half a mile of overhead trolley wire, at £39, has been accepted by the Tramways Committee.

Maidstone.—The T.C. has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for coal for a year for the electricity works, at 13s. 7d. per ton for Northumberland rough smalls, and 16s. 3d. for Yorkshire house screenings.

Manchester.—The Electricity Committee has accepted the tenders of the Western Electric Co., Ltd., and Messrs. Chas. Macintosh & Co., Ltd., for supplies of cable. The tender of the British Westinghouse Co., for a 5,000/6,000-KW. turbo-alternator at the Stuart Street station has been accepted, and licence has been granted to sub-let to the following firms :—Alternator, Siemens Bros. Dynamo Works, Ltd.; portion of pipework and condensing plant, Messrs. Mirrlees, Watson & Co., Ltd.

The Tramways Committee has accepted the quotation of the Tudor Accumulator Co., Ltd., for the welding of rail joints, and also that of Messrs. W. Macfarlane & Co., for the ironwork for tramway refuges.

Peterborough.—The T.C. has accepted the tender of Messrs. J. Fairweather & Son for coal for the electricity works for a year, at 14s. per ton for Tibshelf peas (½ in. by 1 in.).

Shipley.—The following tenders have been accepted by the D.C. :—
British Westinghouse Co.—Three sets of switchgear for sub-stations, £79 the Council's workmen to do the fixing.
Herbert Morris, Ltd.—Ten-ton crane for the engine house.
Sturtevant Co.—Air pumps.

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Sheffield.—The City Council is recommended to accept the following tenders for supplies :—

Willans & Robinson, Ltd.—Manufacture and storage of spare blading material, £947.
Dick, Kerr & Co., Ltd.—Spare coils for alternator, £558.
Stirling Boiler Co., Ltd.—Tubes for two Stirling boilers, £208.
Davy Bros., Ltd.—Removal of the existing tube box and supplying a new air heater on Stirling boiler, £195.
Steel, Peech & Tozer, Ltd.—1,000 tons of tram rails.
David Ashton & Co.—New generating set at the Lumley Street destructor, £449.

Stretford.—Contracts have been placed by the Tramways and Electricity Committee, as follow :—

Lancashire Dynamo, &c., Co., booster	£473
Bertram Thomas, switchboard, &c.	314
Tudor Accumulator Co., battery	2,323

Sunderland.—The T.C. on Wednesday accepted the following tenders on behalf of the Electricity and Lighting Committee :—

W. G. Farrow & Co.—Cast-iron gutters, cast-iron bends.
Jackson Electric Stove Co., Ltd.—Domestic cookers.
Carron Co., Ltd.—Domestic cookers.

Warrington.—The Electricity and Tramways Committee has accepted the following tenders :—

Titan Trackwork Co., Ltd.—Special trackwork, £247.
A. Thorne & Sons.—Two sockets for tramway poles, £22.
Thermit, Ltd.—About 100 Thermit welded joints, 21s. 6d. per joint.

West Bromwich.—The Electricity Committee has made arrangements with Boston & Son and the Aldridge Colliery Co., for the supply of 12,000 tons of slack during the ensuing year.

Wrexham.—The T.C. has accepted the following tenders :—

Lancashire Dynamo Co.—Dynamo, £616.
Bellliss & Morcom, Ltd.—Engine, £1,055.
British Westinghouse Co., Ltd.—Condenser, £899.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, July 11th. Visit to Carborundum Co., Ltd., Trafford Park.
Junior Institution of Engineers.—Saturday, July 18th. At 2.30 p.m. At Purfleet. Visit Tunnel Portland Cement Works.
Nottingham Society of Engineers.—Saturday, July 18th. Ladies' day: Visit Sherwood Forest.

THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued :—

Headquarters will be opened daily for the transaction of regimental business from 10 a.m. till 4 p.m., except Saturdays, on which days the opening will be from 10 a.m. till 12 noon. Headquarters will be closed for all purposes on August 3rd and 4th, 1914.

(Signed) F. B. HOLT-WHITE, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

NOTES.

Electrical Contractors' Association of Scotland.—Satisfactory reports of work done in branches in Glasgow, Edinburgh, Dundee and Aberdeen were submitted at the annual general meeting in Edinburgh, when Mr. Alex. Pratt, the President, was in the chair. The accounts of the treasurer showed the Association to be in a sound position financially. The following office-bearers were elected :—President, Mr. E. J. B. Lowdon, of Messrs. Lowdon Bros. & Co. ; vice-president, Mr. T. B. Wright, of Messrs. Anderson and Munro, Ltd. ; secretary and treasurer, Mr. J. M. Davies, jun., C.A. ; and solicitor, Mr. Walter Finlay, W.S.

Copper.—A comparison of the statistics for the fortnight ending June 15th with those for the whole month, as set forth in Messrs. H. R. Merton & Co.'s tables, shows that it is impossible to estimate satisfactorily the position for the month from the figures for the first half. While supplies from North America up to June 15th were 14,475 tons, the quantity for the whole month was 36,086 tons, considerably under double the first figure. Spain and Portugal, on the other hand, show a very low figure for the fortnight, 226 tons, and an unusually high one—3,029 tons—for the month. Chile shipments were 1,400 up to June 15th, and 3,500 for the month, slightly above the average. Australian were 1,900 tons, and 2,550 for the two dates, the latter rather a low figure, average for the past 12 months being 3,450 tons per month. The total supplies were not much less than double the fortnightly figure, 21,708—total, 50,636—but not sufficiently near for the first to be reckoned as representing half the second.

The visible supplies are steadily maintained. On June 15th English stocks were 13,436 tons ; on June 30th, 14,721. European visible supplies were 32,920 tons, and 33,271 on the same dates. The latter figure is 900 tons higher than that for the end of May. The consumption during the month—49,785 tons—was fairly high, o the increase in stocks cannot be entirely attributed to depression n the general outlook.

Stock in American producers' hands (as published by the American Producers' Association) was 31,401 tons at the end of April, and 37,653 tons at the end of May. The world's visible supply at the end of May was 70,023 tons, an increase of 9,344 tons over the quantity for the end of April.

"Give us Back our Skin."—A dispatch from Pittsburg says that this is the heading of an article being issued by the striking employés of the Westinghouse Co. at East Pittsburg and Swissvale. The article criticises Charles Mensor, an employé of the Union Switch and Signal Co., who returned to work against the will of his fellow employés, who some time ago gave a large amount of their cuticle that his life might be saved by the skin-grafting process. Mensor was injured in an accident in the plant 18 months ago. Skin-grafting was the only means of saving his life. Eight fellow-workmen contributed 102 sq. in. of skin for use in the operation, which was successful. According to the strikers, Mensor was the first to desert them. Threats and entreaties were of no avail, and the strikers' publication came out with the words "Give us back our skin" across the top of the sheet. It also said that if Mensor was caught on the streets the skin he "borrowed" would be taken from him. Mensor is escorted by a policeman to and from his daily work.

A Well-Deserved Sentence.—At Newcastle-on-Tyne Police Court on Wednesday, Felix Murphy, a labourer, was charged with stealing a pair of rubber gloves, the property of the Cramlington Coal Co., Ltd., from the power house at the Shankhouse Colliery. The solicitor for the Coal Co. stated that accused went into the power house, and after securing possession of the gloves put them on and commenced interfering with the electrical plant. The ventilating fan for the mine was stopped, and 25 to 30 men, who were underground at the time, ran a grave risk of being suffocated. As a result of the damage done by accused to the plant, the pit was laid idle for a day. In sentencing the prisoner to three months' imprisonment, with hard labour, the chairman said he should feel thankful that he was still alive.

Electricity Supply Rifle League.—In connection with the above League a prize meeting was held on the 27th ult. on the range of the Hackney Electric Rifle Club, Clapton, when there were 40 members competing for the various events at 25, 50 and 100 yards. The weather was on its best behaviour, but some of the competitors would have preferred a cooling breeze, as they found the sun too powerful, and the shooting was not up to standard. The following were the results :—

25 YARDS SCRATCH.—F. Winchcombe (98), first, attaché case ; W. Mursell (96), second, case of brushes ; E. Matthews (96), third, cigarette case.
25 YARDS HANDICAP.—H. T. Dartnall (98·71), first, barometer ; H. A. Pearman (98·5), second, case of fish carvers ; C. Saunders (98·36), third, tea set.
25 YARDS RAPID.—R. Tufnell (91), first, carriage clock ; W. C. Young (89), second, case of fish eaters.
50 YARDS SCRATCH.—J. Harrison (100), first, kit bag ; H. J. Cope (97), second, flower stand.
50 YARDS HANDICAP.—E. Matthews (98·28), first, tantalus ; P. Barrow (97·69), second, case of tea knives ; A. T. Atkins (97·56), third, Toby beaker.
100 YARDS SCRATCH.—F. Winchcombe (93), first, flower stand ; F. Foster (92), second, jam dish.
CHAMPIONSHIP.—F. Winchcombe (285), gold medal.

The President of the League (Mr. L. L. Robinson) presented the prizes at the conclusion of the shooting, which lasted until after seven o'clock, and also handed over to the Westminster Club the handsome shield which has been purchased for presentation to the champion team each year. The usual votes of thanks were accorded before the company dispersed.

Complimentary Dinner to Sir John Snell.—A general desire having been expressed that the honour of knighthood recently conferred upon Sir John F. C. Snell, President-Elect of the Institution of Electrical Engineers, should be made the occasion of a complimentary dinner in the early autumn, a committee is in course of formation to make the necessary arrangements. Those wishing to associate themselves with the event are requested to send their names as soon as possible to any one of the following :—

P. F. Rowell, the Institution of Electrical Engineers, Victoria Embankment, W.C.
D. N. Dunlop, British Electrical and Allied Manufacturers' Association, King's House, Kingsway, W.C.
A. H. Dykes, Association of Consulting Engineers, 11, Victoria Street, S.W.
H. F. Proctor, Incorporated Municipal Electrical Association, The Exchange, Corn Street, Bristol.
L. G. Tate, Electrical Contractors' Association, 20, Bucklersbury, E.C.

Parliamentary.—SECOND AND THIRD READINGS.—In the House of Commons on June 29th the Yorkshire Electric Power Bill was read a second time ; and in the House of Lords on June 30th, the Bristol Corporation (Tramways) Bill, and the Glasgow Corporation (Tramways, &c.) Bill, were read a third time ; on Monday the Deal and Walmer Gas and Electricity Bill passed its third reading ; on Tuesday the Norwich Electric Tramways Bill passed through the same stage.

Platinum.—It is reported from Paris that large quantities of platinum have been discovered in the North Ural district, about 90 km. to the east of Cologne.

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Foreign Trade in June.—The official figures published this week show that in the value of exports during June there was a fall of nearly three millions sterling or 6·9 per cent. as compared with the same month in 1913. For the six months, with a total of 255½ millions sterling, there is a decrease of practically £1,600,000 or 0·6 per cent. The export decreases during the month have occurred chiefly in cotton piece goods, iron and steel, and new ships. The electrical and machinery exports are down for the month, and the imports slightly up, as shown in the following figures; for the six months, machinery imports and exports are both up, but electrical exports show a large fall.

	Month of June	*Inc. or dec.*	*Six months, 1914.*	*Inc. or dec.*
IMPORTS.	£	£	£	£
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	124,401	+ 8,140	804,645	+ 58,516
Machinery	689,059	+ 93,814	4,144,344	+386,606
EXPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	271,280	− 30,174	1,704,229	− 978,582
Machinery	3,098,382	−135,528	19,469,555	+1,045,012

Metalliferous Mines.—The Royal Commission appointed to inquire into the subject of metalliferous mines and quarries, has issued its report this week, recommending that the application of the Factory Act to these should be replaced by the adoption of a special Act, providing for inspection, and special regulations in the case of mines where inflammable gas is found.

Fatality.—The Leeds City Coroner (Mr. J. C. Malcolm), on July 1st, held an inquest touching the death of Joseph Roddy (39), linesman in the employ of the General Post Office. The evidence showed that deceased left home on the previous Monday morning, apparently in the best of health, and was engaged in the task of fixing notices on Post Office telegraph and telephone poles which also carried at the top the wires of the Yorkshire Electric Power Co., warning the Post Office workmen against ascending the poles beyond a platform separating the Electric Power Co.'s wires from the Post Office wires, on account of the danger from the former. Towards the top of each pole was fixed an iron platform to prevent workmen getting too close to the wires. Deceased had to affix 56 notices, and when engaged in the task of putting one on a pole at Rothwell—which was the thirty-sixth of a series—a young woman, named Edith Gould, saw a flash and the deceased lying on the ground. Help was obtained, and he was taken to the Leeds Infirmary, where Dr. Flint found that he was unconscious, but suffering from severe shock; his hair was singed, and he had severe burns on his face, his hands and knees. On the left side particularly there were also other injuries to the body caused by the fall. Deceased died within an hour after admission to the Infirmary. The expert witnesses who were called could give no explanation for the accident. Mr. Arthur Edwin Bland, senior inspector in the employ of the Post Office, said Roddy was engaged on special and dangerous work at the time of the accident. Deceased had had 15 to 20 years' experience of the work, and was a most careful man. A verdict of "Accidental Death" was returned.

Gyroscopic Stabiliser for Aeroplanes.—Mr. E. A. Sperry, the inventor of the Sperry gyro-compass, which is largely used by the American Navy, has carried out tests in France with a stabilising device mounted on an aeroplane. According to the *Electrical World*, use is made of four gyroscopes with their axes at right angles. It is possible to tilt the machine sufficiently to make turns safely, but the aviator cannot tilt it to a dangerous angle. The gyroscopes operate valves leading to two servo-motors which control the planes and steering gear of the machine. The entire stabilising equipment weighs 100 lb. and is operated by alternating current from a generator driven by the aeroplane engine.

Electrical Material in Russia.—Speaking at the annual meeting of the Spies Petroleum Co. in London last week, the chairman, (Mr. J. Annan Bryce, M.P.), said it was mentioned in the report that the completion of the electric station had been delayed by non-delivery of material. "This applies especially to material ordered in Russia, and I may add, that another electric installation ordered by one of our neighbours has been delayed even more than ours. Some people have said, 'Why do you not see that your material is delivered?' Well, gentlemen, you can only order from the ordinary sources in Russia. If you order outside you have to pay 100 per cent. import duty, and it would be madness to work your business on the basis of paying 100 per cent. import duty. This difficulty we have had in obtaining the delivery of materials has applied to all the other industries in Russia. Every industry in Russia has been hampered by it, and so bad has it been that representations have been made to the Government to withdraw the import duty on iron in order that there might be a chance of obtaining delivery from outside. People were willing to pay a higher price demanded by Russian producers so long as they could get delivery, but not being able to get deliveries in consequence of the enormous pressure of business, they have been pressing the Government to withdraw the import duty temporarily, but they have refused to do so. This shows that the criticism on the company for not getting delivery of pipes is absolutely absurd and preposterous. The Government Commission of Inspection has been so satisfied with the work so far done that it has dispensed with further inspection. Our installation is now in partial operation, and the use of the power is being gradually extended over our fields. But the transference from one source of power to another over a large sphere of operations is necessarily a somewhat slow process, and the full benefit of the change may therefore not be reaped for some time. We are having numerous applications from other producers for the supply both of power and of light."

Educational Notes.—The Verband Deutscher Elektrotechniker is organising a special summer series of six lectures by specialists on high voltages, to be given at the Technical High School in Charlottenburg in September next. The example is worth notice.

Inquiry.—A correspondent asks for the name and address of the maker (Continental) of a carbon brush suitable for turbo-dynamos, bearing the mark N R C 2 X.

Appointments Vacant.—Switchboard attendant (37s. 6d.), for Northampton Corporation; jointer, for Borough of Haslingden; plumber-jointer for Salford electricity works; electrical drawing office and laboratory instructor (£125) for City and Guilds Technical College, Finsbury. Particulars are given in our advertisement pages to-day.

Institution of Civil Engineers.—On Thursday last the annual conversazione of the Institution was held in the new building, together with an exhibition of scientific and engineering apparatus.

Electric Charging for Commercial Vehicles.—The County of London Electric Supply Co. are now prepared to charge electric vehicle batteries at their City Road station, and facilities have been provided for the drawing in and standing of the vans in question. All inquiries as to rates are to be addressed to their head office, Moorgate Court, Moorgate Place, E.C.

Annual Holidays.—The British Westinghouse Co. announce that their works will be closed from Friday, July 24th, until 7 a.m. on Tuesday, August 4th, for the annual holidays. A staff will be in attendance to deal with matters of extreme urgency.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—On Friday, July 3rd, MR. HERBERT COOCH, assistant City sub-stations engineer of the Charing Cross, West End and City Electricity Supply Co., was presented with a mahogany timepiece on the occasion of his marriage. Mr. Brazil, the head of the department, made the presentation on behalf of the City office staff, men of the City sub-stations, and friends in the head office, and Mr. Cooch suitably acknowledged.

Accrington Electricity Committee has renewed the engagement of MR. WHITTLE as canvasser for a further 12 months at his present salary.

The Bath Electric Lighting Committee has recommended the increase of the salary of the engineer (MR. F. TEAGUE) from £550 to £600 per annum.

MR. JAMES SLEVIN has been appointed borough electrical engineer of Wigan (instead of electrical and tramways engineer), as from August 1st next, at a salary of £400 per annum, with house, coal and light. This appointment has been made in consequence of the desire of the Council that the electrical engineer should now devote the whole of his time to the electricity undertaking. The Tramways Committee has been instructed to take the necessary steps to appoint a tramways manager.

The Brighton T.C. has decided to increase the salary of MR. JOYCE, assistant manager of the electricity works from £300 to £325, with a further increase a year hence to the maximum of £350; that of MR. CLAUGHTON, assistant engineer, from £350 to £375, and at the end of the year to a maximum of £400; and that of MR. T. HENWOOD, mains engineer, from £205 to £220, and a year hence to a maximum of £250.

The Manchester Electricity Committee has fixed the commencing salary of MR. W. DUNDAS, resident engineer at the city stations, at £325 per annum; and the commencing salaries of MR. J. H. NIVEN and MR. E. ATKINSON, shift engineers, will be £171, rising in each case to £190 at the end of 12 months' satisfactory service. The Committee has appointed MR. H. W. SAUNDERS as draughtsman, at £225 per annum.

MR. WAMPACH has been appointed chief assistant engineer at the works of the Folkestone Electricity Supply Co., Ltd.

Tramway Officials.—The Coventry Tramways Committee has recommended the City Council to increase the salary of MR. T. R. WHITEHEAD, engineer and manager, from £450 to £500 per annum.

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The Rotherham Corporation has appointed an Officials' Salaries Committee, to consist of nine members of the Council. A scheme of graded salaries in the various official staffs has been prepared, and amongst the minimum salaries fixed that of the tramways manager and electrical engineer is £600, with three weeks' summer holiday.

On Friday last, MR. G. GROVES, the manager of the Worcester tramways, was married to Miss Ethel J. Walter, daughter of the late Mr. J. Walter, Worcester. Amongst the presents was one from Mr. H. S. Day, chairman of the company, and one from the tramway staff.

The staff of the South Lancashire Tramway Co. have presented a gold watch, suitably inscribed, to MR. S. DEAN, the secretary of the sick club, who has left to become the manager in the sales department of a Liverpool firm.

An Australian newspaper states that MR. ALEXANDER CAMERON has been requested by the Prahran-Malvern (Vic.) Tramway Trust to devote his whole time to the service of the trust, and has agreed. The salary will be £900 per annum.

General.—DR. A. S. MCALLISTER, President-Elect of the Illuminating Engineering Society, U.S.A., was born at Covington, Virginia, in 1875. He received at the Pennsylvania State College, in 1898, the degree of B.S. and subsequently the degree of E.E. For several years later he was connected with the Berwind-White Coal Mining Co. at Windber, Pa., devoting his time to electric lighting and electric locomotive operation and repair. The following year he spent in the factory of the Westinghouse Electric and Manufacturing Co., studying the manufacturing details of direct-current and alternating-current machinery. He took a post-graduate course at Cornell University in physics and electrical engineering, and received the degree of M.M.E. in 1901. Four years later he received the degree of doctor of philosophy. From 1901 to 1904 he was an assistant and instructor in physics and applied electricity at that institution. In 1904 he became acting assistant professor of electrical engineering. In 1905 he became associate editor of the *Electrical World*, of which journal he is now editor-in-chief. Since 1909 he has been professional lecturer on electrical engineering at the Pennsylvania State College. Dr. McAllister is the

author of a book entitled "Alternating-Current Motors" (1906); chapters on "Transformers" and "Motors" in the "Standard Handbook for Electrical Engineers," and he has filed several patents for alternating-current machinery. He has also contributed many articles on engineering subjects to the technical Press and the transactions of scientific and commercial organisations. Prior to his election to the presidency, he had been a director for three years and an active member of several committees of the Illuminating Engineering Society. Dr. McAllister is a Fellow of the American Institute of Electrical Engineers, and a member of the American Association for the Advancement of Science, the American Electrochemical Society, the National Electric Light Association, the New York Electrical Society, the Society for the Promotion of Engineering Education, the Illuminating Engineering Society, the Sigma Xi, Phi Kappa Phi, and Eta Kappa Nu fraternities, and a number of prominent social clubs and organisations.

It is announced at the Massachusetts Institute of Technology that the Romford medal of the American Academy of Arts and Sciences has been awarded to WILLIAM DAVID COOLIDGE, assistant director of the Research Laboratory of the General Electric Co. at Schenectady. The award was made for his invention of ductile tungsten and its application in the production of radiation.

MR. WILLIAM STONE, who has been connected with the Japan Department of Communications since 1873, has been granted an Order of First Grade as a special honour in recognition of his services to Japan during the past 41 years. His services in the negotiations for the reduction of the rate on foreign telegraph messages, and for the purchase of telegraph lines from foreign concerns, are understood as being the most distinguished of all. Mr. Stone is one of the oldest Britishers in Japan still in active service.

The Freedom of the City of Newcastle-on-Tyne is to be conferred upon the HON. SIR C. A. PARSONS, K.C.B., F.R.S., to-day at Newcastle-on-Tyne.

The Civil List Pensions announced last week included one of £100 to DR. OLIVER HEAVISIDE, F.R.S., in addition to his existing pension, in recognition of the importance of his researches in the theory of high-speed telegraphy and long-distance telephony. MRS. JESSIE GRAY figures in the list with a pension of £50, granted in July last year. She is the widow of the late Mr. John Gray, so well known to members of the British Association and to ourselves and readers of the REVIEW. The grant was made in recognition of her late husband's valuable contributions to the science of anthropology, and in consideration of the circumstances in which she was left by his death. A third appearing in the list is MISS KATE BABB HEARDER, who is granted a pension of £70 in consideration of the contributions to electrical science and telegraphy of her late father, Dr. Jonathan Nash Hearder, and of her straitened circumstances. MRS. ANNIE WALLACE, widow of the late Dr. Alfred Russel Wallace, O.M., LL.D., F.R.S., has been granted a pension of £120 in consideration of the eminent services rendered to science by her husband, and of her inadequate means of support.

According to a Sheffield paper, MR. ARTHUR SMITH, electrical engineer to the contractors for the recently opened King George Dock at Hull, has accepted the post of electrical engineer under the Sheffield Corporation for its new waterworks undertaking at Bolsterstone.

MR. JAS. ROBERTS, foreman electrician at the Fenton Collieries, Ltd., who is leaving to take up an appointment at a South Yorkshire Colliery, has been presented by his colleagues with a gold signet ring.

MR. C. O. GABY, of the London office of Messrs. Saxby & Farmer, has secured the appointment of an electrical engineer in Southern India.

The marriage took place at St. Paul's Church, Bedford, on July 2nd, of MR. THOS. BRITTEN, manager of the Arc Electrical Works, Chelmsford (Messrs. Crompton & Co., Ltd.), son of Mr. Arthur Britten, of Great Billing, Northants, and Miss Edith J. Wells, youngest daughter of the late Mr. Charles Wells, and of Mrs. Wells, of Newnham House, Bedford.

At Ospringe (Kent) Parish Church on July 1st, the marriage took place of MR. JOHN SACKVILLE GOLDEN, of the Knole, Charing, near Ashford (Kent), and Miss Frances Mary Louise Tett, only daughter of the late Mr. Henry Seymour Tett, J.P., of Whitehall House, Ospringe, the founder and head of the firm of H. S. Tett, Ltd., electrical engineers, of Faversham and Sittingbourne.

MR. H. V. SCHOFIELD, of the staff of the Newcastle and District E.L. Co., at Close Power Station, and formerly of the Whitby Electricity Works staff, has been appointed battery inspector to the Chloride Electrical Storage Co., Ltd., of Manchester.

MR. H. BEDSON, of the electrical engineering department of the London County Council Paddington Technical Institute, Saltram Crescent, W., has been appointed Assistant Lecturer in Engineering under the Staffordshire County Council.

MR. W. H. BLYTHE, the first holder of the Bacup Mechanics' Institute Scholarship, has obtained the Certificate of Distinction in Electrical Engineering at the Manchester University. For the last year of his tenure he had been engaged in research work on "The Cooling Constants of Turbo-Generators," which resulted in considerable alterations being made to a £40,000 turbo-generator at present in course of erection in Sweden. Mr. Blythe is only the second man to hold such a certificate.

According to the *Times*, the Postmaster-General announces, in the Official Circular, that the Telegraph and Telephone Traffic Sections have been amalgamated, and MR. J. LEE, MR. W. H. A. NAPIER and MR. J. S. JONES become jointly telegraph and telephone traffic managers.

The British Insulated and Helsby Cables, Ltd., have appointed MR. G. E. MASON manager of the new branch which they are about to open in Leeds in the immediate future.

Obituary.—MR. FRANK SNOW.—A Chatham paper says that news has been received from Montreal, Canada, to the effect that Mr. Frank B. Snow, son of Mr. and Mrs. W. C. Snow, of Gillingham, passed away on the 27th ult. from scarlet fever. Mr. Snow was apprenticed at the Gillingham electric light works, and three years ago left England to join the Grand Trunk Railway as travelling electrical engineer of that company.

Will.—MR. JAMES HOWDEN, of Messrs. James Howden and Co., Ltd., Glasgow, who died last November, aged 81, left £388,252 personal, in addition to real estate.

NEW COMPANIES REGISTERED.

Telephone Co. of Pernambuco, Ltd. (136,737).—Registered June 30th, by Norton, Rose, Barrington & Co., 57½, Old Broad Street, E.C. Capital, £100,000 in £1 shares (55,000 7 per cent. cumulative preference). Objects: To acquire, construct, equip, develop, maintain, and work any lines of telephone, telegraph or other means of communication in Brazil or elsewhere, except the United Kingdom. The signatories (with one share each) are:—H. Harper, 10, Penerley Road, Catford, S.E., accountant; A. J. Medleycott, 86, Northumberland Park, Tottenham, N., clerk; M. P. Howell, 101, Croxted Road, West Dulwich, S.E., registrar; C. M. Plumtre, 77, Overhill Road, East Dulwich, S.E., clerk; F. R. Smethurst, 12, Egerton Gardens, Hendon, N.W., buyer to railway company; E. T. Washington, 1, Chaucer Terrace, Eltham, S.E., clerk; H. L. Hamlyn, 20, Rostrevor Road, Fulham, S.W., clerk. Minimum cash subscription seven shares. The first directors (to number not less than three or more than five) are to be appointed by the signatories. H. Tatham is first secretary; qualification, £1.

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Trautmann's Patents Co., Ltd. (136,788).—This company was registered on July 2nd, with a capital of £40,000 in £1 shares, to take over the business of Trautmann Gesellschafft m.b.H., of Dresden, together with certain patents relating to electric or mechanical burglar alarms, to carry on the business of manufacturers of and dealers in the said alarms, signals and the like, experimenters in electrical and mechanical instruments and appliances, &c. The subscribers are:—E. Schneider, 11, Blasewitzer Strasse, Dresden, manufacturer, 100 shares; M. Trautmann, 11, Blasewitzer Strasse, Dresden, engineer, 100 shares; E. L. Leman, 28, Bishopsgate, E.C., engineer, 100 shares; F. Bedford, 85, Gracechurch Street, E.C., clerk, 1 share; A. G. Narris, 85, Gracechurch Street, E.C., clerk, 1 share; P. Werner, 85, Gracechurch Street, E.C., clerk, 1 share; W. S. Rouse, 85, Gracechurch Street, E.C., secretary, 1 share. Minimum cash subscription, £300. The number of directors is not to be less than three or more than nine; the first are E. Schneider, M. Trautmann and E. L. Leman; qualification, £100; remuneration, £150 each per annum (chairman £250). Solicitors, Cruesemann and Rouse, 85, Gracechurch Street, E.C.

Belco, Ltd. (136,797).—This company was registered on July 3rd, with a capital of £35,000 in £1 shares, to take over the business and all, or any, of the assets and liabilities of the British Economical Lamp Co., Ltd., at Windsor House, Kingsway, W.C., and to carry on the business of electrical engineers, manufacturers of electric lamps and fittings, suppliers of electricity, &c. The subscribers (with one share each) are:—Brigadier-General G. P. Bourcicault, 50, West Kensington Mansions, W.; R. Niepel, Windsor House, Kingsway, W.C., merchant. Private company. The number of directors is not to be less than two or more than seven; the first are Count Hutten (chairman), Brigadier-General G. P. Bourcicault, R. Niepel (managing director), J. Sless and L. Spiller (managing director); qualification, £250; remuneration, 8 per cent. of the net profits, divisible. Registered office, Windsor House, Kingsway, W.C.

"Krisco" Patents, Ltd. (136,705).—This company was registered on June 29th, with a capital of £500 in £1 shares, to carry on the business of sellers and distributors of the invention of A. Christmas and H. Christmas for improvements in connection with electric lamps for motor-driven vehicles, known as the "Krisco Magneto Light" (self-contained), to acquire the benefit of an agreement between the said vendors and F. W. Barnes, and all rights, privileges and personal property belonging to the said F. W. Barnes thereunder, and to adopt an agreement with the said F. W. Barnes and R. J. Rodd. The subscribers are:—F. W. Barnes, Rex House, St. Andrew's Square, Surbiton, engineer, 75 shares; R. J. Rodd, The Old House, Surbiton, Walton-on-Thames, electrical engineer, 75 shares; A. W. Love, 5, High Street, Walton-on-Thames, accountant, 26 shares. Private company. The number of directors is not to be less than three or more than five: the first are F. W. Barnes, R. J. Rodd and A. W. Love (all permanent, subject to holding 25 shares each); qualification of ordinary directors, £50 shares. Registered office, The Old House, Church Street, Walton-on-Thames.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Best's Safety Lamps, Ltd.—Particulars of £4,000 debentures, created May 28th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £3,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Joseph Collis, Ltd.—Particulars of £4,000 first mortgage debentures, created by resolutions of May 29th and June 13th, and secured by trust deed dated June 13th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital, and freehold land, messuages and premises in Strood, Kent, with plant and machinery thereon. The Capital and Counties Bank, Ltd., has been appointed to have the custody of the deeds.

Particulars of £2,000 debentures, created May 29th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, subject to any outstanding debs. of a first series for £4,000. No trustees.

Electric Supply Corporation, Ltd. (52,036).—Capital, £250,000 in £5 shares. Return dated June 3rd, 1914; 42,000 shares taken up; £175,000 paid; £35,000 credited as paid. Mortgages and charges: £154,914.

Pontelec Welding Patents, Ltd.—Issue on June 19th, 1914, of £100 debentures, part of a series of which particulars have already been filed.

Winscombe Electric Light and Power Co., Ltd.—Particulars of £3,000 debentures, created November 8th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,130. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Alexander Wright & Co., Ltd.—Particulars of £11,000 debs., created June 12th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £450. Property charged: The company's undertaking and property, present and future, except uncalled capital. No trustees.

West India and Panama Telegraph Co., Ltd. (11,116).—Capital, £2,445,630 in 34,563 first pref., 10,000 second pref. and 200,000 ord. shares of £10 each. Return dated June 11th, 1914. 34,563 first pref., 4,669 second pref. and 88,921 ord. shares taken up. £1,275,530 considered as paid. Mortgages and charges: £80,000.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—Particulars of £21,000 debs., created May 20th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

River Plate Electricity Co., Ltd.—Trust deed, dated June 22nd, 1914, as substituted security supplemental to trust deed dated June 8th, 1903, securing £250,000 deb. stock, of which only £200,000 has been issued, charged on certain land in Argentine Republic, and company's undertaking and other assets. Trustees: River Plate Trust Loan and Agency Co., Ltd., 52, Moorgate Street, E.C.

Oriental Telephone and Electric Co., Ltd.—A memorandum of satisfaction to the extent of £1,600 on June 10th, 1914, of debenture stock covered by trust deed dated June 28th, 1905, and deed of acknowledgment dated June 12th, 1907, securing £200,000, has been filed.

Telephone Co. of Egypt, Ltd.—A memorandum of satisfaction to the extent of £1,674 on June 10th, 1914, of debenture stock covered by trust deed dated July 27th, 1904, and deeds of acknowledgment dated February 21st, 1906, March 4th, 1908, and October 27th, 1909, securing £200,000, has been filed.

Carrara-Versilia Electric Railway and Power Co., Ltd.—Charge on concession and right under the Convention with the Province with Province of Lucia, Italy (dated October 22nd, 1911), and the company's undertaking and property, present and future, including uncalled capital, dated May 25th, 1914, to secure £40,000. Holders: Commercial Bank of Scotland, Ltd., 62, Lombard Street, E.C.

Spencers, Ltd.—Particulars of £2,000 debs., created June 22nd, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £250. Property charged: The company's undertaking, present and future, including uncalled and unpaid capital. No trustees. Also issue on June 22nd of £1,000 debs., part of a series of which particulars have already been filed.

Liverpool Electric Welding Co., Ltd.—Particulars of £500 debentures, created June 18th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Fisher Humphreys & Co., Ltd.—Particulars of £12,500 first, and £4,000 second mortgage debentures, created June 25th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Cutting Bros., Ltd.—Particulars of £4,000 debentures, created July 7th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £3,800. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

A memorandum of satisfaction in full on July 15th, 1913, of debentures dated July 25th, 1911, securing £4,000, was also notified on June 23rd, 1914.

Hydro-Electric Concessions, Ltd.—Mortgage on uncalled capital dated June 29th, 1914, to secure £750. Holders: F. Chaplin and G. Robarts, 15, Lombard Street, E.C.

Pernambuco Tramways and Power Co., Ltd. (126,731).—Issue on June 16th, 1914, of £100,000 debs., part of a series of which particulars have already been filed.

Sheerness and District Electric Power and Traction Co., Ltd. (65,749c).—Issue on April 28th, 1914, of £80 debs., part of a series of which particulars have already been filed.

CITY NOTES.

Chile Telephone Co., Ltd.

IN their report for the year ended March 31st, 1914, the directors state that the aggregate number of subscribers at all centres at the end of the year was 13,975, a gain of 1,824 for the year. The gross revenue in Chile from all sources was, $3,157,003, an increase of $320,453; the expenditure in Chile was, $1,620,821, an increase of $244,406; the net income in Chile from all sources was, $1,536,182, an increase of $76,048. The average rate of exchange for the year was 9·60d., as compared with 10·13d. in the previous year, giving a decrease for the year of 0·53d. Converted into sterling at these rates, the net income was £61,454, a decrease of £169. The liquid assets and liabilities in Chile on March 31st, 1914, were valued at 9½d., the current rate of exchange on that day, as compared with 10d. at which they were valued on the corresponding date of the previous year. The balance to the credit of the revenue account, including £3,901 brought forward, is £61,146, of which £15,683 has been expended on replacements, &c., of plant, and £15,106 carried to reserve. An interim dividend of 3s. per share, free of income-tax, was paid on January 16th, and the directors now recommend a final dividend of 5s. per share, free of income-tax, leaving £3,956 to be carried forward. The board reports, with much regret, the death of Mr. Frank W. Jones, who was an original director of the company, and the retirement of the Hon. Herbert T. Allsopp, on account of ill-health.

The meeting is called for July 15th.

Underground Electric Railways Co. of London, Ltd.—At a meeting held in London last week, the resolutions passed relating to the conversion of the company into a holding company were confirmed.

Dublin United Tramways Co. (1896), Ltd.—Interim dividend for the half-year to June 30th, 6 per cent. per annum on the preference and 5 per cent. per annum on the ordinary.

British Electric Traction Co., Ltd.—A lengthy statement has been circulated by the directors to the preference and ordinary stockholders and the holders of income certificates, in which a scheme is advanced in detail for reducing the capital by £908,372.

Stock Exchange Notices.—Applications for the quotation of the following in the Official List have been made:—

Constantinople Telephone Co.—£200,000 6 per cent. obligation bonds of £100 each.

Lanarkshire Tramways Co.—Further 3,500 shares of £10 each, fully-paid.

City of London Electric Lighting Co., Ltd.—It is stated in the daily papers that the Streets Committee is advising the City Corporation that it would be inexpedient to execute the powers of purchasing the electric light companies in the City either this year or in 1915.

Aluminium Corporation, Ltd.—The resolutions referred to in our last issue were unanimously carried at the extraordinary general meeting held on July 1st.

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General Electric Co., Ltd.

THE annual meeting was held on July 2nd at the Cannon Street Hotel, E.C., Mr. H. HIRST presiding.

In proposing the adoption of the report (ELEC. REV., p. 1083), the CHAIRMAN said he was happy to think that during the past twelve months the company had had its share of benefit from the wave of industrial prosperity which had swept over the whole world during the last few years. They showed again a progressive balance sheet and he thought their proposals as to how to deal with the results should prove to the shareholders that they realised that this pleasant state of affairs could not continue for ever, and they were making every possible preparation to face cheerfully and successfully more difficult times whenever they fell on the country generally or on the company in particular. The net trading profit for the past year was £157,894, as against £145,261 for 1913. Adding to this the balance brought forward they had to dispose of the respectable total of £190,225. Debenture interest absorbed £8,000; depreciation £24,328. The directors had put aside the same generous amount as in past years, but the state of the books permitted them to use out of this amount the sum of £10,000 for removal expenses which they must incur as soon as their Kingsway building was completed. They had provided £10,156 for managing director's and employees' bonus. He thought shareholders ought to know that the total bonus paid to employees was considerably larger, and the difference between the figures shown and the amount actually paid was defrayed out of revenue. They had put aside £14,000 towards writing off the expenses of the new issue of capital. This issue was not made during the year under review, but since its completion, but, as the commitments existed, he trusted they would agree that it was wiser to start meeting them at this moment. The rest of the allocations were similar to last year. The carry-forward was £4,000 more, and a further £3,000 appropriation to staff benevolence was still conditional. He was, however, in a position to announce that a scheme was practically completed, and he would probably be able to inform them next year that they had found it desirable to co-operate with the long-service members of their staff in a scheme of insurance with one of the leading insurance companies, which would probably free the amounts set aside for other purposes. The only outstanding feature of the balance sheet was that stock in trade and sundry debtors had again increased, but he would like to emphasise that, in spite of this increase, their proportion to the business done was smaller than in any previous year. The fact that the reserve fund now equalled the whole of the debenture issue was also worth noting. Those who watched the conservative and careful way in which they were disposing of their profits might wonder "Why all this care, what do they fear? what is at the back of it all?" He was happy to say that they feared nothing and that there was nothing at the back of it except a firm conviction in the continuance of electrical expansion. If they wished to share in this expansion and to retain the leading position, they would have to undertake and solve many problems, and they could not hope that everything they undertook would always lead to direct success. The possibilities were tremendous and they wished to give themselves every chance of attaining them, but beyond this they had recently undertaken a new and grave responsibility by increasing their capital. Their recent issue of £300,000 preference and £100,000 ordinary shares was a great success and showed confidence on the part of the public in the company. On that occasion they announced that a part of this money would go towards building central offices and warehouses in Kingsway. The contract for this building had been placed but, owing to the building strike, they had not been able to go ahead with it as yet. There might be delay before they could occupy it; when they did they would better be able to display their manufactures and they would also save the heavy expenses and the dislocation of trade caused at the present time by the carrying on of their London business in something like thirteen different buildings. A prominent feature of their business during the last few years had been the possession of the sole rights of the Osram lamp within the British Empire. By a large-minded arrangement between the leading firms of Germany, America, and this country, co-operation in research and laboratory experience was taking place. By that means they would participate, together with their friends, in every progress made by the joint and organised efforts of many hundreds of chemists and scientists throughout the world. It was extraordinary what rapid advances were being made. A few years ago the Osram was a delicate and brittle, though very efficient lamp. To-day the filament could be made of an unbreakable drawn wire of a diameter scarcely visible to the naked eye. During the past year the half-watt lamp had put in an appearance, and they were already doing a satisfactory business in half-watt Osrams. That was an incandescent lamp with the filament burning in nitrogen instead of in a vacuum. What further surprises might be in store for them through development in this direction he should not care to predict, but, partly from what he saw and partly intuitively, he felt that these surprises were very close ahead of them. The progressive results of this year's trading had been principally due to the expansion of their engineering and other departments. A certain class of the public identified them too much with the small electric supply business. It was true that that branch of electrical engineering had played an important part in the development of the company. It was also true that the growing demand for domestic electrical apparatus, including electric heating and cooking, would claim a considerable part of their capital and attention. But it was too little realised that the company to-day was in the front rank of those who supplied the world with large electrical machinery. They were making a particular study of large engineering units and they had realised that, in the future, electricity supply undertakings would tend in the direction of larger units, of high-speed turbines coupled to generators, or generators coupled to Diesel or slow-speed gas engines. They were producing machines up to 6,000 KW., and they hoped to go still further. So much for the generating of the current, but the application of this current offered an increasing field for enterprise. They now employed a number of specialists who could study and advise upon the problems of dock lighting and railway lighting, on the equipment of rolling mills, on the electrification of breweries, distilleries and spinning mills. In the past it had been the habit to build machines and let the various trades struggle for themselves as to how they could best make use of them. They realised the benefit to their clientèle as well as to themselves in providing able engineers to study the technical requirements of each particular trade. In this way they obtained the best results from special and particular machinery and were able to advise on the special arrangement of drives and grouping of machinery. Good results had already accrued from this policy, and they expected still better in the future. In a similar way they had made a close study of apparatus designed for the handling of heavy material, for instance, the handling of iron by magnets, and the development of winders and haulage gear for coal mines. They had always manufactured machinery which generated current; they had always manufactured machinery which applied and controlled current. The one hiatus had been that they had not manufactured the material which transmitted it. The last important development to which he wished to refer was the cable works at Southampton. These cable works would complete the circuit, and they would now manufacture everything electrical that could be manufactured. They found it essential that they should no longer be dependent for their cables and wires on the supplies from either competitors or foreign sources. The close relations which they had for years enjoyed with the firm of Messrs. Pirelli & Co., of Milan, one of the best and most importable cable-making concerns in the world, had led to a partnership agreement. They had, therefore, in conjunction with Messrs. Pirelli, formed a company for the erection of a cable factory at Southampton; for the present its capital consisted of £200,000, each party subscribing 50 per cent. The works were now completed and the machinery was being installed as rapidly as possible, and they hoped within a few months to supply cable and wire made at the Southampton factory of a quality and at a price that would compare favourably with that of any other firm. This review would show them that they were taking every step that might help to make them more powerful and more successful and less susceptible to conditions over which they had no control. It should, however, also justify their policy of building up large reserves and of a conservative division of profits. They had so many irons in the fire that, if they neglected to solidify the basis on which they rested they ran a risk of being too much disturbed by periods of depression, by strikes, and by the hundred and one unforeseen and unforeseeable troubles which would afflict any large organisation. With the care they were taking and with the provisions they had made, however, and under anything like normal conditions, he was looking forward to the future cheerfully and full of confidence.

Mr. E. G. BYNG seconded the motion, which was carried without any discussion.

Chilian Electric Tramway and Light Co., Ltd.

THE annual meeting was held on July 2nd at the offices, 1, London Wall Buildings, E.C., Mr. LUDWIG BREITMEYER in the chair.

In proposing the adoption of the report, as below, the CHAIRMAN said that at the last meeting he was able to present record figures, and he was pleased to be again in the position of informing them that the year 1913 furnished another record. With regard to the tramways, although they had carried about seven million more passengers, owing to the fall in the rate of exchange and increased operating expenses the profit fell short of the previous year by about £23,000. The lighting and power department, however, had made good and remunerative progress, the receipts for the past year being 7,658,983 pesos, or an increase of 1,092,311 pesos over the preceding year, the resulting profit being more than sufficient to make up the decrease in the tramway profit. The hydraulic works were now in full working order and giving satisfactory results. The capital expenditure during the year amounted to £251,173, but considerable further expenditure had yet to be made to meet the growing demands on the business, and if they were to reap the benefits they must keep pace with its requirements.

Mr. HECTOR DE BACKER seconded the motion, which was adopted.

The report for the year ended December, 1913, says that after deducting interest and redemption of debentures, London office and other charges, there is a balance to the credit of profit and loss account of £163,557, plus £8,381 brought forward, making a total net balance of £171,938. From this amount £60,000 has been placed to renewals reserve account, and £7,000 to insurance suspense account. There remains an available bal-

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ance of £104,938, out of which the directors now recommend the payment of a dividend of 6 per cent. on the preference shares for 1913, amounting to £39,000, also the payment of the following further dividends in respect of the arrears outstanding on these shares, viz., dividend of 1 per cent., the balance of the arrears for the year 1902 amounting to £5,500, the full dividend of 6 per cent. on account of the year 1903 amounting to £33,0000, and 3 per cent. on account of the year 1904 amounting to £18,000. This leaves a balance outstanding on this account of £146,000. The balance of £9,438 remaining to the credit of profit and loss account will be carried forward to next year. The average rate of exchange ruling during the year has declined from 10¼d. to 9 25-32d. During 1913 the tramways carried 109,444,579 passengers, earning $9,765,669, as against 102,677,482 passengers, earning $9,114,551 in 1912, but owing to the heavy increase in the working expenditure the result is a decrease in the profit as against 1912 of $491,670. The lighting department again shows a gratifying advance over the previous year; the receipts during 1913 amounting to $7,658,983 as against $6,566,671 in 1912. Some small extensions on the track have been completed during the year, additional rolling stock acquired, and the enlargement of the power station has been commenced; the various improvements undertaken have involved an expenditure on capital account during the year of the sum of £251,273 15s. 4d. Mr. Carl Müller resigned his position as managing director of the company in December last. He will retain his seat on the board. Mr. S. W. Jameson was elected a director in February of this year.

Edmundsons' Electricity Corporation, Ltd.

THE directors' report for the year ended 31st March, 1914, states that the business of the company continues to show steady progress. Gross trading profit has increased by £911, and dividends and interest have increased by £1,640, whilst the loss on working the local authorities' undertakings is reduced by £137. The net profit, after providing for administration expenses and for debenture stock interest and redemption amounts to £23,125, an increase of £4,226. After deducting the interim half-yearly dividend paid in January last on the cumulative preference shares, there remains a balance of £17,125, which the directors recommend should be applied as follows: Carried to reserve, £9,000; final half-yearly dividend for the year ended 31st March, 1914, on the cumulative preference shares, £6,000; carried forward, £2,125. During the past year the Cromer undertaking has been taken over by the company from the Cromer Urban District Council.

From the schedule showing capital expenditure and gross profits of subsidiary and other companies for the years 1912 and 1913, we extract the following:—

	Gross profit (before providing for capital charges and depreciation). 1913.	1912.	Lamps connected (equiv. 88-watt). 1913.	1912.
Alderley	£2,849	£2,842	27,823	24,898
Bromley	13,196	13,038	115,518	107,649
Folkestone	17,994	16,073	139,100	131,253
Guernsey	5,895	5,529	126,774	112,930
Isle of Wight	14,402	14,171	133,809	125,155
Ilfracombe	1,252	1,234	21,159	19,936
Lymington	2,058	1,896	20,894	18,610
Melton Mowbray ..	2,654	2,519	23,206	21,965
Newmarket	2,690	2,559	29,729	27,811
North of Scotland ..	7,075	6,395	87,570	76,882
Ramsgate	3,492	3,619	40,478	37,519
Scarboro' Trams ..	790	877	—	—
Salisbury	5,783	6,346	43,881	41,621
Urban Co.	61,684	54,265	760,319	677,495
Wycombe	6,242	5,730	65,250	63,505
Cromer	1,109	1,100	16,828	16,805
Dorking	2,643	2,290	24,141	21,908
Frome	1,446	1,499	48,991	43,745
Hamilton	3,640	3,639	67,368	58,427
Surbiton	*4,254	*4,637	*47,313	*42,518
	£161,228	£149,768	1,839,651	1,669,952

* Figures for year ended March 31st.

Total capital expenditure, 1913, £3,098,053; 1912, £3,001,669.

The meeting was held yesterday (Thursday).

South American Light and Power Co., Ltd.

THE 11th annual general meeting was held on Thursday, at Dashwood House, E.C., Mr. T. P. GASKELL presiding.

In proposing the adoption of the report (ELEC. REV. p. 26), the CHAIRMAN said it would be seen that they had done much better last year than in the preceding 12 months. They might, in fact, have paid 7 per cent. instead of the 5 per cent. which they recommended, but unfortunately although the past year had been a good one they could scarcely hope that they would do better in the current year, if indeed they did as well. For the first nine months of the year under review they were making very much larger profits than in the corresponding period, their net profits increasing by about 15 per cent., but in the last three months their receipts were actually less than for the corresponding three months. Therefore when the question of the dividend came to be considered, although as he had said they had earned sufficient to pay 7 per cent., the board thought it would be more prudent to only pay 5 per cent. and to devote £3,000 of the profit towards repaying the expenses of the debenture issue made 18 months' ago. In a company like that it would be a great drawback if they paid a larger dividend one year and then found that they could not continue it. He hoped and believed that the shareholders would think that the board had acted wisely therefore in limiting the dividend to the 5 per cent. recommended in the report.

Mr. F. O. SMITHERS seconded the motion and the report was adopted without discussion.

In their report the directors state that the increase in the business has been as follows:—

	1912.	1913.	1914.
Arc Lamps, connected	639	733	813
8 c.p. Inc. Lamps, connected ...	46,530	52,234	56,142
Fans, connected	271	312	311
Motors	81	91	116
Customers	1,381	1,706	1,924

Electric and General Investment Co., Ltd.

THE annual meeting was held on June 30th, at the offices, 1, Great Winchester Street, E.C., Mr. J. B. Braithwaite presiding.

In moving the adoption of the report (ELEC. REV., p. 1085), the CHAIRMAN said the record of the year was a very simple one. They had earned £15,282, as compared with £14,797 last year; in other words they had earned approximately £500 more. They proposed to adopt the same conservative policy as last year and distribute £3,000 in dividends—that was the full 10 per cent. on the £20,000 paid up on the ordinary shares, and 6d. per share on the preference shares; to add £3,285 to their provision for contingencies, raising that fund to £84,000, and to carry forward a little over £3,000. It would be seen that the amount available for distribution was divided into about three equal parts; one was given to the shareholders, one was placed to the carry forward to ensure as far as possible the same dividend next year, and the larger balance was carried to the provision for contingencies. In addition to making that provision, they had during the year redeemed and cancelled £1,707 worth of debenture stock, so that the amount outstanding was only £17,863, as against the original sum of about £22,000. They would therefore see that the stock, which was the only thing which stood in front of the preference shares, was being steadily wiped out. He might say that there had been a good many difficulties of various kinds during the year, and on the whole he thought they were fortunate in having earned £500 more than in the preceding year. It would not be their policy to increase their dividends materially—certainly by not more than £1,000—until the reserve for contingencies was fully equal to depreciation on their investments, which was not quite the case at present. They had not quite reached the figure at which they could say that the depreciation on the investments was fully represented by the contingencies fund, but they were getting nearer to that position every year they added to the fund.

Mr. J. C. BULL seconded the motion, which was carried unanimously.

Marconi International Marine Communication Co., Ltd.

COMMENDATORE MARCONI presided at the Hotel Metropole on June 30th over the annual meeting.

In moving the adoption of the report (ELEC. REV. p. 1084), the CHAIRMAN said that the company had continued to make sound and substantial progress. The receipts from ships' telegrams, news services, rentals, etc., during the past year was £146,316, as compared with £100,322 in the preceding year, showing an increase in round figures of £46,000. On the other hand the expenses, although necessarily higher, had not increased out of proportion. The principal item of increase was shown under station expenses, which of course rose with the number of stations, and likewise the amount of depreciation. On the debit side of the balance sheet the issued capital had been increased to £306,084, and on the credit side, plant, apparatus, furniture, and stores, had increased to £213,000, which after making allowance for depreciation, showed an addition of £69,000, which was accounted for of course by the additional ships which had been fitted with wireless apparatus. It was a matter of great satisfaction to the directors, and, if he might be allowed to say so, especially to himself, to see this company now soundly on its feet, earning reasonable profits and paying a fair return to its shareholders, for he could not forget that when this company was registered in the year 1900, it had for its object the introduction of wireless telegraphy upon ships at sea to save life and to save ships, but with very few exceptions they found very little disposition to take advantage of the valuable services which they offered. In these days when many ships had been saved by means of wireless telegraphy, and thousands of people owed their lives to the fact that installations were on board most of the important ships, it would be scarcely believable to those of their shareholders who had not been thoroughly acquainted with the development of the company, that they expended something in the neighbourhood of £200,000 in creating and popularising their service before they were ever able to earn a profit. As a result, however, of the great energy of their staff and the hard work of every

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member of the company, they were able this year for the fourth successive year to pay a reasonable dividend. He thought he was warranted in saying that the nation at large, if not the whole civilised world, owed respect at least to this company for the untiring and patient work which it had done in causing loss of life at sea to be so much less than it otherwise would have been; yet, notwithstanding, there were members of Parliament who never missed an opportunity of attacking their company and complaining of the monopoly which they alleged the company possessed. He would ask them if they could contend that they had turned that monopoly to an improper account. Did the history of the company suggest anything of the kind? Did the ten per cent. dividend which they were now able to declare, after nine years without any return at all for the capital invested, savour of extortion? Had they any knowledge or appreciation of the company's vast organisation? Did they know that every young man serving with them as a telegraph operator on board ship, and there were now some 1,500 of them, had been taught by them without charge; that not one of them had ever failed to do heroic duty, even to the sacrifice of his life when circumstances had called upon him to do so. There had never been any evidence that a ship in distress, fitted with a Marconi installation, had ever yet called for assistance without receiving an answer. In every important port throughout the world there was a Marconi inspector ready to overhaul the wireless apparatus of every ship that called, and they and the operators must work together under carefully considered rules which had to be most rigorously adhered to by the company to ensure the magnificent discipline so essential to the public and which prevailed throughout the service. Only a few days ago, Lord Mersey, as president of the court at present inquiring into the disaster which recently overtook the "Empress of Ireland," complimented the Marconi operators, and stated that they were a credit to the service to which they belonged, and innumerable were the letters of appreciation which were received by the company from all the important shipping companies throughout the country. He contended that it did not lie in the mouth of anybody to complain of the monopoly which the company possessed—if it possessed one—for it owed it to the invention, to an organisation and a perfect discipline, which were essential and could not exist were the business in many hands, and to the important capital which it had invested, so providing a valuable well conducted and reliable service to the whole travelling public, which it was very probable would never have existed at all but for the company's own efforts. In view of the bill which had been introduced into Parliament to carry into effect the International Convention for the Safety of Life at Sea, under which wireless telegraphy became obligatory upon ships carrying fifty persons or more including crew, the directors had consented to enter into an agreement with the Board of Trade to supply their installations in a similar way as they had done before whenever they might be called upon to do so. It was proposed that the remuneration which they were to receive should be left to a referee. Having regard to the very reasonable terms which the company had been in the habit of charging, the directors saw no objection to accepting these conditions. The directors had established, subject to the approval of shareholders, a superannuation fund, of which the North British & Mercantile Insurance Co. would act as trustees. This fund was for the purpose of providing pensions for employees of the company when they eventually retired from work. Similar funds had been brought into existence by other Marconi companies, and it was thought that it was highly desirable, now that this company had been placed on a sound profit-earning basis, to commence to make provision for employees upon their reaching the age of well-earned rest. The company and its employees would contribute jointly and in equal proportions to the fund, and the directors were of opinion that such a scheme was due to its employees, besides going a long way to encourage them to remain in the company's employ, and materially assisting therefore in maintaining the discipline of such pre-eminent importance in the responsible work which the company conducted.

Mr. GODFREY ISAACS (managing director) seconded the motion, which was carried without discussion.

The retiring directors were re-elected, and at an extraordinary meeting which followed, the shareholders agreed to an alteration in the articles of association to allow of the superannuation scheme being carried out.

Telephone Development Co. (1912), Ltd.—The report of the directors for the year ending June 30th, 1914, states that for the year ending June 30th, 1914, there is a balance to the credit of the revenue account of £16,078. A note in the revenue account shows that dividends to the further amount of £4,000 are estimated to have accrued within the period covered by the accounts. The company was incorporated on April 3rd, 1912. The directors now recommend that a dividend be paid at the rate of 5 per cent. per annum, calculated from the date of payment of the respective instalments on the shares, less income-tax. The payment of this dividend will absorb £14,742, leaving £1,336 available for the payment of directors' fees and carry forward to next year. Mr. J. E. Kingsbury offers himself for re-election as a director. It is proposed to change the name to the Telephone Development Co., Ltd.

Crompton & Co., Ltd.

THE directors, in their report to March 31st last, state that although the company was registered on June 19th, 1913, the business was taken over as from April 1st, 1913. The accounts now presented, therefore, cover a period of 12 months. The gross profit for the year is £48,672. After deducting general charges, depreciation, interest on debentures and other items, there remains an available balance of £13,551. Of this amount there has been set against the purchase price of the business, as representing approximately the profit earned up to June 19th, 1913, £2,970. The directors recommend that there be placed to general reserve fund £2,500; written off preliminary expenses, £1,500; dividend on the preference shares, at the rate of 5 per cent. per annum, £4,392; balance to be carried forward, £2,189. The directors have pleasure in reporting that the reconstruction of the company has had a beneficial effect on the business. All departments of the company are fully employed, and the outlook for the current year is promising. A technical difficulty raised by certain debenture holders of the old company has been overcome by a scheme continuing the debentures in force as debentures of the new company, the interest being increased to 5½ per cent. per annum. The scheme has been confirmed by the Court. Owing to pressure of other business, Mr. Lionel Hanbury retired from the board in October last. The Hon. Sir C. A. Parsons, K.C.B., has been appointed a trustee for the debenture-holders in the place of the late Sir Charles D. Rose, Bart.

The meeting is to be held on Monday next.

Continental.—FRANCE.—Among the new companies recently formed in France are:—The Société Regionale Electrique de Saone-et-Loire, formed at Lacrost (Saone-et-Loire), with a capital of £4,000; the Société Union Electrique de l'Auvergne et du Bourbonnais, Paris (149, Rue de Rome), with capital £9,000; and the Société des Forces Mortrices de la Vienne, Poitiers (33, Rue Renadet), with capital £100,000.

The report of the Société Lyonnaise des Forces Motrices du Rhone for the last financial year shows an available net profit of £57,666, which is being disposed of as follows:—To depreciation, £18,000; for renewal of plant, £20,000; to the shareholders, £8,400; to the holders of the founders' shares, £5,880; to the directors, £1,680; to the share reduction fund, £840, leaving a balance of £2,866 to be carried forward.

BELGIUM.—A profit of £3,495 is reported for the last financial year by the Antwerp Telephone and Electrical Works, of Berchem, Antwerp.

The report of the Société Internationale de Telegraphie Sans Fil, of Brussels, for the last financial year shows a profit of £8,058.

ROUMANIA.—The Electrica Co. (Lahmeyer), of Budapest, reports a net profit of £18,800 for the last year, as compared with only £16,816 in the preceding 12 months. The dividend is being increased from 8 to 9 per cent. The report of the Roumanian General Electric Co., of Budapest, a branch of the A.E.G., of Berlin, shows a net profit for 1913 of £6,276, as contrasted with only £3,597 in the preceding year. A dividend of 5 per cent. is being declared.

TURKEY.—The *Times* Brussels correspondent states that there was formed in Brussels on June 30th the Société des Tramways et Electricité de Constantinople, with a capital of 18 million francs, divided into 72,000 shares at 250 fr., for the purpose of becoming the principal shareholder in the Constantinople tramway concern, and obtaining a monopoly of electric lighting in Constantinople by agreement with the firm of Ganz, of Budapest. The formation of this company is the result of the Belgo-German group formed in September, 1911, which acquired the capital of the Metropolitan Railway, of Constantinople, from Galata to Pera. The chairmanship of the new concern has been entrusted to M. Heineman, director of the Société Financière des Transports, Brussels.

Japan.—The electric light companies in Tokio are just now suffering from the effects of severe competition, which is reflected in the reduced profits. Thus, the Tokio Electric Light Co., while again paying a dividend at the rate of 10 per cent. per annum for the last half-year, is only able to carry forward a sum of £13,621, as against £36,898 brought over from the last half-year. The available profit for the six months, including the sum just mentioned, was £220,821, out of which £9,200 is being placed to reserve, and £198,000 distributed in dividends.

Sheerness and District Electric Power and Traction Co., Ltd.—According to the *Financial Times*, the accounts for 1913 show a loss, after providing for debenture interest, of £1,805, thus converting a credit balance brought forward into a deficiency of £1,476.

Sao Paulo Tramway, Light and Power Co., Ltd.—The directors announce a dividend of 2½ per cent. on the capital stock.

Lima Light, Power and Tramways Co., Ltd.—The directors have declared a dividend of 1 per cent. for the quarter ended March 31st.

Telegraph Construction and Maintenance Co., Ltd.—The directors announce an interim dividend of 12s. per share.

Clontarf and Hill of Howth Tramroad Co., Ltd.—The directors announce an interim dividend of 3s. per share.

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STOCKS AND SHARES.

Tuesday Evening.

AFFAIRS in the Stock Exchange seem to be looking up. It is necessary to use this tone of caution, because so many false starts have been made of late that mere habit of mind leads one to ask what will be the next unpleasant surprise to be sprung upon markets. There are various quarters from which a buffet or two may yet come, but the pronounced cheapness of money is forcing unfavourable factors to one side, and, by leading the bears of Consols a rare dance, infuses strength into all investment departments of the House.

Foreign banking firms report a large demand for money over the period when the big French National Loan will open its subscription-lists, so evidently the stags abroad are busily sharpening their antlers.

Investment it is which has led to rises in such shares as Charing Cross Electric Lighting Preference, City Preference and County Preference. People have had such painful experiences of foreign securities, in too many cases, that they are turning to such domestic issues as preferable from the safety standpoint, and with the available supply none too liberal, the present quiet demand makes itself felt upon quotations. The ordinary shares in the Electric Supply list are somewhat overlooked, and the common tendency towards lower prices which the summer brings, is noticeable in declines amongst St. James's, City Lights and Metropolitan Ordinary. Moreover, the absence of any supporting anticipation is making itself felt, in regard to which all that can be said at present is that movements are afoot which will fructify by-and-bye. Edmundson's report shows good progress, and the Preference are ⅛ up. Central Electric Debentures put on 1½ points.

Home Railway stocks ignore the latest labour outbreak at Woolwich Arsenal, and hang hopes and prices alike upon the rising of Consols. Steam stocks have risen appreciably within the past few days. Undergrounds kept pace with them. Metropolitans and Districts, with Metropolitan Surplus Lands, show substantial advances, but the Underground Electric Railways share group is dull, with falls in the £10 shares, though the bonds are better. The market rather fears the appointment of a Commission to inquire whether the motor-omnibuses or not are to contribute something to the upkeep of the roads. At Sheffield it was decided the other day that local omnibus services must pay for their running powers, and this plain hint has not been lost upon proprietors of the various issues connected more or less directly with the London General Omnibus Company. A sharp fall has lowered National Steam Car shares. Moreover, the parlous condition into which the London tramway business has drifted, renders it highly probable that new, vigorous competition may be expected from the L.C.C. trams. Large orders are recommended to be placed with the Brush Company for the supply of electric trailers to the trams, though the object of this is economy rather than competition.

London United Tramways Debenture stock and London and Suburban issues are unchanged on the week. Metropolitan Electric Trams First Debenture stock has shed a point.

Anglo-Argentine Trams First Preference shares at 4⅞ are better, but the Seconds have eased off ⅛, and at the middle price of 4¼ they give the handsome yield of 6½ per cent. on the money. United Electric Trams of Monte Video are down 5s. Brisbane Trams Investment Ordinary gained ⅛; there are vague rumours that the company is biding its time for a new issue of Debenture stock.

The Mexican stocks and shares are rather a better market. Irresponsible reports continue to credit the Niagara Conference with pacific intentions, and brisk rises in Mexican Railway stocks supplied a trifle of driving power to the utility descriptions. It takes little, however, to scare bullishness, and not all in the group show strength. Canadian generals are shaky, Common and Preferred shares both falling 2 points, but Shawinigans rose 4. Barcelona Tractions have dropped 2, to 21. Brazilian Tractions unsteadied on the news that the large loan which the Brazilian Government expected to raise, had been called off, for the time being, in consequence of negotiations breaking down.

Further depression in West India and Panamas is one of the features amongst cable shares. The Ordinary broke to 1 5/16, and the Preferences are dull. The market is still worried by the remnant of stale bull accounts in the shares. At the present price they should be worth looking up. Indo-Europeans are 10s. higher, and Telegraph Constructions gained 30s. at 38½. Advances have been secured by the Anglo stocks, Western Telegraphs, Eastern Ordinary, Globe Ordinary and Preference, while Commercial Cable Debenture has followed up its 2 points rise with another of 1½. The only dull spot, apart from West India and Panama shares, is Direct United States Cable, where the price is ⅛ easier.

The Marconi market has given way again. No other shares in the Stock Exchange are the sport of rumours to one-half the extent that Marconis are. Some of them, at least, must soon be laid to rest by the dividend announcement and the issue of the report. The net decline since last we wrote is 7/16. After the official close of business to-night, Tuesday, Marconis fell further to 2½ sellers.

The British Electric Traction scheme for reorganising the capital account is now available. Its main feature is the proposed consolidation into two stocks of the present cumbrous capital, and the writing down the capital by £908,000. Upon first examination, the proposal looks a fair and equitable effort towards the various classes, and the market view is expressed by advances of 2 points in the 6 per cent. Preferred and the Deferred stocks, though the first Debenture fell 1. Stockholders are asked for their opinions on the proposals.

Willans & Robinson Preference has dropped 2, and Babcocks are ⅛ lower, the Preference ⅛ better. Manufacturing shares keep firm. Callenders are 2s. 6d. up. No change has occurred in Brush issues. General Electric New Ordinary are very firm at 30s. premium. The Crompton report was considered satisfactory. Rubber shares are a dull and stupid market, activity being held in suspense by the lumpishness of the raw material.

MARKET QUOTATIONS.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, July 8th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt	5/-	..
a " Nitric	"	22/-	..
a " Oxalic	per lb.	2¼d.	..
a " Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	"	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29	..
a Bleaching powder	"	£6 5	..
a Bisulphide of Carbon	"	£18	..
a Borax	"	£17 10	..
a Copper Sulphate	"	£21	..
a Lead, Nitrate	"	£28 10	..
a " White Sugar	"	£27 10	..
a " Peroxide	"	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a " Chlorate	per lb.	3½d.	..
a " Perchlorate	"	3½d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	"	7½d.	..
a Shellac	per cwt.	65/-	5/- dec.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	"	£8 10	..
a " Recovered	"	£5 10	..
a " Lump	"	£5 5	..
a Soda, Caustic (white 70/72 %) ..	"	£10	..
a " Chlorate	per lb.	3½d.	..
a " Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£86	..
b " Wire, in ton lots (1 to 14 S.W.G.)	"	£107 6 8	..
b " Sheet, in ton lots ..	"	£112	..
g Babbitt's metal ingots	"	£50 to £221	..
c Brass (rolled metal 2° to 12° basis)	per lb.	7½d.	½d. inc.
c " Tube (brazed)	"	9½d.	½d. inc.
c " " (solid drawn)	"	7½d.	½d. inc.
c " Wire, basis	"	7½d.	½d. inc.
c Copper Tubes (brazed)	"	9½d.	½d. inc.
c " " (solid drawn)	"	9½d.	½d. inc.
g " Bars (best selected) ..	per ton	£78	£1 inc.
g " Sheet	"	£78	£1 inc.
g " Rod	"	£78	£1 inc.
d " (Electrolytic) Bars ..	"	£64	..
d " " Sheets ..	"	£82 10	..
d " " Rods	"	£70	..
d " " H.C. Wire	per lb.	8½d.	..
f Ebonite Rod	"	4/6	..
f " Sheet	"	4/-	..
a German Silver Wire	"	1/6	4d. dec.
b Gutta-percha, fine	"	6/10	1/2 dec.
h India-rubber, Para fine	"	2/10	½d. inc.
l Iron Pig (Cleveland warrants) ..	per ton	51,3½	½d. inc.
l " Wire, galv. No. 8, P.C. qual.	"	£14	..
g Lead, English Pig	"	£19 15	2/6 dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£6 15	5/- dec.
e Mica (in original cases) small ..	per lb.	6d. to 8s.	..
e " " " medium	"	3/6 to 6/-	..
e " " " large ..	"	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	"	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	"	1/1 to 1/3½	..
p " " rolled bars & rods	"	1/0½ to 1/3	..
p " " rolled strip & sheet	"	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	£65	..
g Tin, Block (English)	"	£146 10 to £147 10	£5 10 inc.
n " Wire, Nos. 1 to 16	per lb.	2/3	..
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh's (Vieille Montagne bnd.)	"	£25 2 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare
h Edward Tull & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Prospectus.—*Barcelona Traction, Light and Power Co., Ltd.*—The list was to close last Saturday in an offer for sale of £3,118,060 5 per cent. first mortgage 50-year bonds in this company, of which Dr. F. S. Pearson is president, and Dr. H. F. Parshall is a director. The offer was made at the price of 82½ per cent.

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SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations July 7th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	¼ — ⅜	..	Nil
Do. 5 % Pref.	1	5	5	⅞ — 1	..	6 12 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	15½ — 17½	+2	..
Do. Do. Deferred	100	..	..	8 — 10	+2	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	86 — 89 xd	..	6 11 2
Do. 7 % Non-Cum. Pr'f.	100	8	8½	53 — 56 xd	..	5 18 8
Do. 5 % Perp. Deb.	100	5	5	91 — 93	−1	5 7 5
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 79	..	5 14 0
Central London Railway, Ord.	100	8	8	87 — 89	..	4 16 9
Do. Gtd. Assented	100	..	4	83 — 84	..	4 15 8
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	84 — 86	..	4 18 0
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	80 — 89	..	4 17 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1893	100	5	5	91 — 94	..	5 5 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1908	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	86 — 88	..	4 11 0
Hastings Trams, 6 % Pref.	1	6	6†	⅜ — ⅝	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	5	2 — 3	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76 xd	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	84½ — 86½ xd	..	5 15 4
London and Suburban, Ord.	1	..	..	⅛ — ¼	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅜ — ½	..	8 0 0
Do. Do. 4½ % 1st Deb.	100	4½	4½	74 — 79 xd	..	5 14 0
London Elec. Railways, 4 % Deb.	100	4	4	88 — 90	..	4 9 0
London United Trams, 4 % Deb.	100	4	4	54 — 58 xd	..	6 18 0
Metropolitan Railway Consol.	100	1⅝	1⅝	41½ — 41⅝	+1⅛	3 17 10
Do. Surplus Lands	100	2⅛	2⅛	61 — 63	+2	4 7 4
Do. 5½ % Deb.	100	5½	5½	87 — 89	..	5 18 7
Do. 5½ % Pref.	100	5½	5½	83 — 84	..	4 8 4
Do. 5½ % Con. Pref.	100	5½	5½	79 — 81	..	4 6 4
Metropolitan District Ord.	100	Nil	..	26 — 26½	+1½	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 0
Do. 4 % Deb.	100	4	4	91 — 93	..	4 6 0
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 86	..	5 4 8
Do. 5½ % Gtd.	100	5½	5½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 87	−1	5 3 6
Do. 5 % Deb.	100	5	5	85½ — 89½	..	5 12 0
Potteries, Ord.	1	3½	3½	⅝ — 1⅜	..	8 12 10
Do. 5 % Pref.	1	5	5	⅞ — 1⅛	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	81½ — 84½	..	5 6 2
South Metro. Trams, 4 % Deb.	100	4	4	54 — 58 xd	..	5 17 8
Underground Elec. Railways	10	..	..	3⅛ — 3⅜	— ⅛	Nil
Do. "A"	1/-	..	..	⅛ — ⅜	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	116 —118	+1	5 1 7
Do. 4½ % Bonds	100	4½	4½	98 —100 xd	..	4 10 0
Do. 6 % Income	100	6	6	90½ — 91½	+ ½	6 11 2
Yorkshire (West Riding), Ord.	5	Nil	Nil	½ — ⅝	..	Nil
Do. 6 % Pref.	5	6	4	4 — 4½	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	88 — 96 xd	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4½ — 5	+⅛	5 10 0
Do. 2nd Pref.	5	5½	5½	4½ — 4⅝	— ⅛	6 5 9
Do. 4 % Deb.	100	4	4	91 — 93 xd	..	4 6 0
Do. 4½ % Deb.	100	4½	4½	96 — 99 xd	..	4 11 0
Do. 5 % Deb.	100	5	5	95 — 97	+ ⅜	5 3 0
Auckland Trams, 5 % Deb.	100	5	5	101 —104 xd	..	4 16 3
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11⅜	..	5 5 2
Do. 4½ % Deb.	100	4½	4½	94 — 96 xd	..	4 18 9
Do. 5 % 2nd Deb.	100	5	5	100 —102	..	4 18 0
Brazilian Traction, Light and Power	$100	6	6†	77½ — 79½	— ½	7 11 0
Brisbane Trams Invt., Ord.	5	8	8	7 — 7⅛	+ ⅛	5 6 8
Do. 5 % Pref.	5	5	5	4⅜ — 5⅛	..	4 15 8
Do. 4½ % Deb.	100	4½	4½	98 —100 xd	..	4 10 0
B. Columbia Elec. Rly., Def.	100	6	8†	106½ —110½	—1½	7 4 10
Do. Pref. Ord.	100	6	6	108 —107	..	5 12 1
Do. 5 % Pref.	100	5	5	105 —108	..	4 12 7
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 0
Do. 4½ % Vancouver Deb.	100	4½	4½	94 — 98	..	4 12 0
Do. 4½ % Con. Deb.	100	4½	4½	95½ — 97½	..	4 7 2
Calcutta Trams, Ord.	5	7½	9½	6⅝ — 7	..	6 15 9
Do. 5 % Pref.	5	5	5	4⅛ — 5⅛	+ ⅛	4 17 7
Do. 4½ % Deb.	100	4½	4½	97 —100	+1	4 10 0
Cape Electric Trams	1	5	5	⅜ — ½	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5⅛ — 5⅜	+⅛	4 11 0
Do. 4 % Deb.	100	4	4	95 — 100 xd	..	4 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	91 — 95	..	5 5 3
Havana Elec. Rly., 5 % Bonds	$1000	5	5	96½ — 97½	..	5 2 6
Kalgoorlie El. Trams 5% A Deb.	100	5	5	89 — 97	..	5 15 0
Do. 5% B Deb.	100	8	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord.	1	..	..	⅛ — ¼	..	..
Do. Pref.	1	4½d.	6	⅝ — ¾	..	6 5 0
Lisbon Elec. Trams, Ord.	1	6	6	1⅝ — 1⅞	..	6 9 8
Do. 6 % Pref.	1	6	6	1⅝ — 1⅞ xd	..	6 8 8
Do. 5 % Deb.	100	5	5	92½ — 97½ xd	..	5 2 6
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4½ — 5½	..	5 14 8
Elec. Tr. (1904), Deb.	100	5	5	98 —101 xd	..	4 19 0
Manaos Trams & Lt., 1st Deb.	100	5	5	75½ — 78½ xd	..	6 7 5
Manila Elec. R. and Ltg., Bonds	£1000	5	5	99½ — 100½	..	4 19 6
Mexico Trams Com	$100	7	7	73 — 76	..	..
Do. Gen. Con. 5 % Bonds	..	5	5	80 — 84	..	5 19 1
Do. 6 % Bonds	100	6	6	74 — 78 xd	..	7 18 10
Para Elec. Rlys. & Lt., Ord.	5	10	10	4 — 4½	..	11 2 2
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	87½ — 90½	..	5 10 8
Rangoon El. Tr. & Sup., Pref.	5	6	6	4⅞ — 5⅛ xd	..	5 11 7
Do. 4½ % 1st Deb.	100	4½	4½	94 — 96 xd	..	4 18 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	97½ — 99½ xd	..	4 19 6
Do. 5 % Mort. Bonds	100	5	5	90 — 92	..	5 8 8
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	£500	5	5	97 —101	..	4 19 0
Singapore Trams, 5 % Deb.	100	5	5	88 — 93	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 8 0
Un. Elec. Trams Monte Video	5	7	7	4½ — 4⅝	— ⅛	7 7 4
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛	..	5 17 8
Do. 5 % 1st Deb.	100	5	5	93½ — 96½	..	5 3 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 96½	..	4 14 8

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9⅞ — 10⅜	..	4 5 9
Do. Second 6 % Pref.	10	6	6	10⅜ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96 xd	..	4 13 9
Brompton & Kensington, Ord.	5	10	10	8⅞ — 9⅛	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8⅛ — 8⅜	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91 — 94	+1½	4 5 1
Charing Cross, West End & City	5	5	6	4⅞ — 5⅜	+ ⅛	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 5/16 — 4 7/16	+ ⅛	4 18 8
Do. Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Chelsea, Ord.	5	5	5	4⅜ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	95 — 98 xd	..	4 11 0
City of London, Ord.	10	9	10	16 — 17	— ½	5 17 8
Do. 6 % Cum. Pref.	10	6	6	13 — 14	+ ½	4 5 9
Do. 5 % Deb.	Stock	5	5	115 —118 xd	..	4 4 9
Do. 4½ % Second Deb.	100	4½	4½	98 —101 xd	..	4 9 1
County of London, Ord.	10	6	7	11⅜ — 12½	..	5 14 8
Do. 6 % Pref.	10	6	6	11⅞ — 12⅜	+ ⅛	4 17 0
Do. 4½ % Deb.	Stock	4½	4½	101 —104 xd	..	4 6 7
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 1
Edmundson's, Ord.	£8	..	..	7/16 — 9/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅝ — 4⅛	+ ⅛	7 10 0
Do. 6 % Non-Cum. Pref.	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	83 — 86	..	5 4 6
Folkestone	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9
Hove	5	8	9	8¼ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7⅞ — 7⅞	..	5 14 3
Do. 4 % Deb.	Stock	4	4	91 — 93	+1	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2⅜	3	1⅜ — 1⅝	..	5 10 7
Do. 6 % Pref.	5	6	6	4½ — 5¼	..	5 14 8
Do. 4 % First Mort. Deb.	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	4½	4½	8⅜ — 8⅝	— ⅛	6 4 2
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅝ xd	..	4 10 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 99 xd	..	4 11 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	82 — 84 xd	..	4 3 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	+1	4 18 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¼ — 10½ xd	..	5 17 3
Oxford	5	7	7	5⅞ — 6⅜	..	5 10 0
St. James' and Pall Mall, Ord.	5	10	12	9⅛ — 9⅜	— ⅛	6 4 8
Do. 7 % Pref.	5	7	7	6½ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	82 — 86 xd	..	4 2 4
South London, Ord.	4	5⅜	5⅜	2⅜ — 3⅛	..	6 10 4
Do. 5 % First Mort. Deb.	100	5	5	97 —100 xd	..	5 0 0
South Metropolitan, 7 % Pref.	1	7	7	1 3/16 — 1 5/16	..	5 6 8
Do. 4½ % First Deb. Stock	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£8	Nil	..	7/16 — 7/16	..	..
Do. 5 % Cum Pref.	5	8½	4	2⅛ — 3	..	6 18 4
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 8
Westminster, Ord.	5	10	10	8⅜ — 8¾	..	5 12 ..
Do. 4½ % Cum Pref.	5	4½	4½	4 13/16 — 5 3/16 xd	..	4 6 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Funded Certs.

Continued on next page.

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SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 7th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	£	6	6	5⅜ — 5⅝	..	£ s. d. 5 11 7
Calcutta, Ord.	£	8½	9	7¼ — 7⅝	..	5 18 0
Do. 5 % Pref.	£	5	5	5 1/16 — 5 1/16	..	4 14 1
Calgary Power, 1st Mort. Bds.	100	5	5	87 — 89 xd	..	5 12 8
Canadian Gen. El. Com.	$100	7	8	98 —108	..	7 15 6
Do. 7 % Pref.	$100	7	7	116 —121	..	5 15 10
Cordoba Lt., Power and T., Ord.	1	5	..	⅞ — 1	..	7 12 0
Do. 5 % Deb.	100	5	5	80 — 85	..	5 17 8
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	81 — 83 xd	..	6 19 6
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	94 — 97 xd	..	5 8 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93 — 96	— ½	5 5 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅛ — ⅜	..	Nil
Do. 6 % Pref.	£	6	4	¾ — 1	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	99 — 102 xd	..	4 18 0
Madras, Ord.	£	Nil	..	1¼ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	108 —106	..	4 14 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	58 — 60 xd	..	7 18 8
Mexican Lt. & Power, Common	$100	4	4†	46 — 49	..	..
Do. 7 % Cum. Pref.	$100	7	7	73 — 77	..	9 4 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	76 - 81	+1	6 3 5
Do. 5 % 2nd Mort. Bonds	100	5	5	59 — 64	..	7 18 8
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	* 100	1912. 5	1913. 5	48 — 53	—1½	..
Montreal, Lt., H. and Power	$100	9	10†	230 —235	..	4 5 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	10	235 —245	..	4 1 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	97 —108	..	5 16 6
Do. 5 % Deb. Stock	Do.	5	5	99 —101 xd	..	4 19 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital	$100	5½	6	137 —141	+4	4 5 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	103 —106 xd	..	4 14 4
Do. 4½ % Per. Deb.	Stock	4½	4½	100 —102	..	4 8 8
Toronto Power, 4½ % 1st Deb.	Do.	4½	4½	98 —100	+1	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	83½ - 84½ xd	..	5 18 4
Victoria Falls Power, Pref.	1	6	6	1 1/16 — ¾ xd	..	8 6 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	108 —105	..	5 14 8

MANUFACTURING COMPANIES.

Arun, Ord.	£	7	7	⅜ — ½	..	8 0 0
Do. 6 % Pref.	£	6	6	⅜ — ½	..	6 17 2
Babcock & Wilcox	£	16	16	2 3/32 — 2 3/32	—3/32	5 9 8
Do. Pref.	£	6	6	1 1/16 — 1 1/16	+1/16	4 8 6
British Aluminium, Ord.	£	..	5	1 1/16 — 1 1/16	..	4 14 1
Do. 6 % Cum. Pref.	£	6	6	⅝ — ⅝	..	6 9 0
Do. 5 % Prior Liens Debs.	100	5	5	95 — 98 xd	..	5 2 9
Do. Deb. Stk.	100	5	5	90 — 95	..	5 5 8
B.I. & Helsby Cables	£	10	18	9⅜ — 9⅞	..	6 11 8
Do. Pref.	£	6	6	5⅝ — 6⅛	..	4 14 1
Do. Deb.	100	4½	4½	100 —103 xd	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref.	£	Nil	5	1⅛ — 1⅞	..	5 6 8
Do. Deb.	100	4	4	78 — 76	+1	5 5 3
Do. 6 % Prior Lien	100	6	6	101 —104	..	5 16 6
Brotherton, Lindley, Ord.	£	..	..	2/- —3/-	..	Nil
Do. Pref.	£	..	..	8/- —8/6	..	Nil
British, 7 % Pref.	£	Nil	..	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 — 85 xd	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb.	100	4½	4½	23 — 28	..	13 12 8
Callender's Cable	£	15	15	11½ — 12½	+ ½	6 2 5
Do. Pref.	£	5	5	5 — 5½	..	4 15 3
Do. Deb.	100	4½	4½	97 —103	..	4 10 0
Castner-Kellner	£	20	22½	2 1/16 — 2 1/16	..	8 15 5
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Dick, Kerr	£	Nil	..	⅜ — ½	..	..
Do. Pref.	£	6	6	⅝ — ¾	..	6 17 2
Edison & Swan, A, £3 paid	£	Nil	..	1/32 — 3/32	..	Nil
Do. fully paid	£	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	57 — 61	..	6 11 1
Do. 5 % Second Deb.	100	5	5	61 — 66	..	7 11 6
Electric Construction	£	5	6	⅜ — 1⅛	..	8 14 6
Do. Pref.	£	1	7	1 — 1⅛	..	6 4 5
Greenwood & Batley, Pref.	£	10	7	6¾ — 7¼	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	£	10	6	10⅜ — 10⅞	..	5 10 4
Do. Deb.	100	4	4	88 — 92	..	4 7 0
Henley's, Ord.	£	15	20	14½ — 15½	..	6 9 0
Do. Pref.	£	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	99½ —101½	..	4 8 8
India-Rubber, G. & T.	£	7⅛	7⅛	9¼ — 10⅜	..	7 2 10
Do. Pref.	£	5	5	8⅞ — 9⅝	..	5 4 0
Telegraph Construction	£	20	20	87½ — 89½	+1½	6 1 7
Do. Deb.	100	4	4	97 — 99 xd	..	4 0 10
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	..	68 — 87	..	5 19 8
Do. B 4 % Cum. Pref.	100	..	£4	38 — 42	—2	9 10 6

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	£	4½	4½	5⅝ — 6⅛	..	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 98 xd	+1	5 2 0
American Telep. & Teleg., Cap.	$100	8	8	121 — 125	—1	6 8 0
Do. Collat. Trust	$1000	4	4	91 — 94	+1	4 5 0
Anglo-American Telegraph	Stock	3	3	64 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	107⅜ —108⅜	+ ⅛	5 10 7
Do. Def.	Do.	30/-	30/-	22⅞ — 25⅜	+ ⅛	6 8 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	£	6	6†	7½ — 7¾	..	5 6 8
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80⅜ — 82⅜	+1⅛	4 17 0
Cuba Telegraph	£	6	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	£	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	£	4	4	3½ — 4	..	5 0 0
Do. 10 % Cum. Pref.	£	10	10	7½ — 7¾	..	6 9 0
Direct United States Cable	£	4	4	6½ — 6¾	..	5 18 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	130 —133	+1	5 5 3
Do. 8½ % Pref. Stock	Do.	8½	8½	76 — 78	..	4 9 9
Do. 4 % Mort. Deb.	Do.	4	4	95½ — 97½	+ ½	4 2 1
Eastern Extension	£	7	7	124 — 13	..	5 7 9
Do. 4 % Deb.	Stock	4	4	95½ — 97½	..	4 2 1
Globe Telegraph and Trust	£	6	6†	10⅞ — 11⅜	+ ⅛	5 5 6
Do. 6 % Pref.	£	10	6	12⅜ — 12⅝	+ ⅛	4 18 1
Great Northern Telegraph	£	20	20	8[illegible] — 88½	..	5 19 5
Indo-European Telegraph	£	18	18	67 — 69	+ ⅛	5 11 1
Mackay Companies Common	$100	5	5	80 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 72	..	5 10 1
Marconi's Wireless Telegraph	£	20	20	2½ - 2⅝	— 1/16	7 12 4
Do. 7 % Cum. Partic. Pref.	£	17	..	2⅜ — 2½	— ⅛	7 11 2
Monte Video Telephone, Ord.	£	6	6	⅛ - ⅜	..	6 8 0
Do. 5 % Pref.	£	5	5	⅜ — ⅝	..	5 18 6
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100½ — 101½	..	4 9 0
Oriental Telep. and Elec.	£	10	10	2 1/16 — 2 1/16	..	4 7 6
Do. 6 % Cum. Pref.	£	6	6	1 1/16 — 1 1/16	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	86 — 88 xd	..	4 11 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98 xd	..	4 1 8
Reuter's	£	10	10	7½ — 8¼	— ½	8 9 8
Submarine Cables Trust	Cert.	6	6	127 —130	+1	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	97 — 99	..	4 11 0
United River Plate Telephone	£	8	6†	6⅝ — 6⅞	— ⅛	6 0 9
Do. 5 % Cum. Pref.	£	5	5	5 — 5⅛ xd	..	4 11 0
West Coast of America	2½	2½	N	⅛ — 1⅛	..	Nil
Do. 4 % Debs., 1 to 1,500 guar. by Brax. Sub. Tel.	100	4	4	96 — 99 xd	+1	4 0 10
West India and Panama Teleg.	10	1½	1½	1 7/16 — 1 7/16	— 1/16	8 13 10
Do. 6 % Cum. 1st Pref.	10	6	6	9⅛ — 9½	— ½	6 9 9
Do. 6 % Cum. 2nd Pref	10	6	6	8¾ — 8⅞	..	6 16 9
Do. 5 % Debs.	100	5	5	98 —101	+ ⅛	4 19 0
Western Telegraph, Ltd.	10	7	7	13⅜ — 13⅝	+ ⅛	5 0 11
Do. 4 % Debs.	Stock	4	4	97½ — 97⅝	+ ⅛	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	94 — 97	..	4 12 9

* Unless otherwise stated all shares are fully paid. † Interim dividend. a Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Water-power Congress.—The second White Coal (Houille Blanche) Congress, noticed in our issue of June 19th, will be held, not at Paris—as stated in our previous note—but at Lyons, and will cover three days (September 7th to 10th), followed by four days' excursions (September 11th to 14th) to hydraulic installations on the Alps. To the legislation section are appended an economic and technical section, and among the questions treated will be the following:—Economic results expected from the utilisation of the Rhone (M. E. F. Cote, a director of the Houille Blanche Congress); the rôle of reservoirs in the regulation of water-courses (Mr. Wilhelm, Ingénieur des Ponts et Chaussées at Grenoble); the intervention of the State in the development of "Houille Blanche"; financial burdens affecting private water-power and those powers granted by the State, departments and communes; the economic progress and local benefits to which valleys at the foot of mountains have a right by the development of their water-power sources; useful undertakings for the bettering of the distribution of water; "white coal" and metallurgy; "white coal" and the electrical working of railways; "white coal" and agriculture. In the technical section the subjects treated will be:—Installation of water-power works in France and abroad, from the standpoint of canels, dams and stations—financial and economic programme; protection of banks; measurement of flow; water-hammer; the hydroelectric laboratory; high-pressure metal pipe lines; high-pressure cement conduits; turbines; equipment and protection of high pressure lines; and the importance and influence of the transport of energy. The excursions will embrace visits to the principal hydroelectric installations in the Alps of Savoy and Dauphiné.

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REVIEWS.

Camp Co-operation: Book of Proceedings at Association Island, 1913. New York: The Roycrofters. Price $1.25.

At this moment, when the I.M.E.A. Convention has just been held, and when many pens are scratching their wielders' opinions on the late Industrial Committee, it is rather appropriate that this highly interesting book should make its appearance.

It may be well first to say that Association Island is in Lake Ontario, State of New York, that its attractiveness as a recreative vacation resort was noticed by a small group of electrical men about ten years ago, and that in 1907 the Association Island Corporation was organised and the island was purchased. It appears that now every year, workers in all sections of industry which may have any bearing upon electricity meet there, lead the simple life, and talk shop.

The record of the proceedings of 1913 is now under notice, and as a sample of the general high level of the contents we may mention that there are contributions from—we mention the names that are most likely to be known on this side—Mr. Samuel Insull, Dr. Charles P. Steinmetz, the Hon. John H. Roemer, of the Wisconsin Utility Commission; Mr. Frank Vanderlip, President of the National City Bank of New York; Mr. Joseph B. McCall, President of the Philadelphia Electric Co., and of the National Electric Light Association, who was the chairman of the gathering; Dr. Thomas Darlington, the Hon. Willard Howland, of the Legislative Assembly of Massachusetts, and many others whose renown is no doubt equally great in their own country.

The subjects discussed cover an enormously wide field, and give much food for thought. Co-operation is, of course, the key-note of all the addresses delivered as well as of the speeches made in discussion. Mr. Insull treats of the Distribution of Electrical Energy, Present and Future; Dr. Steinmetz of the Future Technical Development of the Electrical Business; other members deal with co-operation among manufacturers, the Society for Electrical Development, co-operative advertising in regard to electric vehicles, and the co-operative organisation of the Illuminating Engineering Society—and it may here be noted, as exemplifying the extent to which the co-operative idea extends, that this is not a society of illuminating engineers, but "a society to provide for a closer co-operation on matters pertaining to the use of light among laymen as well as professionals; among electrical engineers, gas engineers, architects, and designers of fixtures and glassware; to point out in what way the best illumination results may be obtained from any source of light."

Then there are important papers on Favourable Conditions for Labour (we refuse to leave the "u" out), by Dr. Darlington; Financing Electricity, by Mr. Vanderlip; Government in relation to Business, by the Hon. W. Howland; Principles of Resale Control, by Mr. F. P. Fish; and State Commission Control, by the Hon. J. H. Roemer. To get together men of such eminence, and to get them to give their experience of and opinions upon the matters with which they are most intimately concerned, and so to contrive that the bearing of finance, medicine, and political administration upon electricity and its progress is brought into effective prominence, is in itself no mean achievement.

Mr. Chattock's presidential address to the I.M.E.A., dealing as it did with the possible nationalisation of electricity supply, and Dr. Ferranti's well-known views on the same subject, really mean that the need for co-operation is also realised over here. The existence of the B.E.A.M.A. among the manufacturers, of the E.C.A. among contractors, of the A.C.E. among consultants, and of other similar bodies, shows that each section of the industry is awake to the necessity that its members shall work together for the common good of all. Now, if we may digress for one moment and refer to Mr. Wordingham's article: "Should the Council be Blamed?" in our issue of May 29th last, we would, while thanking him for his timely emphasising of the fact that after all the engineering talent is the most necessary of all those which have been given to the industry as a whole—for the commercial man with no engineering knowledge can make a far worse hash of his undertaking than the engineer without commercial ability—say that there is surely only one step between the co-operative effort of members of a section and the co-operation of the sections together. There is no need to-day for Mr. Wordingham's "appeal to arms," and fighting "as often and as furiously as is necessary." The answer to this part of Mr. Wordingham's article is to be found under the frontispiece of this book, a portrait of the First Co-operator, viz.: "There never was a good war nor a bad peace."

We have deemed it our duty to deal more particularly with the book as a whole, and the general principle enunciated by it. Indeed, if we tried to comment upon each subject in detail, we should need the whole of this issue of the journal for the purpose.

We are constantly reminded of the need for an American-English dictionary, or rather, a comparative manual of grammatical usage. Possibly M. Bergson could best deal with the yawn-inspiring intricacies of American "humor" as exemplified in Mr. Elbert Hubbard's remarks about "the late J. Cæsar." Speaking individually, we are also more than a little bored with the language of the "man who can take pictures in the mind." This is Mr. Herbert Kaufman, whose essay on The Dreamers was read by Mr. Henry L. Doherty, the Wall-Street banker, in the discussion on Mr. Roemer's paper. Many sales managers nowadays deem it necessary to write ungrammatical and childish boosting letters to their salesmen, based on the old "heart-to-heart talk," which, ten years ago, was only to be found in the cheapest and least responsible papers for girls, mostly read by servants. This is, we suppose, a sign of the times, and will be levelled out in the future.

As a book, this publication is nicely got up, well printed, and illustrated with portraits of the authors of the several addresses and of typical scenes in the life of the camp. There are eight split infinitives, and we have noticed "facotry" on p. 153, and on the plate facing p. 73; Hon. John C. Roemer instead of Hon. John H. Roemer. The book is in marbled paper boards, half buff basil, is well indexed, and provided with a bookmark. Its dimensions are 9in. by 6in., and it is entirely free from advertisements. We give these details to show that for five shillings anyone can buy this nice volume, just as for the same sum he can buy the paper-covered and often carelessly-printed Proceedings of the I.M.E.A.

In conclusion, we recommend the book to the careful perusal of all who have the ultimate welfare of our profession and industry truly at heart.

Insulation and Design of Electrical Windings. By A. P. M. Fleming and R. Johnson. London: Longmans, Green & Co. Price 7s. 6d. net.

It should be generally recognised that insulation, since it is the most vulnerable, is the most important part of electrical machinery. Both electrical manufacturers and buyers are faced with the problem of ensuring the maintenance of electrical service, while dependent on the use of materials which are inherently of a treacherous mechanical character.

The use of very large units, the interior of the windings of which must of necessity be at a high temperature, owing to their relatively small volume,

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has made the insulation problem of paramount importance.

Until comparatively recently, the amount and quality of the insulation used in an electrical machine were fixed almost entirely by a method of trial and error, but at the present time a large number of careful, and more or less reliable, research results are available in various *Proceedings* and *Journals*.

The volume under review is one of the very small number of books dealing with this vital question in a connected and scientific fashion. It consists of seven chapters, the first of which deals with the physical characteristics of gaseous, liquid and solid dielectrics. A good and interesting résumé of the researches due to Sir J. J. Thomson (mis-spelt Thompson on pages 1 and 6) and others, is given. It should have been pointed out on page 13, when discussing the loss due to corona on transmission lines, that this loss with a given voltage decreases both with increase in diameter of the conductor and with increase in the spacing. A number of curves are given which illustrate very clearly the complex character of the phenomena which have to be investigated in connection with dielectrics generally.

Chapter 2 discusses electrostatic conditions in practical working. It is noteworthy that the apparently academic "electrostatics" of the electricity and magnetism textbooks should have become of industrial importance. The reviewer is glad to see that the authors have not introduced the prehistoric conception of an electrostatic charge on a conductor. The unfortunately common use of this idea destroys the analogy between the two components of the electric field, and makes the discussion of dielectric stresses unnecessarily complicated. A clear account of the voltage distribution for several types of winding is given.

One of the most useful chapters in the book is chapter 3, which deals with the enormous subject of insulating materials. The quantity of scattered information at the disposal of the authors is, of course, prodigious, and it may at once be stated that they have made a careful, and as far as the reviewer has been able to check, an accurate, selection. We are glad to see it clearly pointed out that the majority of insulating materials are of an organic origin, and are therefore naturally subject to continual change, tending ultimately to disintegration. Papers, tapes, varnishes, methods of applying varnishes, fibres, mica and mica products (the latter being included in the excellent articles published in Elec. Rev. Nos. 1817 and 1818), oils, etc., all receive a due meed of attention. Some very useful and, so far as the reviewer is aware original information is given at the conclusion of this chapter regarding the mechanical strength of insulators and conductors. The statement in Professor Walker's paper on turbo coils, that some forms of insulation appeared to have considerable strength or stiffness, is supported by the results recorded here.

Chapter 4 is devoted to the design of insulation and windings. The chapter opens with some common-sense remarks on the principles governing the rating of machines, followed by the German standard specification for the testing of electrical machinery. The reviewer is quite of the authors' opinion as to the marked difference in temperature rise allowed by the German Normalien for cotton and papers, not being justified. Owing to the discrepancies of at least 10 per cent. in temperature measurements, and to the fact that electrical machines may have to work in temperatures of 40°C., it is desirable that the allowable temperature rise for fibrous materials of all kinds should not exceed 50°C., since these materials cannot be safely exposed to greater temperatures than 100°C. Furthermore, since the insulation is not itself the seat of the generation or loss of heat, it is the temperature of the adjacent copper or iron which has to be considered, and as this temperature depends on the heat flow, no method of measurement is really accurate unless these conditions are known, and they can never be accurately known in a commercial machine.

The principal types of machine and transformer windings and their insulation on scientific principles are next discussed in a satisfactory manner.

Chapter 5 deals with insulation tests. We are glad to see the fallacy of paying great attention to insulation resistance tests pointed out. It is rather extraordinary that even in these days there should still be so much misconception regarding this matter. Insulation resistance measurements have their use, but are no criterion whatever of the quality of the materials used, as prolonged drying raises the reading to an almost unlimited extent provided that the surfaces are clean.

A précis is given of the German and American regulations regarding insulation tests, together with the usual methods of testing armatures for open circuits, etc. Some useful information regarding testing transformers for apparatus of large electrostatic capacity is also included.

Following we have a number of practical observations regarding the drying and handling of electrical windings, which though somewhat brief are quite sound.

The concluding chapter consists of five pages dealing with the principal types of insulation failures. A good index is appended.

As a whole the book is by far the best value for the money that the reviewer has seen on this most important and difficult subject.—H.G.S.

ELECTRICAL TERMS AND DEFINITIONS.

(*Concluded from Vol. 74, page 1040.*)

Ruhmkorff Coil.—A kind of transformer used for producing high electromotive forces, consisting of a primary and a secondary winding on a straight core. The primary is supplied with a continuous current which is periodically interrupted.

Running Light (of a generator, converter, or transformer). —Running when no appreciable current is delivered to the external circuit. (Of a motor).—Running when no power is delivered at the shaft.

Safety, Factor of.—*See* Factor.

Sag of a wire.—The maximum vertical distance between a wire and the straight line joining the points from which it is suspended.

Secondary of a transformer.—*See* Secondary Winding.

Secondary Battery.—*See* Accumulator.

Secondary Winding of a transformer.—The winding in which the electromotive force is generated by electromagnetic induction and from which electrical energy is supplied to the external circuit.

Section Insulator.—An insulator by means of which a conductor is divided electrically into sections while maintaining mechanical continuity.

Section Switch.—A switch for electrical disconnection of a circuit into sections.

Selector Switch.—A switch for connecting a circuit to any one of a number of other circuits.

Self-induction, Coefficient of.—*See* Induction, Self-.

Sensibility or Sensitivity.—*See* Figure of Merit.

Series.—Two or more conductors are said to be in series when they are so connected that they are traversed by the same current.

Series Dynamo.—A dynamo in which the field magnet coils are in series with the armature.

Series Parallel.—(*a*) A number of pieces of apparatus are connected in parallel and the groups so formed are connected in series.

(*b*) A number of pieces of apparatus are connected in series, and the groups so formed are connected in parallel. In U.S. it is common to call (*b*) Parallel Series in order to distinguish it from (*a*).

Series-Parallel Connection.—Pieces of apparatus are connected either in series or parallel with arrangements for changing over from one set of connections to the other.

Series-Parallel Controller.—A device for making Series-Parallel Connection.

Short.—A colloquial abbreviation for a Short-circuit or for the act of making a Short-circuit.

Short-circuit.—A connection, whether accidental or intentional, between two points in a circuit, by means of a path having a low resistance.

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Short-circuited Rotor.—A rotor which is short-circuited in itself. *See* Squirrel-cage.

Shoe.—An appliance for effecting a sliding connection between a conductor rail of an electric railway and the electrical equipment of a car.

Shunt.—(*a*) Circuits are said to be in shunt or in parallel one to the other when a current is divided between them.

(*b*) A by-path for an electric current.

(*c*) Shunt circuit is a term applied to the pressure circuit of measuring instruments such as electricity energy meters, wattmeters, etc.

(*d*) A current shunt is a term applied to a low resistance used for the measurement of currents by means of a potentiometer; or by an ammeter through which only a fraction of the current passes.

Shunt Coil or Winding.—A coil or winding which is connected in shunt or parallel to some part of the circuit.

In a generator or motor.—The field magnet coils of a shunt dynamo or motor, these coils being excited by a current practically proportional to the pressure.

Shunt Dynamo.—A dynamo in which the field magnet coils are connected to the terminals in shunt.

Shunt Instrument.—An instrument in which all but a fraction of the current to be measured is passed through a resistance connected in parallel with the measuring instrument.

Shunt Motor.—A motor in which the field magnet coils are connected to the terminals in shunt.

Shuttle or Siemens Armature.—An early form of armature for a generator or motor, resembling a shuttle, and having a single coil and two core faces. Sometimes called an H armature.

Sibmens Dynamometer.—An instrument for measuring currents, either continuous or alternating, consisting of a fixed coil and a suspended coil controlled by a spring, the torsion of the spring being proportional to the square of the current when the coils are brought back to their initial relative positions.

Siemens Unit of Resistance.—The resistance of a column of mercury of a sectional area of one square millimetre and of a length of one metre, at 0°C.

Silver Voltameter.—An apparatus for measuring a quantity of electricity by the weight of silver deposited on a platinum kathode from a solution of silver nitrate.

Simplex.—A method of telegraphic working in which only a single message is transmitted at one time.

Single-phase.—*See* Phase.

Single-Pole Switch.—A switch which opens a circuit at one point only.

Siphon Recorder.—An apparatus used in submarine telegraphy consisting of a magnetic field in which a moving coil makes a record of the signals by means of a siphon acting as a pen.

Skate.—An appliance for effecting a sliding electrical connection between the studs of a surface contact system and the electrical equipment of a car.

Slide Wire.—In a measuring instrument a wire of uniform resistance on which a sliding contact makes connection at any desired point.

Slip.—In an induction motor the angular velocity of the rotor is less than that of the rotating magnetic field of the stator, and this difference expressed as a fraction of percentage of the angular velocity of the rotating magnetic field is called the slip. The use of the word Slip to express the mere difference of angular velocities is not recommended.

Slipper Brake.—A brake in which a block or slipper is pressed against the rails of a tramway. Also called a Track Brake.

Slip-ring.—A conducting ring for effecting, by means of a brush, a sliding connexion between a revolving conductor and a fixed conductor. *See* Collector ring.

Slot System.—*See* Conduit System for traction.

Slotted Core.—An armature core of a generator or motor having slots in the iron in which conductors are placed.

Smooth Core.—An armature core of a generator or motor on the surface of which conductors are laid.

Socket, Lamp-.—Synonym for Lampholder.

Solenoid.—A coil of tubular form for producing a magnetic field.

Sole Plate (tramway).—A plate or piece of rail fastened below a rail joint for strengthening and anchoring it.

Sounder.—A telegraphic receiving instrument producing audible signals.

Spacing Current.—In telegraphy a current used to produce the space between the signals, flowing generally in the reverse direction to the signalling currents.

Span Wire Construction.—A mode of supporting a trolley wire by transverse span wires stretched between poles or buildings.

Spark (electrical).—A disruptive discharge of electricity through a dielectric.

Spark-gap.—Any break in the continuity of a conductor so arranged as to permit of a disruptive discharge across the break.

Specific.—Pertaining to or characteristic of a substance; *e.g.* the specific resistance of a given material is the resistance between the opposite faces of a cube of that material whose edge is one centimetre.

Squirrel-cage.—A winding used on induction motors which consists of a number of bars, the ends of which are short-circuited.

Standard (noun).—A thing serving as a basis of comparison. Such as a weight or measure to which others conform or by which the accuracy of other weights or measures is judged. *See* also Unit.

Standard Candle.—Formerly used in photometry. A sperm candle weighing one-sixth of a pound, intended to burn 120 grains per hour.

Standard Candle (International).—Unit of light. One-tenth of the light given horizontally by the Standard Ten-candle Pentane lamp under specified conditions.

In U.S. the Standard is maintained through the medium of a group of selected incandescent lamps at the Bureau of Standards in Washington.

Standards, Electrical.—British Board of Trade. *See* also Units, International. Resistance, the one-ohm coil of wire. Current, the one-ampere balance. Potential difference, the 100-volt electrometer.

Standard Lamp (electrical fitting).—A lamp to stand on a table or floor. Lamp-standard, a pillar supporting a street lamp.

Star.—A mode of connection in polyphase alternating-current working, in which three or more conductors meet at a common junction called the neutral point. When there are only three conductors, also called a Y connection.

Static.—(1) Pertaining to electricity at rest. Abbreviation for Electrostatic. (2) Sometimes applied to a transformer, to distinguish it from a converter. Not recommended.

Stator.—In an alternating-current generator or motor, the winding and associated iron, whether acting as armature or as field magnet, which does not rotate.

Storage Battery.—*See* Accumulator.

Striæ.—In an electric discharge through a gas, alternate dark and luminous transverse bands.

Stud (tramway).—A piece of metal or apparatus from which the current is collected, laid down in the street between the rails of a surface-contact system of traction.

Sub-station.—Officially defined in Great Britain as premises in which electrical energy is transformed or converted for the purpose of supply to consumers, if such premises are large enough to admit the entrance of a person after the transforming or converting apparatus is in position. (Thus distinguishing it from a Transformer Box or Chamber).

Sulphate, of an accumulator.—In a lead accumulator the formation on the plates of a sulphate of lead which is inactive and hinders the action of the cell.

Surface Contact System.—A tramway system in which studs normally dead, placed between the rails, become connected to a main only when a car passes over them.

Surge.—An abnormal rush of electricity along a conductor.

Surge-impedance.—The natural impedance of any long conductor to transmit electric currents or surges, $= \sqrt{l/c}$.

Susceptibility.—*See* Magnetic Susceptibility.

Suspension Wire (Telegraph).—Synonym for Messenger Wire.

Switchboard.—An assemblage of switches, fuses, conductors, measuring instruments, and other apparatus for the control of electrical machinery and circuits.

Switch Hook (Telephone).—The book on which a receiver is hung. When the receiver is placed on the hook its weight performs certain switching operations.

Synchronism.—Two machines are said to be in synchronism when they are running on one system with identical frequency and a definite phase relation.

Synchronize, To.—To cause two or more machines or pieces of apparatus to have the same periodic time or frequency and a definite phase relation.

Synchronous Motor.—An alternating-current motor which normally runs at the speed corresponding to synchronism with the supply.

Synchronoscope.—An apparatus intended to indicate when two alternating potential differences are in synchronism and in phase.

Syntonize.—To adjust to the same periodic time or frequency. In wireless telegraphy called to Tune.

Syphon Recorder.—*See* Siphon Recorder.

Tandem.—*See* Cascade.

Tapper (Wireless).—An apparatus which taps a coherer and automatically decoheres it after the receipt of a signal.

Telegraph.—An apparatus for transmitting messages to a distance by means of signals.

Telegraph Line.—*See* Line.

Telephone.—An apparatus for transmitting sound to a distance.

Telpherage.—A system for the electrical transport of goods or materials in self-contained motor-driven receptacles suspended from, and running on, stretched wires.

Temperature Coefficient.—The change in the magnitude of any property of a substance caused by a rise of one degree Centigrade in the temperature, expressed as a fraction of the magnitude at some definite temperature adopted as a standard.

Temperature Rise.—Of electrical machinery. The increase of temperature of any part of an electrical machine above the temperature of the surrounding atmosphere.

Tension.—A synonym for Electromotive Force or Difference of Potential. Obsolete term when used alone.

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Tension, High.—Synonym sometimes used for High Voltage, or High Pressure. Abbreviation H.T. (Board of Trade limits, 650 to 3,000 volts, whether continuous or alternating).

Tension, Extra High.—Synonym sometimes used for Extra High Voltage or Pressure. Abbreviation E.H.T. (Board of Trade limit, above 3,000 volts, whether continuous or alternating.

Terminal.—That part of an apparatus or circuit to which conductors are intended to be joined in order to connect it electrically to another apparatus or circuit.

Terminal Voltage.—*See* Difference of Potential at the Terminals.

Thermo-couple.—A pair of conductors joined to produce a Thermo-electric Effect.

Thermo-electric Effect.—The electrical effect due to a difference of temperature between two junctions. Sometimes called Seebeck Effect.

Thermo-pile.—Apparatus consisting of thermo-couples suitably arranged.

Third Rail.—*See* Conductor Rail.

Thomson Effect.—(*a*) The electrical effect due to a difference of temperature between two parts of one and the same conductor; (*b*) the liberation (or absorption) of heat which takes place when current flows from a hotter to a colder portion of the same metal.

Three-phase.—*See* Phase.

Three-phase Transformer.—A transformer in which three magnetic circuits have parts in common with one another.

Three-wire System.—A system of supply through three wires, in which the potential of the middle wire is intermediate between those of the outer conductors.

Time-constant.—When the rate at which a function is diminishing equals the function multiplied by a constant quantity, the reciprocal of this quantity is called the time-constant. It is equal to the time taken by the function to fall to $\frac{1}{e}$, that is, 36.8 per cent. of its initial value.

Total Loss.—The difference between input and output.

Transformer.—An apparatus without moving parts which by means of electromagnetic induction transforms alternating voltages into alternating voltages of the same frequency, but generally of different magnitude.

Transformer Box or Chamber.—A box or chamber containing a transformer and not large enough to admit the entrance of a person after the transformer is in position. (Thus distinguishing it from a Sub-station).

Transformer, Core Type.—A transformer with a closed magnetic circuit in which the copper windings completely or almost completely enclose the iron core.

Transformer, Primary of.—*See* Primary.

Transformer, Secondary of.—*See* Secondary.

Transformer, Shell Type.—A transformer with a closed magnetic circuit in which the magnetic circuit completely or almost completely encloses the copper windings.

Translator.—A form of telegraphic relay. Also called a Repeater.

Transmitter.—That part of a telegraphic or telephonic apparatus by which signals are sent.

Trolley System.—A traction system employing cars on each of which is mounted a standard carrying a boom. At the end of the boom is fixed a swivelling trolley head containing a trolley wheel which runs on the trolley wire. When the car is single-decked or has a roof over the upper deck the boom is carried on a base.

Trunk Main (*a*) in electrical supply.—A main used as a feeder between a generating station and a sub-station or between two generating stations. (*b*) in telegraphy and telephony.—A line consisting of numerous circuits connecting two or more towns or exchange areas.

Tube of Force (Electrostatic Faraday Tube).—The unit tube of force is bounded laterally by lines of force which enclose unit charges at its ends. It therefore contains 4π lines of flux.

Tune, To (wireless telegraphy).—To adjust to a given periodic time of frequency.

Turns, Ampere-.—*See* Ampere-turn.

Two-Phase System.—*See* Phase.

Two-phase Transformer.—A transformer for two-phase currents, in which two magnetic circuits have parts in common with one another.

Unifilar Suspension.—The suspension of the moving part of an instrument by a single thread or wire or strip, the restoring force being produced by its torsion.

Unipolar.—*See* Homopolar.

Unit (physical).—A selected definite physical quantity in terms of which the magnitudes of other physical quantities of a like kind may be reckoned or expressed.

C.G.S. system of units. A system employing the centimetre, the gramme, and the second as the fundamental units.

Electromagnetic primary Units. 1. Unit of Resistance. 2. Unit of Current. 3. Unit of Difference of Potential.

Derived Units. Quantity, Capacity, Self-induction.

Practical Units. *See* Practical Units.

International Units. The Ohm, Ampere, Volt, and Watt.

Board of Trade Unit. One Kilowatt-hour or Kelvin.

Virtual Ampere.—The alternating current which produces the same heating effect as one ampere continuous current. The root-mean-square of the current, sometimes called Effective Ampere. A term not recommended.

Virtual Volt.—The alternating electrical pressure which when applied to a non-inductive resistance of one ohm produces one virtual ampere. The root-mean-square of the volts. Sometimes called an Effective Volt. A term not recommended.

Volt.—(*a*) The electrical pressure which when applied steadily to a conductor the resistance of which is one ohm, produces a current of one ampere.

(*b*) 10^8 C.G.S. electromagnetic units of Electromotive Force.

Voltage.—Synonym for Electromotive Force, Difference of Potential and Pressure. Generally used descriptively.

Voltaic Current.—An electric current produced by chemical action.

Voltameter.—An electrolytic cell arranged for the purpose of measuring an electric current by determining the amount of chemical action produced.

Voltmeter.—A measuring instrument with its scale graduated in volts for measuring electromotive force.

Wall Plug.—An appliance containing both of the terminals of a twin flexible conductor, generally in the form of two pins (two-pin plug) or a pin and a concentric ring (concentric plug) which, when it is inserted in a wall socket, makes connection between the flexible conductors and the fixed leads.

Wall Socket or Shoe.—An appliance fixed to the wall into which are brought both the leads or conductors connected to a source of supply so that connection may be made by inserting a wall plug.

Watt.—Unit of Power. The energy expended per second by an unvarying current of one ampere under an electric pressure of one volt. With alternating current, the product of the instantaneous amperes into the instantaneous volts gives the instantaneous value of the power. The mean value of this over a whole period is the power in watts. It is equal to 10^7 ergs per second or 1 joule per second. *See* Kilowatt.

Watt-hour.—The total energy expended when electrical energy is expended at the rate of one watt for one hour, or its equivalent, such as 4 watts for 15 minutes. Equal to 3,600 joules.

Watt-hour Meter.—An integrating meter for measuring watt-hours. Also called an Energy Meter. The use of the term wattmeter in this connection is strongly discouraged.

Wattless.—When the phase difference between the current and the applied voltage is 90 degrees, the current is said to be Wattless or Reactive. In U.S. a term used by some, but strongly disapproved of by many.

Wattmeter.—An instrument with a scale graduated in watts for measuring electrical power.

Weston Cell.—A mercury, cadmium-sulphate, cadmium amalgam cell, prepared according to a certain specification, used as a standard of potential difference.

Wheatstone Bridge.—A particular arrangement of resistance, galvanometer, and battery as an instrument for the comparison of resistances.

Wheel Base (railway or tramway).—The distance between the points of contact of successive wheels of a vehicle with the rails.

Windage.—The friction of the air on moving parts of machinery and vehicles.

Winding.—All the conductors, turns, or coils belonging to one system.

Yoke.—The iron connecting piece between the ends of the core or cores of an electromagnet, which is outside the windings.

ELECTRIC MAINS EXPLOSIONS.

The report of the Board of Trade Committee, appointed in December, 1913, to consider the causes of explosion in connection with the use of bitumen in laying cables at Nottingham, Hebburn, and elsewhere, has been issued.

The committee examined fourteen well known engineers and points out that during the past 11 years some six or seven serious explosions have taken place in houses due to the ignition of vapour generated by short-circuits between electric cables laid underground in the streets. Explosions have occurred from similar causes in manholes or street boxes; there have been many cases of minor explosions which have merely raised the lids of manholes or have disturbed the pavement, and there have been also explosions in electric street boxes due to the accumulation of coal gas from leaks in defective gas mains.

In investigating the causes of these explosions the committee found that no serious cases have been recorded, nor could witnesses adduce instances, where the supply was given by alternating current, by concentric mains, or by lead-covered paper-insulated cables, and evidence showed that three-core cables may be added to this exclusory list.

Vulcanised bitumen has been the material used for insulating the cables in all the cases of serious explosions in houses, and these have been drawn into bitumen casing or have been laid in bitumen on the "solid system."

While mains have been laid in many thousands of miles of streets with separate cables on the solid system and the serious accidents which have occurred through explosions have not been numerous, it appears that gradual deterioration sometimes takes place owing to original defects in the method

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of laying, or to injury inflicted on the cables in the course of other work in the street, such as alterations of gas mains, &c.

The Committee found that serious explosions, with, perhaps, one exception, have not occurred in small towns.

The use of pitch-compound instead of bitumen has developed to a sufficient extent to justify the view that serious explosions do not occur when such material is used for filling on the solid system.

Deterioration of vulcanised bitumen cables arises from three causes: (A) Coal-gas coming into contact with bitumen softens it, and the insulation suffers, but no case of explosion has been traced to this cause. (B) In the case of positives a fault, probably rarely due to an original defect, but generally to some injury inflicted during or after laying, is attended by corrosion, the production of green incrustation, and eventually by interruption of the copper conductor. The electric current which leaks to earth is so small that it cannot be distinguished by ordinary instruments from general leakage, the total insulation of such cables never being high. A solitary defect of this kind appears to result in nothing more than the inconvenience of the breach of continuity. (C) A fault to earth on a negative decomposes the insulating material and not the conductor. By the action of osmosis, moisture is attracted and the vulcanised bitumen becomes pulpy or sodden. The effect spreads, and sometimes many yards in length are affected. Electrical tests of inspection may reveal such faults, but if not detected, a leak between negative and positive, or, in the case of three-wire systems, between negative and middle, develops and results in a short-circuit. Where the resistance of the cables is sufficient to control the current, the heat may only melt the surrounding bitumen, which flows in, quenches the arc, and seals the fault.

If, on the other hand, the arc persists, the vulcanised bitumen and the bitumen in which the cables are laid is melted. Both vapour and gas are given off. At the high temperature which is present the vapour is "cracked" or dissociated into gas in considerable volume, and if in a confined space, under considerable pressure. When these products can force their way and escape through the surface of the roadway or between the joints of paving stones there is a chance that the arc may burn itself out, either by flooding of bitumen or by failure of current consequent on the lengthening of the arc owing to melting and volatilisation of the copper. If owing to an impervious pavement the gas is forced, or if having free access it passes into a house and becomes ignited, an explosion may be the result.

Bitumen casing is now no longer manufactured, but considerable quantities remain in use in districts where no accident due to bitumen gas has occurred.

This narrows the matter to the consideration of the filling material used on the solid system, and the troughs into which it is poured.

It must be admitted that bitumen and pitch-compound are the only practical materials that can be used to fill the troughs.

The advantages of bitumen are that, since it undergoes a process of preparation, it can be supplied of a quality which is claimed to liquefy at a practicable temperature, to run freely, to weld itself to a subjacent layer, to adhere firmly to cables and to the right kind of bridges, to retain at temperatures above freezing point such viscosity that in case of subsidence of the ground it will bend slowly without fracture, or if cracked, will re-unite. So long as it is continuous it protects the cable from moisture. The temperature recommended for pouring is between 250° and 350° Fahr. If it is heated above 400° Fahr. hydro-carbons are driven off and it becomes brittle, but some engineers have found it difficult to make a good job unless the bitumen was run at about 420°. Mains to the value of between two and a half and three millions sterling are said to have been laid in this way.

The alternative to bitumen is pitch. Blast-furnace pitch contains substances which make it unsuitable. Coal-tar pitch by itself is too brittle, though it has been used successfully for 40 years for protecting lead pipes. Experiments in tempering it with oil and afterwards strengthening it with whinstone dust were encouraging, and resulted in one case in a mixture of three tons of pitch to two of stone dust and 10 gallons of pitch or creosote oil. In another case 10 cwts. of pitch, 10 cwts. of limestone dust, and 10 gallons of tar oil were used; this pitch-compound was tested in a cement-testing machine and was found to be as tough as bitumen. The chief advantage claimed for this over bitumen is cheapness. The melting point is lower; it can be run at 260° Fahr. This lower temperature and the fact that the specific heat of pitch is about 0.5 as against 0.8 for bitumen have the advantage that cables over which it is poured are not so likely to be overheated. On a damp day hot bitumen froths up, and unless considerable care is taken the copper core expands and the cables writhe and buckle. Pitch-compound holds firmly to unglazed stoneware bridges; it is apparently not affected by creosote or by coal-gas.

It appears that a condition precedent for a serious explosion is to be found where two or three separate vulcanised bitumen cables are laid solid in bitumen in one trough. The experience of breakdowns has led to certain improvements in carrying out the solid system, and where conditions are such that lead-covered paper-insulated cables or armoured cables laid direct in the ground cannot be recommended, the solid system carefully laid with due precautions has its advantages, but it ceases to be a cheap method. Earthenware troughs with separate chases or a separate trough for each cable is the best method, but it is expensive and occupies a good deal of space.

The Hebburn accident was due to three preventable causes. At a corner where the direction changed 40 degrees, wooden troughs were merely mitred together. (*a*) Not only had the two cables been pulled up against the wood, but the outer one had been pulled until it rode over the other, and so remained for 11 years, when a fault developed. (*b*) An impervious continuous cement pavement was laid over the cables. (*c*) The cables were laid close to the foundations of a house, and these consisted of loose rubble with no lime or cement.

In most cases where explosions have occurred an impervious pavement of concrete or asphalt had been laid over the mains. It is found that with a flagged pavement the gas can escape between the joints. The nature of the pavement should be taken into account in considering the use of a solid system employing bitumen.

In three cases of explosions services have been so laid that access was given to the interior of houses, and gas freely entered. Most witnesses agree that services should be solidly bricked in, armoured cable being generally preferred. There was general agreement that services should not be carried in on the solid system. On the other hand the committee learned that over 10,000 services on the solid system had been laid in a Midland city, and that there had not been a single fault.

The testing of the insulation of a distributing network of mains has a bearing on breakdowns and on accidents arising therefrom. Separate vulcanised bitumen cables claim to be sufficiently well insulated to offer satisfactory continuity of service, but do not compete with other classes of cables in measurable insulation. In order to comply with the Board of Trade Regulation 34, in some cases the middle wire feeders are bunched on to one bus-bar and the total current is recorded on one instrument, but by the use of a number of recorders on different circuits the localisation of faults is facilitated, and an erratic record suggests that a fault is on a consumer's premises, while a steadily increasing current indicates that it is on the network.

The current which may be neglected as the sum of inevitable leakages depends on the size of the undertaking. The one-thousandth permitted by Regulation 34 could not be tolerated on a large network, for with an output of 8,500 amperes, 8½ amperes would be considered a very serious fault, and if not removed would result probably in a short-circuit or breakdown. As soon as three or four amperes is recorded tests would be immediately undertaken to find the fault. In many large and small towns the current to earth from the middle wire is regarded as a practical indication of a fault. In small towns if one-fifth of an ampere leakage is found the engineers proceed to look for it.

The fraction one-thousandth clearly cannot apply to networks of all sizes, but no suggestion has been made for a test which can be of general application. If the principle of districting is carried out, a large network can be cut up either normally or by the action of fuses into small ones.

Automatic records are supplemented by other tests, *e.g.*, in one city, the use of a bank of lamps between middle wire and earth. A switch cuts these in or short-circuits them, and the positive and negative ammeters are observed and from their indications leakages to earth may be estimated. Another test is to take a reading of the amperes to earth on the middle wire connection and then to put the positive main to earth through a resistance, and read the altered current to earth. If the normal reading indicates a fault to earth of the negative and the second reading is zero, it shows that the artificial leak put on the positive is equal to the leak on the negative. Another method is to send out men with a bank of lamps taking, say, 10 amperes, and to connect these between positive and earth and between negative and earth at various points on the network at prearranged times. The switchboard attendant notes the current indicated at those times by the ammeter. If the whole 10 amperes is accounted for on the switchboard it is evident that the insulation of the network is good.

In another class of tests the middle wire is disconnected from earth.

Another method is one of observing leakages rather than testing insulation. This is to disconnect the middle wire from earth, and to earth the positive and the negative alternately through an adjustable resistance. This gives the combined leakage current of the neutral and the opposite polarity main.

In certain small towns where there have been no explosions of any importance, the leaks are so small that they would not be recorded on ordinary commercial instruments, and the practice is to disconnect the middle wire, and to put the outers alternately to earth through a lamp.

Where 20 amperes is considered a normal leakage, a bad fault will pass twice that current or more, and there is a difference of opinion whether such currents may injure the cables by developing incipient faults. Some few engineers hold that it is desirable thus to break down incipient faults and put the outers direct to earth without any controlling resistance.

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It is difficult to draw a distinction between this "test" and the practice known as burning out a fault. The witnesses by a large majority deprecated this practice.

It is possible by disconnection of cables or of links in junction boxes to cut off part of a network for repair. Such disconnection is sometimes made for the purpose of localising a fault. This practice, desirable in the case of large networks, is not feasible in small towns.

In one large city the engineer prefers to keep no less than 206 districts electrically separate, connected neither by fuses nor links. This practice has continued for 16 years and there have been no explosions.

Many large undertakings have networks interconnected by fuses which normally carry moderate balancing currents, but two difficulties prevent a wider use of this system. The fuses should be placed at points where there is no current, but the distribution of load in winter may differ so much from that in summer, that the fuses need constant attention. The other difficulty is that certain kinds of fuse go off explosively on heavy short-circuits, as when tested on a large battery.

On the other hand, some few engineers prefer the more simple plan of one solid network of single cables with no fuses, and rely on the burning out of a fault when it occurs. Such networks are divided only for the purpose of localising faults, and the insulation in such cases is generally so low that incipient leaks cannot be detected in time to prevent breakdowns.

The committee concludes that in view of the small number of serious accidents which have occurred, compared with the large extent to which vulcanised bitumen cables laid solid in bitumen have been used, it is unable to recommend the Board of Trade to discontinue to approve of this system.

In view of conflicting opinions of witnesses, the committee cannot recommend that iron or stoneware troughing should be used to the exclusion of wood, but it recommends that wood troughing should be used only where it can be ascertained that the soil is suitable; that where separate mains are laid in troughing each cable should be laid in a separate trough, and that between the troughs there should be a space of not less than 2 inches tightly packed with earth or sand.

The committee recommends (1) that separate mains for continuous current supply should not be laid on the solid system below impervious pavements or close to the walls of houses; (2) that easy bends should be laid at corners, and the bitumen or pitch-compound should be poured after the straight lengths have cooled; (3) that where sharp corners of troughing are suspected to exist the mains should be opened up and the corners eased; (4) services should be taken into houses (preferably by the use of armoured cables) in such a manner that gas cannot enter.

In an appendix Dr. Wheeler, of the Home Office Experimental Station, Eskmeals, reports in regard to bitumen explosions, that no evidence could be obtained of any liability to spontaneous combustion on the part of the finely divided carbon that arises from decomposition at high temperatures of the hydrocarbon gases evolved from bitumen and pitch.

The limits of inflammability of the gases evolved on heating bitumen and pitch depend upon their composition, which varies with the temperature at which they are evolved. The gases evolved at 1,000° C. without cracking, have the following limits of inflammability:—

	Lower limit.	Upper limit.
Gas from bitumen	5.4 ...	20.5 per cent.
Gas from pitch and whinstone dust composition ...	10.7 ...	47.5 ,,

Thus, any mixture of air and the particular sample of bitumen gas tested that contains between 5.4 and 20.5 per cent. of bitumen gas is capable of self-propagation of flame; whilst in the case of the gas evolved at 1,000° C. from the pitch and whinstone dust composition, the limits lie wider apart—any mixture of air and the gas containing between 10.7 and 47.5 per cent. of gas is capable of self-propagation of flame.

When the gases are "cracked" by passing them over a highly heated surface, the percentage of hydrogen in them increases at the expense of the hydrocarbons. This tends to widen the limits of inflammability.

On the whole it would appear that pitch would be, if anything, a more dangerous material that bitumen from the point of view of possibility of explosion from the gases derived from it.

The pitch and whinstone dust composition can also be regarded as more dangerous than bitumen, not only on account of its wider limits of inflammability but on account of the high percentage of poisonous carbon monoxide that it contains.

If "cracking" of the gases is presumed to take place, the difference in composition between bitumen gas and pitch gas largely disappears, so that the limits of inflammability of the two kinds of gas become similar, but the gas from the pitch and whinstone dust still contains a high percentage of carbon monoxide.

Patent Restoration.—An order has been made for the restoration of patent No. 4,030 of 1908, for "Improvements in telegraph poles," granted to Frederick H. Tidnam.

THE MUNICIPAL ELECTRICAL CONVENTION.

(*Concluded from page 37.*)

Report of the Council.

The report of the Council showed that the membership of the Association stood at 379, made up as follows:—

Committees (Members)	165
Chief Electrical Engineers (Members)	175
Honorary Members	6
Chief Assistants (Associate Members)	4
Assistants (Associates)	29

There was a net decrease of seven on last year's total, chiefly among the associates.

In connection with the standardization of metal filament electric lamps, the representatives of the Association on the Lamp Standards Committee of the Engineering Standards Committee urged the adoption of watt marking only; they found themselves in direct antagonism with representatives of the War Office, the Admiralty, the Post Office, and Public Works, all of whom were tied down to vote, under the direction of their respective departments, though they were personally in sympathy with the view of the I.M.E.A. A letter was subsequently sent to the Tungsten Lamp Association, informing them that the Standards Committee, by the majority of the votes from Government officials on that Committee, had decided to adopt the standard of marking both the candle-power and watts on lamps. The I.M.E.A. strongly objected to the same, and urged the Tungsten Association to adhere to the resolution already adopted by them in regard to watt marking only. The Tungsten Lamp Association in reply expressed their hearty approval of the marking of all lamps with watt rating only. The only exceptions made by members of the Association were where Government departments made specific requests for candle-power markings.

Thus matters had practically come to a deadlock so far as the I.M.E.A. and the Engineering Standards Committee were concerned, and it was not likely that a specification would be issued by the Standards Committee which would be acceptable to the members of the Association, unless the contemplated re-arrangement of the Standards Committee should result in considerable change in its constitution.

The Electric Vehicle Committee had recommended to the British Engineering Standards Committee that the 150-ampere concentric charging plug and receptacle, standardized by the Electric Vehicle Association of America, should be standardized for use in the United Kingdom for the charging of electric vehicle batteries, with the addition of means for earthing the chassis of the vehicle through the plug and receptacle and a third conductor in the flexible cable, with protection for the flexible cable similar to that known as "Cab-Tyre Sheathing." The Committee was considering the standardization also of a method of gripping this cable to the plug.

At the instigation of the committee, the B.E.A.M.A. had decided to recommend to the Engineering Standards Committee that lead traction battery plates should be standardized, viz., 8⅛in × 5⅛in., with lug centres 4⅛in.

The committee hoped that important accessories connected with the electric battery vehicle might be made International Standards, and the International Electrotechnical Commission had agreed to undertake this work in co-operation with the committee.

Recommendations as to suitable charges to be made by electric supply undertakings for the supply of electric energy for charging the batteries of electric vehicles had been sent to every electric supply undertaking in the United Kingdom, and in very many cases the supply authorities had intimated their willingness to come into line with these recommendations.

The committee approached the various insurance companies and had made arrangements whereby the Car and General Insurance Company, of 1, Queen Victoria Street, intimated that they would give a 15 per cent. preference off their ordinary petrol insurance tariffs in favour of the electric battery vehicle, and probably later on increase the preference to 20 per cent. The committee believed that it would be only a matter of time before other offices came into line in this matter.

As the result of an application made by the committee, the Local Government Board stated that they were "prepared to entertain applications from local authorities for sanction to borrow money for the purchase of vehicles which they were authorised to provide in connection with the exercise of their statutory powers."

The Council had spared no efforts to press forward the Electric Lighting Bill, and desired to acknowledge the assistance rendered by Mr. Hugo Hirst and the late Mr. A. Bruce Anderson, chairman of the B.E.A.M.A. A circular letter was sent to all members of the association with regard to securing promises to ballot from the various members of Parliament, but no place was secured which could be of practical use.

The bill in its present form had the support of the British Electrical and Allied Manufacturers, and it was believed of all other interested parties except the Electrical Contractors' Association, which had declined to accept the proposed amend-

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ments, and had also signified its refusal to have the matter submitted to arbitration.

The Council had had under consideration the standardization of conditions of contract. The I.M.E.A. representatives on the I.E.E. Model General Conditions Committee suggested that the I.E.E. should leave in abeyance their final proof pending agreement by other interested bodies. This suggestion was, however, not adopted, and the I.E.E. had issued their conditions without reference to either the I.M.E.A. or to the B.E.A.M.A. as being in agreement therewith.

The Institution of Electrical Engineers having disbanded the Industrial Committee, the Council had considered the desirability of the formation of an influential body representative of all sections and departments of the electrical industry, competent to deal with all matters of grave importance to the electrical industry. It was agreed that the proposal be approved in principle, and that preliminary arrangements be entered upon.

The hon. treasurer reported that there was a surplus for the year of £65 and a total surplus of assets over liabilities of £786, of which sum £600 was invested in L.C.C. stock. The association had borne the preliminary expenses in connection with the Electric Vehicle Committee, amounting to about £12, but some scheme will have to be devised whereby the committee would become self supporting. The balance sheet showed that the association was in a sound financial position.

The question of the salaries paid to central station engineers and their assistants had been carefully considered, but the Council was unable to take action.

A sub-committee, consisting of Messrs. Cramb, Wilkinson, Fedden, and Seabrook, had been appointed to deal with the standardisation of electrical accessories, including cooking appliances. The Engineering Standards Committee had invited the appointment of two I.M.E.A. representatives on their Electrical Plant Accessories Sub-Committee, and Mr. Cramb and Mr. Seabrook had been so appointed.

The Council of the National Association of Local Government Officers held a meeting at Bristol on March 14th last, when the question of superannuation was discussed; it was more particularly in this connection that the association became affiliated to the N.A.L.G.O. It was reported that over 200 members of Parliament had been approached, and practically all supported the principle of superannuation. A letter was to be sent to the Chancellor of the Exchequer asking him to receive a deputation from the association, and the question would be raised as to the possibility of the chancellor obtaining a grant from the Government towards the cost of the scheme. The establishment of a Provident Section to commence with a deposit scheme for sickness benefit, and a scheme for death benefits, was also discussed, and the recommendation carried.

A draft form of "Conditions of Supply" had been drawn up by the I.M.E.A., to serve as a model only, being amended where necessary to suit local conditions.

ANNUAL GENERAL MEETING.

At this meeting some preliminary discussion took place on the new form of ballot sheet. It was resolved that the member of Council longest in office should retire earliest.

Objection was taken to the method of voting adopted, which follows I.E.E. procedure, but a subsequent resolution to amend this in future elections was lost.

The HON. SECRETARY (MR. H. FARADAY PROCTOR) made a statement from which it appeared that the position as regarded the model general conditions of tender was a stationary one.

Some discussion took place as to the position of the I.M.E.A. Bill, which, we gathered, remains stationary. The HON. SECRETARY commented on the lack of interest taken in the matter by members of Parliament, and appealed to the association to help matters forward through this channel. He pointed out that they had the hearty support of everybody but the electrical contractors, and that if a number of corporations were to join in promoting a bill for similar powers it might facilitate the I.M.E.A. Bill passing at a later stage.

Subsequently the report and balance sheet were adopted, and the council and officers for the ensuing year elected as follows:—

President: *H. Richardson, Dundee. Sen. Vice-President: *A. C. Cramb, Croydon. Jun. Vice-President: : *F. M. Long, Norwich.

Past Presidents: J. Christie, Brighton; G. Wilkinson, Harrogate; R. A. Chattock, Birmingham.

Hon. Solicitor: *Ald. Pearson, Bristol.

Hon. Secretary: *H. Faraday Proctor, Bristol.

Hon. Treasurer: *J. E. Edgcombe, Kingston-on-Thames.

Members of Council—Engineers: A. H. Seabrook, Marylebone; S. J. Watson, Bury; F. Ayton, Ipswich; T. Roles, Bradford; S. E. Fedden, Sheffield; W. Wyld, Hampstead; *W. A. Vignoles, Grimsby; *J. W. Beauchamp, West Ham; *A. C. Blackman, Sunderland.

Committee Representatives: Coun. Gibson, Wolverhampton; Ald. Sinclair, Swansea; Ald. Smith, Barrow; Coun. Ellaway, Birmingham; *Coun. Crowther; Sheffield; *Coun. W. B. Smith, Glasgow.

It was agreed to leave the arrangements as to place of meeting next year in the hands of the Council, the members being assured in the meantime of a hearty welcome at Dundee. A resolution was passed expressing the sympathy of the members with Mrs. Bruce Anderson and with the council and members of the B.E.A.M.A. on the loss which they have recently sustained. Votes of thanks were also passed to those who had so generously entertained the visitors during the week.

(*Elected.)

Mr. A. H. SEABROOK (Marylebone), with the idea of obtaining the views of the association on the subject, wished to move a resolution expressive of the regret of the members at the dissolution of the Industrial Committee of the I.E.E. He subsequently withdrew the matter after hearing the views of the Hon. Solicitor (Ald. Pearson), that the committee representatives were not competent to vote on such a question.

Mr. W. A. VIGNOLES (Grimsby) moved a resolution that a special committee of the I.M.E.A., not necessarily consisting of members of council, and with power to co-opt suitable outside representatives, be formed to deal with any matters for furthering the supply and use of electricity from public supply mains. Other committees had failed because of the clashing of interests; he thought their interests were united.

Ald. SMITH (Barrow) thought it would be necessary to narrow down the subjects to be dealt with to one or two to obtain success, but Mr. F. AYTON (Ipswich) pointed out that sub-committees could deal with any special branch of business, as in the case of the Electric Vehicle Committee.

After Mr. J. E. EDGCOME had suggested the advisability of working on specialised lines, the resolution was carried.

A hearty vote of thanks was passed to the President (Mr. R. A. Chattock) and the proceedings terminated.

ENGINEERING STANDARDS COMMITTEE.

In consultation with the Institution of Electrical Engineers, the Electrical Section of the Engineering Standards Committee has lately been reorganised. The representation of the Institution of Electrical Engineers on the Main Committee of the Engineering Standards Committee has been increased to three, viz., Colonel R. E. Crompton, C.B., Sir John Snell, and Mr. Charles P. Sparks. By arrangement also with the Institution of Electrical Engineers the new Sectional Electrical Committee becomes the British National Committee of the International Electrotechnical Commission (I.E.C.).

A meeting of the Sectional Electrical Committee thus reconstituted, was held on June 12th last, when Mr., now Sir John Snell, the Chairman, was inducted by Sir John Wolfe Barry, K.C.B., the Chairman of the Engineering Standards Committee. A meeting of the same committee sitting as the British National Committee followed, with Mr. Alexander Siemens in the Chair.

The following is the list of the members of the reconstituted Sectional Committee as well as the list of the Sub-Committees and Panels:—

Sectional Electrical Committee, which is also the British National Committee of the International Electrotechnical Commission.

Sir John Snell (Chairman), representing the Crown Agents for the Colonies.

Alexander Siemens, Charles P. Sparks, Vice-Chairmen.

C. H. Wordingham, representing the Admiralty.

Capt. G. L. Hall, R.E., representing the War Office.

Maurice G. Simpson, representing the India Office.

G. Scott Ram, representing the Home Office.

W. Slingo, representing the General Post Office.

H. A. McFerran, representing the Office of Works.

Dr. R. T. Glazebrook, C.B., representing the National Physical Laboratory.

W. Duddell, F. Gill, R. Hammond, J. S. Highfield, Roger T. Smith, nominated by the Institution of Electrical Engineers.

A. C. Cramb, A. H. Seabrook, nominated by the Incorporated Municipal Electrical Association.

C. Koettgen, P. A. Lange, A. P. Wood, nominated by the British Electrical and Allied Manufacturers' Association.

W. R. Rawlings, nominated by the Electrical Contractors' Association (Incorporated).

E. T. Ruthven-Murray, nominated by the Incorporated Association of Electrical Power Companies.

(To be nominated), London County Council.

S. Sellon, Tramways & Light Railways Association.

Colonel R. E. Crompton, C.B., Sir John Gavey, C.B., Walter Judd, Dr. Gisbert Kapp, Prof. T. Mather, C. H. Merz, H. W. Miller, P. F. Rowell (Hon. Sec., British National Committee), Dr. A. Russell, Capt. H. R. Sankey, R.E. (Ret.), Dr. S. P. Thompson, and A. P. Trotter.

Mr. Alexander Siemens takes the Chair when questions affecting the I.E.C. are discussed.

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List of Sub-Committees and Panels.

1. Sub-Committee on Standardisation Rules for Electrical Machinery. (1).—Dr. R. T. Glazebrook, C.B.
2. Sub-Committee on Physical Standards.—Dr. R. T. Glazebrook, C.B.
3. Sub-Committee on Electric Lamps.—Dr. R. T. Glazebrook, C.B.
4. Sub-Committee on Electric Power Cables.—Charles P. Sparks.
5. Sub-Committee on Electrical Accessories. (2).—C. H. Wordingham.
6. Sub-Committee on Telegraphs and Telephones.—Sir John Gavey, C.B.
7. Sub-Committee on Electric Traction. (To be constituted later).
8. Sub-Committee on Prime Movers for Electrical Plant.—Capt. H. R. Sankey, R.E. (Ret.).
9. Sub-Committee on Electrical Nomenclature.—A. P. Trotter.
10. Sub-Committee on Electrical Symbols.—Dr. A. Russell.

(1) Panel on Rating of Electrical Machinery presided over by Dr. R. T. Glazebrook, C.B.

(2) Panels presided over by Mr. C. H. Wordingham: (1) Meters; (2) Plugs; (3) Switches; (4) Fuses; (5) Heating and Cooking Apparatus; (6) Carbon Brushes, Control Gear and Electric Vehicle Accessories.

Taking over the international work has necessitated the appointment of three Sub-Committees on Prime Movers, on Nomenclature, and on Symbols, to which primarily international questions dealing with their respective subjects may be referred.

The British Committee, as on former occasions, has nominated its Delegates to attend the forthcoming meetings of the Special Committees of the I.E.C., as follows:—Nomenclature, Dr. S. P. Thompson; Prime Movers, Mr. Gerald Stoney; Rating, Dr. Gisbert Kapp; Symbols, Dr. A. Russell.

Mr. A. R. Everest (B.E.A.M.A.) has again been appointed as Counsel to the British Delegate on Rating.

The work at present in hand consists to a large extent in work of revision, though a considerable amount of new work is being undertaken upon which reports will be issued in due course. A preliminary draft of the British Standardisation Rules for Electrical Machinery is being drawn up by the Panel under Dr. R. T. Glazebrook, C.B., as an independent Chairman. In this work much valuable assistance has been rendered by the representatives of the B.E.A.M.A., and the I.M.E.A. The Panel is also co-operating with the Revision Committee of the American Standardisation Rules. The international aspect of the question, being closely bound up with the national, is being considered at the same time and with no little advantage.

The Specification for Electricity Meters is under revision and will be very considerably enlarged in its scope. The Panel, which is under the Chairmanship of Mr. C. H. Wordingham, has already held over sixteen meetings. Due to the cordial co-operation of all concerned, very considerable progress has been made and it is hoped that the revised Specification may be available at an early date.

A Specification for Two-and Three-Plate Ceiling Roses will be published almost immediately, as also a Report on the British Standard Method of Specifying the Resistance of Steel Conductor Rails. Progress is also being made in regard to the Standardisation of Two-pin Plug and Socket devices, a Specification for which should be ready in the Autumn. Through the assistance of the B.E.A.M.A. it is also hoped that considerable progress may be made in regard to the standardisation of a number of other accessories all of which are being dealt with by one or other of the five Panels presided over by Mr. Wordingham. In this connection it should be mentioned that the Committee is co-operating with the Electric Vehicle Committee of the I.M.E.A.

The Report on Cables is to be revised and extended, the work being undertaken by the Sub-Committee on Cables under the Chairmanship of Mr. Charles P. Sparks, who is taking the place of the late Mr. Robert Kaye Gray.

With the assistance and co-operation of the Electric Lamp Associations as well as of large users of lamps, Dr. Glazebrook's Sub-Committee on Electric Lamps will be in a position to continue its work upon a revised Specification to include both Carbon and Metal Filament Lamps.

The question of Tungsten Filament Electric Lamps for Automobiles is also being considered at the request of the Society of Motor Manufacturers and Traders by a Sub-Committee under the Chairmanship of Colonel H. C. L. Holden, C.B., R.A.

The reorganisation of the Electrical Section, uniting as it does all the important branches of the electrical industry, under the able Chairmanship of Sir John Snell, is sure to lead to results beneficial to the electrical industry not only as far as this country is concerned, but also in its broader international aspect.

Stocktaking Notice.—The Walsall Electrical Co., Ltd., announce that their works will be closed from July 25th until August 4th for the purpose of stocktaking. A small staff will be in attendance to deal with urgent matters.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

G.E.C. Explosion-Proof Circuit-Breakers.

The General Electric Co., Ltd., of 67, Queen Victoria Street, London, E.C., have recently placed on the market a small breaker having a capacity of 30 amperes at 300 volts, or 15 amperes at 500 volts. It is of the double-pole type with overload trip, and the case is explosion-proof. The flanges are wide and well machined—in no case are they cut away to take the holding down bolts for the lid—and, in addition, a flame-proof gland is provided for the switch spindle to pass through the case into the interior. Internally the device has been designed with ample clearance, and with ample insulation. The G.E.C. standard patent interlock is embodied, so that the breaker cannot be closed until the lid is first closed, nor can the lid be opened until the breaker is in the "off" position. This interlock has been specially designed for colliery work, for which interlocking gear of a delicate nature is entirely unsuitable. The overload trip is easily adjustable over a wide range. The breaker has been designed to take the G.E.C. standard mining glands, which complete the flame-proof characteristics of the case.

Chromolyte Batteries.

Messrs. J. J. Eastick & Sons, of Clapton Common, N.E., are introducing a patent primary cell in which a number of novel features are embodied. Fig. 1 shows the battery, refills, and a portable lamp. The battery consists of a fixed electrode, a

Fig. 1.—Chromolyte Battery, Refills, &c.

renewable zinc electrode, and a special electrolyte, contained in a hermetically sealed cell; the elements are put out of action by reversing the battery in the strap handle when not required for use. The electrolyte is made by dissolving "Chromolyte," put up in collapsible tubes, in water. The liquid cannot be spilt, and the process of recharging is easy and simple. It is stated that the cells do not polarise, and that they are lighter than storage cells and cheaper in working than dry cells. Other advantages claimed for them are high voltage, long life per charge, freedom from loss by leakage, and immunity from damage by short-circuiting. They are recommended by the makers for motor-car ignition and lighting, driving small fans, &c., and for all other purposes to which portable batteries are adapted.

Variable Precision Condensers.

The Sterling Telephone and Electric Co., Ltd., of Telephone House, 210, Tottenham Court Road, W., have brought out a moving-vane variable air condenser for wireless telegraphy, manufactured according to a process invented by Dr. Seibt, in which the difficulties met with in building up an air condenser with parallel plates are overcome. The plates are in the "Pre-

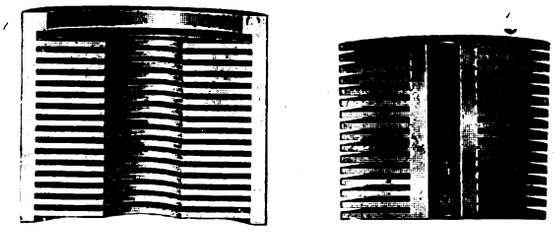

Fig. 2.—Sections of Variable Condenser.

cision" type milled out of solid blocks of aluminium by special machines (fig. 2); one section is stationary, while the other is attached to an insulated steel shaft projecting through the top of the protecting case, which is made of metal and can be filled with oil if it is desired to increase the capacity of the condenser. The

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cover is faced with ebonite, on which the scale is engraved. A counterbalance (seen in fig. 3) attached to the rotary section enables the instrument to be used with its axis in a horizontal position if desired. Each condenser is tested up to 440 volts D.C.

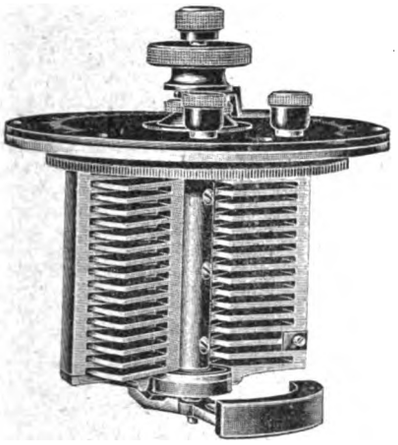

FIG. 3.—VARIABLE CONDENSER REMOVED FROM CASE.

Various patterns are made, including a specially small one for portable wireless installations, being $4\frac{3}{8}$ in. overall in diameter and $3\frac{1}{4}$ in. high, with a maximum capacity of 2,000 cm. Coupled condensers are also made.

Automatic Dimmer Switch.

THE ATLAS ELECTRICAL CO., LTD., of 58, High Street, Charing Cross Road, W.C., have drawn our attention to their patent Atlas automatic dimmer switch with remote control, which is illustrated herewith.

This is intended for use in cinematograph theatres and other places where it is frequently necessary to light or extinguish the lamps gradually, from several points in the building. By using

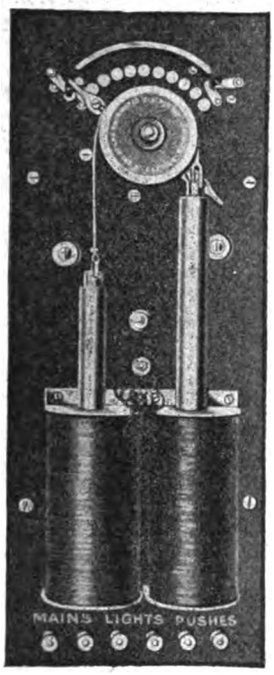

FIG. 4.—ATLAS AUTOMATIC DIMMER SWITCH.

remote control effected with pushes connected in parallel, the cost of wiring is reduced to a trifling amount, and the dimmer can be placed in the most suitable position. The dimmer here shown is actuated by two solenoids; when any push is pressed once, the switch is set in motion, and makes its own circuit, so that it is not necessary to keep the push pressed. After the operation is completed, if a push is pressed again, the action of the switch is reversed; but while the switch is actually in motion it is not affected by the pushes.

New 10-Ampere "Pivot Intermediate" Switch.

MESSRS. A. P. LUNDBERG & SONS, of 477-489, Liverpool Road, N., have recently introduced a new pattern "Pivot Intermediate" switch of 10 amperes capacity, which we illustrate in fig. 5.

The main improvements consist in the substitution of knife-blade and double-spring-clip contacts for the original face contacts, in the elimination of the porcelain rocker, and in the use of a vitreous porcelain base and of mica insulation on the moving part.

The switch may be fitted with either brass or porcelain cover; the current-carrying parts are well sunk in the base, and provision is made for the attachment of an earthing wire.

Although primarily intended for use on two-way intermediate circuits controlling large numbers of lamps, the switch (or, rather, its movement), has many other—and, in some respects, more important—uses.

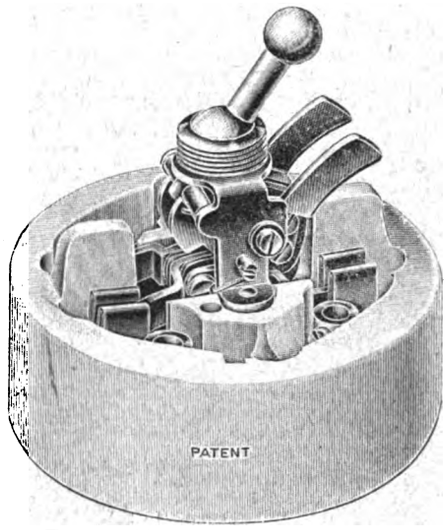

FIG. 5.—NEW 10-AMPERE SWITCH.

Thus, by slight modifications in construction, the switch may be converted into any one of the following types:—

Single-way 20-ampere capacity; in 10-ampere capacity, as single-way with quadruple-break, double-pole, two-way with definite gap in passing over, pilot, reversing, series-parallel, all or part, and one or two special parts.

Some of the above switches are extensively used for the control of heating apparatus and small motors, and others for certain lighting controls. The reversing switch adaptation will be found much more convenient than some of the ancient forms still used in laboratory testing, and other special apparatus.

Modern Steel Works Plant.

One of the oldest works in South Wales engaged in the steel and tin-plate trade, recently brought its plant up-to-date, and electrified a considerable portion of the works.

Probably the most interesting of the motor applications in this works is the electrical driving of the pusher furnaces, which are illustrated in fig. 6. The motors driving these pushers are of the "Witton" reversible intermittent rated type, and have a capacity of 50 H.P.; they are geared to the pushers by spur wheels and rack. One pusher serves for operating two rows of ingots, which it moves alternately. The cold ingots are placed in front of the pusher, which is advanced as soon as the furnace door is opened, and the ingots are forced by successive operations through the furnace. A large roll turning lathe is driven by a direct-coupled

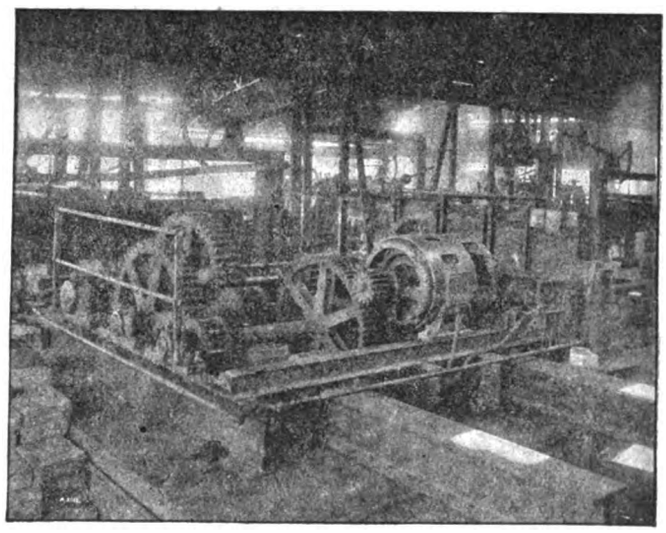

FIG. 6.—50-H.P. THREE-PHASE "WITTON" MOTOR DRIVING A FURNACE PUSHER.

50-H.P. motor through worm gearing. It gives a turning speed on the lathe of 1·5 to 2 R.P.M. by means of a speed controller in the rotor circuit.

Following modern practice, the charging boxes for the steel furnaces are loaded by means of "Witton"-Kramer magnets. As the power generated is alternating current, the magnets, which are 42 in. in diameter, are supplied through motor-generators which convert the three-phase to continuous current. Within six months of the installation of the first magnet, it was realised that very great economies were being effected, and a repeat order was placed for a similar equipment. The electrical equipment for this installation was supplied by the GENERAL ELECTRIC CO., LTD., of Witton, Birmingham.

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NEW PATENTS APPLIED FOR, 1914.

NOT YET PUBLISHED.

Compiled expressly for this Journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

14,932. "Receiving instruments for use in submarine sound signalling." J. GARDNER. June 23rd.

14,946. "Electric cables and cable systems and joints for use therein." E. G. WATERS and CALLENDER'S CABLE AND CONSTRUCTION CO., LTD. June 23rd.

14,955. "Electric light prepayment apparatus." H. SIMS, J. BOOTH, and W. MILLER. June 23rd.

14,965. "Electro-magnetic control break-contact burglar alarm." C. S. HAYNES and C. A. PARISH. June 23rd.

14,966. "Electric railways and tramways and railless electric vehicles." E. CROSS. June 23rd.

14,984. "Method of energy supply and control for wagons or trains of electric railways or similar contrivances by means of variation in the pressure of supply." RIGHT HON. C. E. H. HOBHOUSE, W. SLINGO, H. C. GUNTON, and C. H. DOUGLAS. June 23rd.

14,999. "Electric ignition apparatus." E. ROGALSKI. June 23rd. (Complete).

15,024. "Receiving device for subaqueous sound signals." SIGNAL G.M.B.H. June 23rd. (Convention date, July 24th, 1913, Germany). (Complete).

15,031. "Spark gaps for radio-telegraphy." E. GIRARDEAU and J. BERTHENOD. June 23rd. (Addition to 14,884/14. Convention date, February 25th, 1914, Belgium). (Complete).

15,052. "Electric headlights and the like." L. RENAULT. June 23rd. (Convention date, July 1st, 1913, France). (Complete).

15,074. "Thermo electrification of railways, tramways, rail-less carriages, locomotives, trains, and the like self-contained electrically-connected linked-up vehicles." W. P. DURTNALL. June 23rd.

15,076. "Method of regulating the supply of cooling-water for mercury-vapour rectifiers without natural cooling." ALLGEMEINE ELEKTRICITATS GES. June 23rd. (Convention date, June 21st 1913, Germany). (Complete).

15,082. "Mechanical selector for electro-magnetic waves applicable to wireless telegraphic receiving-apparatus." R. B. GOLDSCHMIDT. June 23rd. (Addition to 14,595/14. Convention date, May 2nd, 1914, Belgium). (Complete).

15,125. "Telephone switches." T. GREEN. June 24th.

15,155. "Controlling-arrangements for direct-current electric motors." SOC. ANON. DITE S.T.A.R. SYSTEME DE TRACTION AUTO-REGULATEUR. June 24th. (Convention date, July 21st, 1913, France). (Complete).

15,160. "Electric dischargers more particularly for use in wireless telegraphy and telephony." T. W. STRATFORD-ANDREWS and GALLETTI'S WIRELESS TELEGRAPH AND TELEPHONE CO., LTD. June 24th.

15,182. "Wireless receiving-apparatus." L. C WILLCOX, B. HIPPISLEY, and E. R. CLARKE. June 24th.

15,188. "Electric lighting-apparatus for vehicles." F. L. BASSETT, and J. A. COLE. June 24th.

15,190. "Method of repairing and regenerating incandescent electric lamps." E. LE NAOUR. June 24th.

15,194. "Electric meters." BRITISH THOMSON-HOUSTON CO., LTD. June 24th. (General Electric Co., United States).

15,202. "Pocket magnetic compasses." W. H. HARVEY. June 25th.

15,203. "Means of operating contact-makers." J. DAVIS & SON (Derby), LTD., and W. H. DAVIS. June 25th.

15,224. "Electrically-operated winch, specially applicable as an ash hoist." G. F. D. CAMPBELL. June 25th. (Addition to 20,853/13). (Complete).

15,233. "Apparatus for massaging, heating, electrifying, and similarly treating human or animal bodies." E. KOPPL. June 25th. (Complete).

15,260. "Induction motors." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO., LTD. June 25th. (Soc. Anon. Westinghouse, France).

15,267. "Manufacture of metal absorption." ELEKTRO-OSMOSE AKT. GES. June 25th. (Convention date, April 29th, 1914, Germany). (Complete).

15,273. "Types for typewriters and typographical setting machines used in the direct reproduction of images transmitted by means of ordinary telegraphic apparatus." U. ELLERO. June 25th. (Convention date, June 25th, 1913, Italy). (Complete).

15,302. "Electric cooking and heating apparatus." W. P. PERRY. June 26th.

15,324. "Apparatus for electrically igniting miners' safety lamps." V. E. JOYCE, and SPAGNOLETTI, LTD. June 26th. (Complete).

15,327. "Electric switch buttons." R. LIEBISCH. June 26th.

15,329. "Metal filament glow lamps." SIEMENS BROS. & CO., LTD., and W. H. LE MARECHAL. June 26th.

15,336. "Method of controlling the vacuum of X-ray tubes." R. S. WRIGHT, and E. E. BURNSIDE. June 26th.

15,338. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. June 26th. (Automatic Electric Co., United States). (Complete).

15,339. "Electric switching device." M. BOCK. June 26th. (Complete.)

15,352. "Oiling devices for magnetos for the ignition of motors." SOC. D'ELECTRICITE NILMELIOR. June 26th. (Convention date, June 27th, 1913, Belgium). (Complete).

15,353. "Magnetos." J. F. J. BETHENOD. June 26th. (Convention date, June 27th, 1913, Belgium). (Complete).

15,356. "Protective apparatus for electrical machines and circuits." J. S. HIGHFIELD, and W. DUDDELL. June 26th.

15,363. "Method of enclosing portable electric batteries and a device therefor." B. PORDES. June 26th.

15,380. "Sparking-plugs." SOC. CARPENTIER, BAL. ET CIE. June 26th. (Convention date, January 7th, 1914, Germany). (Complete).

15,388. "Detectors for electro-magnetic waves or the like." B. STARIE. June 26th.

15,399. "Vacuum-tube lighting apparatus." F. MEYER. June 26th. (Convention date, June 28th, 1913, Germany). (Complete).

15,400. "Automatically locking and unlocking carriage doors of passenger trains, electrically controlled." V. L. COLCLOUGH. June 27th.

15,404. "High-tension sparking plug for internal combustion engines, with special reference to the engines of motor-vehicles and motor-cycles." F. WOOD, and A. H. WILDE. June 27th.

15,405. "Railway safe-running devices." A. R. ANGUS. June 27th.

15,431. "Overhead electric locomotion for the purpose of conveying passengers and goods." H. KLINCKE. June 27th.

15,455. "Electric furnaces." F. J. MACHALSKE. June 27th. (Convention date, June 27th, 1913, United States). (Complete).

15,456. "Electrodes." F. J. MACHALSKE. June 27th. (Convention date, June 27th, 1913, United States). (Complete).

15,464. "Electric starting-device for internal combustion engines." L. RENAULT. June 27th. (Convention date, July 12th, 1913, France). (Complete).

15,471. "Circuit arrangements for telephone systems." SIEMENS BROS. and Co., LTD. June 27th. (Siemens & Halske Akt. Ges, Germany). (Complete).

15,485. "Negative arc-lamp carbon for high specific loads." PLANIAWERKE AKT. GES. FUR KOHLENFABRIKATION. June 27th. (Convention date, March 6th, 1914, Germany). (Complete).

15,487. "Magnetos." J. F. J. BETHENOD. June 27th. (Addition to 15,353/14. (Convention date, July 9th, 1913, Belgium). (Complete).

15,489. "Electric lamps and their holders." F. JONES. June 27th. (Complete).

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

18,368. MULTIPLEX TELEGRAPHIC PRINTING APPARATUS FOR AUTOMATIC AND MANUAL TRANSMISSION AND OF HIGH OUTPUT, ALSO CAPABLE OF BEING USED WITH SUBMARINE CABLES. A. Colonna. August 9th. (June 7th, 1913).

1913.

9,930. ELECTRIC WATER HEATERS AND THE LIKE. R. Weaving, and Ferranti, Ltd. April 28th. (Cognate Applications, 11,896/13 and 23,527/13).

10,803. ELECTRIC RAILWAY SIGNALLING SYSTEMS. J. B. Mouyen. May 7th. (May 8th, 1912).

12,889. ILLUMINATED ADVERTISING DEVICES. W. W. Lower.

12,936. ELECTRIC MOTOR STARTERS. J. Roothaan, and Ferranti, Ltd. June 4th.

13,006. MAGNETO-ELECTRIC IGNITION APPARATUS. Unterberg & Helmle. June 4th. (March 15th, 1913).

13,173. SAFETY DEVICE FOR THE STARTING OF MOTOR CARS. E. Charageat. June 6th. (Patent of Addition not granted).

13,242. TRAIN CONTROL APPARATUS. W. B. Murray. June 7th.

13,243. ELECTRICAL TRAIN CONTROL SYSTEM. W. B. Murray. June 7th.

13,250. ELECTRIC FURNACE WITH ROTARY FLAME FOR THE TREATMENT OF GASES AND VAPOURS. I. Moscicki. June 7th.

13,310. METHODS OF CONTROLLING DISTANT APPARATUS BY ELECTRO-MAGNETIC WAVES. J. H. Hammond, Junr. June 9th. (June 7th, 1912).

13,323. ARTIFICIAL LIGHTING APPARATUS FOR PORTRAIT PHOTOGRAPHY. R. A Higgs. June 9th.

13,358. ELECTRIC SUPPLY DEVICES FOR SERIES LIGHTING AND OTHER PURPOSES. J. P. Naylor & Naylorgraph, Ltd. June 9th.

13,465. SEPARATION OF LIQUID SUSPENSIONS. British Thomson-Houston Co. (General Electric Co.). June 10th.

13,480. APPARATUS FOR TESTING THE SPECIFIC GRAVITY OF ACID IN CELLS WITH SEALED COVERED. D. P. Battery Co. and T. C. Elliott. June 11th.

13,636. RECEIVERS FOR USE IN WIRELESS TELEGRAPHY AND TELEPHONY. Marconi's Wireless Telegraph Co. & C. S. Franklin. June 12th.

13,637. MEANS FOR INCREASING THE FREQUENCY OF ALTERNATING CURRENTS. Marconi's Wireless Telegraph Co. & C. S. Franklin. June 28th.

13,748. SELECTORS FOR AUTOMATIC OR SEMI-AUTOMATIC TELEPHONE SYSTEMS. Siemens & Halske Akt. Ges. June 13th. (June 22nd, 1912).

13,764. ELECTRICAL RESISTANCES. W. M. Mordey. June 13th.

14,994. AUTOMATIC ELECTRIC SWITCHES GOVERNING DUAL-RATE ENERGY METERS. H. H. Perry. June 30th.

16,815. CASH, STAMP, PARCEL, OR THE LIKE TRAY, IN COMBINATION WITH AN ILLUMINATED SIGN FOR ADVERTISING PURPOSES. R. A. Pantlin. July 22nd.

16,963. ELECTRICAL STARTING-APPARATUS FOR INTERNAL COMBUSTION VEHICLES. W. A. Trier. July 24th.

18,438. RELAYS. R. Zei & J. Nardin. August 13th. (August 13th, 1912).

19,121. TELEGRAPHIC RECEIVERS AND RELAYS THEREFOR, AND FOR ANALOGOUS PURPOSES. Eastern Telegraph Co. & A. Fraser. August 22nd.

19,250. LAMP AND THE LIKE REFLECTORS OR GLOBES. B. J. Grigsby, G. Campbell, & R. A. Ives. August 25th.

20,320. INDICATING MEANS CONNECTED WITH RAILWAY CARRIAGE AND LIKE DOORS, AND MEANS COMBINABLE THEREWITH FOR AUTOMATICALLY ACTUATING THE VACUUM BRAKES OF RAILWAY TRAINS. W. K. Kaye. September 9th.

21,309. ELECTRIC ROTARY TRANSFORMERS. Soc. Schneider et Cie. September 20th. (October 31st, 1912).

22,235. CONSTRUCTION OF ELECTRIC FANS. S. G. Leach. October 2nd.

23,841. SECONDARY GALVANIC BATTERIES. A. Iconomus. October 9th.

25,018. ELECTRIC RAILWAY SIGNALLING AND MEANS THEREFOR. Siemens Bros. and Co. & J. Boot. November 3rd.

25,393. PROCESS FOR OBTAINING ADHESIVE COATINGS OF COPPER UPON IRON AND STEEL. S. O. Cowper-Coles. November 6th.

25,716. ELECTRICAL RESISTANCE-MEASURING APPARATUS. M. E. Leeds. November 10th. (November 18th, 1912).

26,278. AUTOMATIC TELEGRAPH TRANSMITTERS. Eastern Telegraph Co., K. L. Wood, and A. Fraser. November 15th.

26,997. TESTING INSTRUMENTS FOR ELECTRIC CONDUCTORS. C. L. Faries. November 24th.

27,753. TELEPHONE SYSTEMS. E. A. Graham. December 2nd.

27,859. ELECTRO-MAGNETICALLY-CONTROLLED PERFORATING APPARATUS. B. Soldatencow. December 3rd. (Addition to and Divided Application on 5,352/13, March 3rd).

1914.

253. DYNAMO-ELECTRIC MACHINES. R. H. Lane. January 5th.

310. TELEPHONE SYSTEMS. E. A. Graham. January 5th.

1,421. METHOD OF AND MEANS FOR THE PRODUCTION OF LIGHT FROM HIGH-TENSION MAGNETO MACHINES USED FOR IGNITION PURPOSES. A. E. Twiddy, and J Stally. January 19th.

2,493. ELECTRIC LOCK AND ALARM APPARATUS. O. Nitsch. January 30th.

3,756. IGNITION DEVICES FOR INTERNAL COMBUSTION ENGINES. W. Peck. February 13th.

4,663. ELECTRIC CIRCUIT-INTERRUPTERS. British Westinghouse Electric and Manufacturing Co. (Westinghouse Electric and Manufacturing Co.). February 23rd.

6,892. AUTOMATIC COIN-FREED DEVICES FOR AUTOMATIC TELEPHONE INSTALLATIONS. Siemens & Halske Akt. Ges. March 18th. (July 24th, 1913).

8,831. TELEPHONIC SYSTEMS. E. A. Graham, and E. A. Sanftleben. April 7th (Addition to 767/14).

8,906. TELEPHONIC SYSTEMS. E. A. Graham, W. J. Rickets, and E. A. Sanftleben. April 8th. (Addition to 6,356/14).

8,916. ELECTRICAL REGULATING DEVICES. Robert Bosch (Firm of), and G. Honold. April 8th. (Addition to 27,961/12).

10,041. ELECTRIC SWITCHES. P. S. Turner. April 23rd. (Divided Application on 14,112/13, June 18th).

12,633. METHODS OF CONTROLLING DISTANT APPARATUS BY HERTZIAN WAVES. J. H. Hammond, Junr. May 22nd. (Divided Application on 13,310. June 9th).

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THE

ELECTRICAL REVIEW.

VOL. LXXV. JULY 17, 1914. No. 1,912.

ELECTRICAL REVIEW.

Vol. LXXV.] CONTENTS: July 17, 1914. [No. 1,912.

	Page
The Miners' Fallacy	81
British Trade in Canada	82
A New Type of Gas Engine	82
Vexatious Inquiries	83
Lead	83
The German Cable-Makers' Syndicate	83
Electrical Accidents	84
Electric Mains Explosions	84
The Fullagar Gas Engine (*illus.*)	86
Correspondence—	
Mica and Micanite	88
Difficulties in Canada	88
Switchgear Contracts: Expenses of Tendering	89
The Policy of the A.E.S.E.	89
The Qualifications of a Consulting Electrical Engineer	90
Electrical Accidents in 1913	91
Electric Signalling on French Railways (*illus.*)	92
Legal	93
Business Notes	96
Notes	103
City Notes	106
Stocks and Shares	108
Share List of Electrical Companies	109
The Examinations of the I.E.E.	111
The Latest Type of Rennerfelt Furnace (*illus.*)	112
Import Trade Statistics of Switzerland	114
German Rules for Electrical Installations	114
Electrical Work at the National Physical Laboratory during 1913	115
The "Point Five" Association	117
New Electrical Devices, Fittings and Plant (*illus.*)	117
New Patents Applied For, 1914	120
Abstracts of Published Specifications	120
Contractors' Column ... Advertisement pages xxii and xxiv	

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THE MINERS' FALLACY.

IT is a little difficult to understand in these days of education and enlightenment how such foolish proposals as the recent decision of the Scottish miners to work only four days per week can be really seriously considered. Or is it that education is not carried far enough, and that the true explanation lies in the fact that "a little learning is a dangerous thing?" We are inclined to this belief, as it is the miner's idea that when prices fall it is solely due to the supply exceeding the demand; this is true to some extent, but there are other factors which enter into the complexity of declining trade and affect the question. The demand may still exist, but at reduced prices, and so long as buyers can get coal at prices which they can afford to give, they will continue to order, and the pits may be kept in full swing. But it is to be noted that lower prices apply not only to the coal trade but to every industry, and the lowering of prices is due to the desire to keep the volume of trade the same. Hence one often hears the expression "Yes, we are busy, but prices are not so good," and if wages are to remain the same, it follows that profits must be reduced. This is what really does happen, often in fact, until instead of profit there is actually a loss; then it becomes necessary, if the works are to be kept going, for the employer to ask the workman to bear his share by accepting lower wages, and this is what the Scottish coalmasters are at present demanding, in order to keep the pits open.

The Scotch miner, however, thinks he can alter all this by simply reducing the output, and he decides to work only four days per week instead of six, so that by limiting the supply the owners will get better prices and his rate of wages will remain the same. But the strange part of the matter is that he entirely ignores the reduced total earnings for the whole week. Thus, if his present rate is 7s. per day, and he works four days, his earnings are 28s., but if he accepts the reduction and gets, say, only 6s. per day, his earnings for six days' work will be 36s. The public, we believe, have always been more or less sympathetically inclined towards the miner, but we doubt whether they will have the same consideration for men who wilfully refuse to work, and who would rather do with a less amount of wages than do their usual work at a reduced rate, but for a greater total. What about all the harrowing tales of the high rate of living and the hardship and poverty of the miners? There never was any real poverty, and, as a matter of fact, there never is, in any mining village. Improvidence there may be, but there is no poverty due to lack of work, except when the men absolutely refuse to work. Evidently the miners have no real complaint to put before the public of the smallness of the living wage.

This, however, is not all, because even if the pits only worked four days per week, this fact would not maintain prices. Buyers would simply go to other districts, and the result would be the diversion of the trade, possibly to such an extent that it would be difficult for the owners to maintain sufficient trade, even at the lower prices, to keep the pits going three days a week; and once trade is gone, it is very difficult to get it back.

The owners naturally propose to resist the attempt of the men to reduce the number of working days, even to the extent of closing down all their pits and locking out the men. As a matter of fact, this is not so much a policy of spite as of economy. The "on-cost" and establishment charges of a colliery can only be covered by a certain out-

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put, which is more or less constant, for if prices are high the charges are higher, and if prices are low the charges are lower. The men, therefore, by their action would reduce the output to such an extent that even if prices remained high there would probably still be a loss instead of a profit; but the masters know only too well that the men's proposal would not result in maintaining prices, and they would not only lose by working the pits four days a week, but they would eventually lose all their trade as well. It would, therefore, be cheaper to close down the mines rather than keep them open on a greatly restricted output. One would think that the labour leaders—who, we suppose, are not entirely devoid of intelligence—would know this and would, therefore, counsel the men otherwise. Or is it that they are afraid to tell their followers the truth?

At a colliery in Cumberland the men, numbering about 300, have been asked to increase the output and submit to a reduction of 10 per cent., or the pit will have to be closed. The Council of the Cumberland Miners' Association has advised the men not to submit to any reduction, so we may assume that the pit will be closed and 300 or more men thrown out of employment in a district were there already exists much distress owing to the recent closing of another colliery.

Some time ago we pointed out that the true effect of the minimum wage would not be felt until trade began to decline and prices began to fall, compelling the masters to ask for reductions in wages. The National Federation of Miners have fixed the minimum wage at 7s. 6d., but the Scottish coal masters have asked for and been awarded a reduction which has brought the wages below this amount, viz., 7s. 3d., and they are now asking for a further reduction. Undoubtedly this will be followed by demands by the owners for reductions in other districts, which we suppose will be resisted by the men, and, on the whole, if the firebrands are allowed to have all their own way the new triple alliance of miners, railway men, and transport workers may have an opportunity of showing its strength; but it cannot possibly alter the fact that any article, even if it be coal, will only sell for what it will fetch, and that the workman can only obtain a portion of this price and not the whole of it.

BRITISH TRADE IN CANADA.

The annual report on the trade of Canada prepared by Mr. C. Hamilton Wickes, H.M. Trade Commissioner in that Dominion, and just published by the Board of Trade, contains some interesting notes on the position of British trade in Canada and some valuable hints as to how it may be improved. By a painstaking analysis of the statistics Mr. Wickes is able to show that the value of the market to British trade is not nearly so great as is generally supposed. The total imports in the year reviewed, viz., the 12 months ended March, 1913, according to the statistics, amounted to £135,960,000, but of this amount he has ascertained that £47,040,000 consisted of goods which must for natural reasons be supplied by countries other than the United Kingdom (chiefly the United States), while a further amount of £12,920,000 represents goods such as raw products, which, though they may be supplied by British merchants, are of no interest to British manufacturers. The remainder, £76,000,000, or only 55·8 per cent. of the total, consists of goods in the supply of which British manufacturers may hope to compete.

Of this amount we actually supply only £25,000,000. Taking all things into consideration, this is by no means an unimportant share, but Mr. Wickes finds that as 85·3 per cent. of these imports from the United Kingdom are granted a preference, and as the fact that we get even this amount of trade may fairly be said to be due to the existence of the preferential tariff, the "position revealed is disquieting." He is of opinion, moreover, that our obtaining even this amount of trade is due rather to the efforts of Canadian buyers in finding out British sellers in order to obtain the advantage of the preference, than to the efforts of British sellers in working the market. All of which is not at all inspiring. Nevertheless, Mr. Wickes admits that serious attempts are now being made by British traders to acquire information as to the conditions existing on the market, and to study how best to market their goods; a further note of hope is struck when he points out that the outlook for an increasing share in Canada's trade being obtained by British manufacturers appears to be promising, having in mind that in addition to the re-awakening of British interest just referred to, that of Canadian firms desiring to be put into touch with British sources of supply is no less remarkable.

Some of the chief reasons why American firms have succeeded in Canada in competition with British were given in last year's report, to which we called attention when it was issued. Mr. Wickes now gives a list of some of the most important points which have been suggested to him on the spot as being necessary to be observed by British firms. Some of these are old suggestions, which are nevertheless of great importance, such as the need for carefully choosing agents (about which many even of our leading firms are singularly careless), the preparation of catalogues in Canadian currency, the proper supply of samples, the need for considering the point of view of the agent as expressed in his correspondence, and a better knowledge of terms of credit. Two other suggestions may be specially emphasised, however, viz., that more attention should be paid to the price at which goods are retailed, and that manufacturers should take the trouble to understand the geographical features of the country. As to the former, it is only too rarely realised that a prime factor in trade is the price at which the goods are finally sold to the consumer: the manufacturer often takes little or no care to keep a check on this price in order to maintain his trade. As to the latter, it may be pointed out again that Canadians are very jealous of the importance of their country, and a lack of knowledge of the existing conditions which is often displayed by firms with which they deal, often has the effect of seriously wounding their susceptibilities.

Dealing with the question of the amount of labour forced upon the agent by quotations in sterling and by constantly changing discounts, Mr. Wickes points out that want of care and consideration in these and other comparatively minor details concerned with the marketing of goods, seriously impedes the development of British trade in Canada. It loses the British manufacturers order after order from the Canadian trade. He adds, "from intimate touch with those acting as agents, we have learned that the same reasons seriously affect their attitude towards British agencies. The more important class of agents, who can pick and choose agencies, will only accept those which give an adequate profit with the smallest amount of clerical labour, consequently their first attitude towards British agencies offered to them is one of doubt."

In addition to general advice to traders, the report contains specific information regarding the trade in particular classes of goods with very exhaustive statistics showing the extent of British and American trade in each line. We shall give next week some extracts from the report, but we would suggest that those of our readers who are interested in trade in Canada should obtain a copy for themselves. For a variety of reasons, some of which are perhaps unavoidable, our electrical business in Canada is none too prosperous. From time to time we have referred to some of these causes at length, and we need not enlarge on them now. That the trade could be substantially increased there can be no doubt, and the report now before us will assist to that end if the suggestions therein made are carefully followed up.

A New Type of Gas Engine.

On another page we print a description of the Fullagar internal combustion engine which was on demonstration at Newcastle last week at the joint meeting of the Institution of Naval Architects and other engineers. It appears that in its cycle of gas operations there is nothing new. It is a two-stroke engine of a quite usual type. Its novelty is purely on its mechanical side. Engineers have for nearly

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two centuries been accustomed to regard the connecting rod, with its very considerably oblique action, with equanimity. In fact, the connecting rod—a strut of two rounded ends—vibrating violently across its longitudinal centre line has been, so to say, taken unquestioningly to our hearts. Why, then, should we seek now to question the oblique side rods of the Fullagar engine? They are less oblique than even very long connecting rods, they are by way of being very square ended indeed, and they are always in tension, and have an inertia bending movement of very trivial intensity. We see no reason whatever why a piston in one cylinder should not be thus connected to a piston in another cylinder for the purpose and with the object explained. And that object is one for which even much of less merit than those oblique rods might be permitted in construction. For it is no less than the return of the engine shaft to its proper condition of a piece stressed in one direction only.

In no part of an engine do reversed stresses play a less desirable part than in the crankshaft. They render imperative a much greater diameter, and they thereby largely increase the friction load of the engine. It is well to abolish this friction in company with much excessive weight and cost and space, if it can be done by the simple connections described. Of course, if to one piston in four happens a misfortune, even though it be a very small one, the whole four pistons of an element of the engine are put out of work. But does not this practically apply to any engine? Obviously this new engine has been run so long that there are no qualms as to showing it, quiet as it has been kept during its probationary period. We feel that it has come to stay, and, since its mechanical construction can be applied to the two-stroke Diesel cycle, there is a wide field for it. It enables four very simple cylinders to be combined in one two-cylinder element, and thus by keeping to moderate cylinder diameters an enormous weight is saved in any engine of a given power.

Vexatious Inquiries.

IN the event of the Revenue Bill of this year receiving the Royal Assent, all owners and occupiers of land and buildings will be required to furnish information with a view to dividing the rateable value of land so as to distinguish between the values attributable and not attributable to houses, buildings or other improvements. This is required in order that the full site values obtained under the Finance (1909-10) Act, 1910, may be adjusted for each separate assessment for local rating purposes.

Although trading and manufacturing firms *per se* do not greatly concern themselves with legislation, the Land Union points out in a memorandum just issued that this proposal will seriously affect them, as the information, demanded under penalty, will be most difficult and costly, if not impossible to furnish, and will include much confidential detail as to profits and working expenses, apparently to be utilised as a basis of rate assessments open to inspection by other ratepayers and by the public.

Amongst other details asked for are particulars of all outgoings and by whom borne, any adverse or beneficial rights, easements or covenants, and any improvements in buildings, plant, and machinery not incurred more than 50 years before the date of record. In the case of tramways, details of car-miles run, receipts from each separate service, working expenses, running powers, and working agreements are required, whilst electricity undertakings must furnish particulars of receipts and working expenses.

We neither support nor object to the Bill on political grounds, but solely as a matter of business we advise our readers to consider carefully the proposals of the Government in order that they may approach their Member of Parliament or take such steps as they may think advisable in organising concerted opposition. Whatever is done must be done without delay.

For ourselves, we think that those who are engaged in the electrical industry are in these days compelled to spend far too much time in compiling returns and furnishing estimates and valuations, in some cases, we are afraid, solely to satisfy a policy which is to a large extent one of theory only.

Lead.

THE position of the lead market, while rather variable, continues on the whole to be fairly satisfactory. There have since last writing been occasional spells of comparative ease, but these have only again given place to renewed firmness and activity due to the covering of oversold commitments. Towards the end of June, owing to the more abundant offers of near metal, and to the fact that immediate demands had subsided, there was an easier tendency, there being, too, more lead coming forward, but while the decline was continued into the present month when June prompts sold down to £19 5s., there was again a tightening up of the reins when deliveries had to be cleared up for the end of June, and as much as £19 15s. was paid by the bears, who never seem to learn the lesson. On the whole it may be said that lead is beginning to come forward with more freedom than for some time, but in spite of this everything coming along is wanted. What the trade earnestly desires is greater uniformity in the arrivals. At present, and for a long time past, metal has been reaching here with considerable irregularity, and the result has been widely fluctuating prices. These tend to create an uncomfortable feeling, and to produce an impression among producers that there is some unnatural interference going on with the regular despatch of lead from producing centres.

A notable feature in the market for some weeks past has been the selling of non-convention metal. Very fair quantities of American lead have thus been sold, both to the London market and to the provinces, while, what is still more strange, German lead from Hamburg works has been imported into London and utilised for deliveries against open market contracts. As long as the London price is in the neighbourhood of £19 10s., it is to be expected that United States lead will be sold to Europe. This is a price which, under existing conditions, pays the Americans very well, and there is a fair quantity of lead to come forward still against old contracts. The market, however, to all appearance, wants all the metal arriving, and the sales of American and German material have merely served to relax very slightly the more acute tendencies of the market.

There is a good deal expected from the reported resumption of operations at the Mexican lead smelters, but really very little definite is known. That the big smelter owners in Mexico—the American Smelting and Refining Co.—have made a fresh start at their Chihuahua plant is believed to be the case, but nothing positive is known except that instructions have been given by the owners for the resumption, and that the labour force has been despatched there. The railway service is still very bad, however, owing to the rolling stock being required for military purposes, and it may take time for operations to be resumed fully. When the railway system is at work smoothly, however, and communications are facilitated, other smelters will be put to work, and as nearly as may be, full production resumed.

The Villa interests are understood to be very favourably disposed to the resumption of industrial operations throughout Mexico, and the American Smelting and Refining Co. admit that under the Villa *régime* they received greater transport facilities that ever before. There is no doubt that Villa is influenced by the taxes payable by the owners of active plants, which he is anxious to receive for payment of troops, &c., and he is likely in consequence to be actively friendly towards corporations recommencing operations. Under the most favourable conditions, however, it must take some months before the American and European lead markets derive any tangible benefits from the commencement of mining and smelting operations at the recently idle Mexican properties.

The German Cable-Makers' Syndicate.

A MATTER of international importance at the present time relates to the likelihood or improbability of the renewal of the German Cable-Makers' Syndicate, whose existing five years' agreement will nominally expire with the end of this year. Having regard to this fact,

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negotiations have been in progress for some time past with the object of securing a prolongation of the combination, but it has so far been impossible to reach an understanding, partly in consequence of the increased allotments or share in the trade claimed by certain of the constituent works, which have consequently given notice of withdrawal from the syndicate. As a general rule, notices are usually given in connection with syndicates as a formal matter, in order that a fresh division of the trade concerned may be effected under conditions whereby some firms hope to improve their position by gaining an increased share in the growing demand. In the case of the cable syndicate, the question of notices is considered to imply more than a formal procedure, as other factors have to be taken into account which render the renewal somewhat difficult. The first is that the cable factory Wahlen, of Cologne, which belongs to the Brown-Boveri group, will be brought into operation shortly, and will require a share in the trade; and secondly, the syndicate is feeling the severe competition of a Belgian company—the Constructions Electriques de Charleroi—and of British, Italian and other cable makers, the result being that prices in international markets have largely declined. Nevertheless, the hope is entertained in German cable-making circles that it will yet be possible to reconstitute the syndicate so as to avoid a return of the difficult times which occurred in 1908-9, when, owing to the advent of fresh competition, the syndicate was dissolved.

Electrical Accidents.

The report of Mr. G. Scott Ram on electrical accidents is always interesting, not only on account of the personal application which it possesses for so many of us, but also because of the interest which attaches to the details of the accidents themselves; we are therefore reproducing it almost *in extenso* elsewhere. We are glad to note that in spite of the constant increase in the use of electricity, the number of mishaps in electrical stations was no greater last year than it was five years ago, and there were only three fatalities, apart from non-electrical accidents. As usual, the switchboard was the scene of the great majority of accidents, a fact which fully justifies the attention given by the Home Office Inspector to this part of the plant; and, again as usual, many of the accidents might, and should, have been prevented by proper care and foresight, which are not always exercised even by experienced engineers. A singular case was that in which a coil of wire curling round a doorway made contact with live metal in another room; and it is surprising that engineers should attempt to handle live oil switches, as they did in three instances.

Unfortunately, there was a serious increase in accidents in factories, with no fewer than 17 fatalities, and the Inspector points out that many of these were due to the lack of skilled supervision, while others were caused by apparatus of faulty design or manufacture, and by disregard of the Home Office Regulations. The electric furnace appears this year in the list for the first time, we believe, a man being severely injured with a pressure of only 60 volts alternating. The accident to a labourer who managed to reach over a screen 6½ ft. high in order to brush high-pressure apparatus, with which he had no concern, while it shows excess of zeal, also indicates that the most careful precautions are unavailing to keep some people out of trouble. Falls from cranes and other elevated apparatus due to shocks occur with regrettable frequency, and very often with fatal results.

A disturbing feature of the latter portion of the report is the evidence of careless design on the part of the engineers responsible for the lay-out of plant. Narrow passages alongside of live metal, oil switches connected to bus-bars without isolating switches, and dangerous fuseboards, are mentioned; we note that one three-phase installation at 440 volts, "put up by a foreign firm of contractors, was dangerous in almost every conceivable way." We are glad to learn, however, that in many stations and works attention to safety has been the first consideration, and many supply engineers are taking pains to see that their consumers' apparatus is in accordance with the requirements. Of the 20 fatalities due to electricity reported last year, no fewer than 12 occurred through shock from low-pressure systems (not exceeding 250 volts).

ELECTRIC MAINS EXPLOSIONS.

We mentioned last week that the Committee's report on electric mains explosions was accompanied by two appendices, and these call for some comment. The first comprises a report addressed to the Secretary of the Explosions in Mines Committee, containing the results of an experimental investigation carried out by Mr. R. V. Wheeler at the Home Office experimental station at Eskmeals, on bitumen gas explosions, and of great value and interest. It is wholly directed to the subject on which the Committee was instructed to report, and it gives definite information on points concerning which everyone having had practical experience of these explosions was hazy.

The Second Appendix contains the reports of the electrical adviser to the Board of Trade on six explosions investigated by him and made at the time of his examination into the respective occurrences.

Samples of the following materials were submitted to Mr. Wheeler for examination:—(1) "Callender" bitumen; (2) "New" bitumen; (3) Callender-Webber casing; (4) Glasgow pitch; (5) Pitch and whinstone dust composition. Three specific questions were put:—

1. Whether spontaneous ignition of finely-divided carbon or of hydro-carbon gases generated in the circumstances described is possible.—The reply to this is, briefly, that carbon will not ignite "spontaneously," but that hot gas will.

2. In what proportions gases generated in such circumstances are explosive.—This was found to depend on the temperature at which they are evolved. At 1,000° C. bitumen gas will form an explosive mixture with air if it be present in any proportion between 5·4 and 20·5 per cent., while with gas from the pitch and whinstone mixture the limits are much wider apart, viz., 10·7 and 47·5 per cent. If the temperature is high enough to "crack" the gases, the limits of inflammability tend to widen, but the behaviour of the gases derived from the two materials becomes more nearly the same.

3. Whether pitch toughened with pitch oil, *e.g.*, as used by the Glasgow Corporation, is less dangerous than refined Trinidad bitumen.—In reply, it is stated that there is not much to choose between the materials so far as the volumes of inflammable gases evolved at 1,000° C. are concerned, but the pitch is likely to be more dangerous than the bitumen on account of the wider limits of inflammability and the greater content of hydrogen. The pitch and whinstone composition is more dangerous than the bitumen on account of the high percentage of poisonous carbon monoxide it contains, as well as the wider limits of inflammability. If the temperature of evolution be raised so that the gases are cracked the differences largely disappear, though the gas from the pitch and whinstone still contains a high percentage of carbon monoxide.

Interesting particulars are given of the composition of the gases evolved at progressively increasing temperatures, and of the volume produced. Attention is drawn to the fact that the results obtained are at variance with those published by Messrs. Thornton & Smythe in 1913. The Appendix concludes with a description of the apparatus and methods employed in the investigation.

These experiments go to show that the material originally used with the solid system—viz., Trinidad bitumen—is substantially safer than the materials which have in some cases been substituted for it with a view to cheapness, and there can be little doubt that its physical properties and its chemical inertness render it far superior to them as a protective covering for cables. There could be no more glaring instance of spoiling the ship for a ha'porth of—— bitumen than the saving of money on the filling of the trough, when the value of the cables to be protected and the cost of opening the ground, laying them, and reinstating the surface of the road or path are considered.

Whether the gases are likely to be cracked in the event of a fault is a matter of considerable importance on which at present there is no information. Most probably the answer is that sometimes they are and sometimes they are not. If the conductor fuses and interrupts the circuit without causing a short, probably there will be no cracking;

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but if a bad short develop, the arc will play between the conductors, causing molten copper to be formed, carbonising the coverings of the cables and the troughing, if of wood, and warming up the ground for a radius of several feet round the fault. The gases will then be in contact with red-hot metal and carbon, and there is every likelihood of cracking taking place. That gas escaping from such a furnace as is thus set up underground will ignite merely on coming into contact with air is a most interesting fact, and one the knowledge of which is very valuable. We now know that we need not seek for the hypothetical, but often impossible, match to explain ignition, nor need we construct in imagination channels for the flame from the arc to flash back through to cause the explosion.

The large percentage of carbon monoxide found when pitch is distilled is important, as it shows that when gas from a faulty main does find its way into a building the danger to the occupants is far greater than that arising merely from risk of explosion; an explosive mixture may not be ignited, but no one can breathe carbon monoxide with impunity.

Appendix II describes the circumstances of various explosions investigated by the electrical adviser to the Board of Trade. The first two were similar to one another and occurred in 1908, one in Hamilton Place, Piccadilly, and the other in Pall Mall. In the first it is not clear what the conditions were as to fuses, but it would appear that the sub-district in which the fault took place was cut off from the rest of the network by fuses blowing, but not from the station. In Pall Mall there were no fuses. In both cases the mains were laid in bitumen casing, but although the fault in Hamilton Place occurred at a point in which it was assumed that water was lodging, the whole blame is laid on the bitumen, the possibility of hydrogen derived from electrolysis of the water not being mentioned. This report ends with some exceedingly inconclusive remarks as to the practicability of fuses on networks.

Mains laid solid furnish the material for the next report, which relates to an explosion in a feeder pillar in Battersea Park Road in 1909. The chief thing to note in this is that the ignition is ascribed to the assumed blowing of a fuse in the pillar; we now know from Mr. Wheeler's experiments that the gas may well have been self-ignited.

The fourth report is of an explosion in the Strand in 1911, which was in connection with cables in bitumen casing laid unusually near the surface over a cellar and near a disused coal shoot. On raising the lid of a box the gas immediately took fire, and shortly afterwards the explosion occurred in the basement of the adjoining building. The most noteworthy thing is that the mains were "districted," yet the cables were burnt right up to a box in which fuses were placed, but the fuses did not go. Surely this shows the absurdity of pinning one's faith on fuses for protection from explosions on underground networks.

The record explosion that has yet been experienced with bitumen mains forms the subject of the next report, which relates to the explosion on vulcanised bitumen cables laid in bitumen casing, which took place in 1911 at the Albert Hotel, Nottingham. It so happens that we saw these wrecked premises rather over a week after the occurrence, and the scene of devastation that they presented was a striking object-lesson as to what bitumen gas can do under certain conditions.

In most cases of fire or explosion, it is exceedingly difficult to be positive as to the exact circumstances of the fault, owing to the destruction that takes place. It is uncertain whether the fault was in this case on the main itself or at the point at which the service cables were jointed to it. Experience would most certainly point to the service, or the service joints, and a careful examination of the burnt-out mains and consideration of all the circumstances indicated that the mischief started on the main very near, if not at, the joint; it was almost certainly not on the service cables. The opinion expressed in the report is that it was not due to softening of the bitumen by coal gas (probably not) nor to wounding by "pick, spike or crowbar" (almost certainly not, as there was not the slightest evidence of such damage, which is usually very easily seen), nor to a crack in the dielectric. The explanation put forward seems to us rather far-fetched and exceedingly unlikely. It is suggested that one of the mains was ruptured and an arc took place between the broken ends, so heating the bitumen. This supposed rupture may, it is stated, have been due to settlement, though it is admitted as unlikely, or to the expansion of the cables during the previous summer (the explosion was in November!) or to a sudden fall of temperature during the night. It seems most improbable that the difference in temperature between night and day should have been felt in the conduits, composed as they are of heat-insulating material, laid underground beneath the pavements and kept warm by the normal current in the cables; added to all this, the fault had developed into a short by half an hour after midnight, so that the change of temperature must have been communicated to the cables in a very short period of time. Even assuming that all these objections can be explained away, it is incredible that the conductors, one quarter of a square inch in section, and composed of soft copper, would have parted under any stress that could have been put upon them by any of the supposed causes mentioned, bearing in mind that any subsidence that could have taken place must have been very slight. It seems to us far more probable that a leak had developed on the main, probably at the joint attaching the service cables, and that a burn-out took place in the usual way. Too much importance seems to us to be ascribed to there being nothing noticeable at the station until the short came on. A fault usually becomes bad suddenly, although its incipient stage may have been lengthy, and once it passes an appreciable amount of current it very rapidly goes from bad to worse.

We are told that "the shift engineers ran up additional engines to maintain the voltage," and a little later we have the interesting official pronouncement that "the shift engineers acted rightly in trying to keep up the supply and to keep it steady;" this will be balm to those who advocate the "column of smoke" type of testing indicator.

The recommendations include the ventilation of the casings at 60-yard intervals, the provision of expansion loops, the use of pipes suitably plugged for services, and the interconnection of districts by fuses, this last in the face of the fact that four lines higher up it is stated that in London three days earlier they had failed to prevent an explosion! The plugging of the pipes is a very necessary precaution which it is well to have pointed out.

The last report relates to the explosion at Hebburn in 1913, which was probably the determining cause of the appointment of the Committee. Two lives were unfortunately lost. The cables were insulated with vulcanised bitumen and laid solid in bitumen in wooden troughs. The main was close to the buildings and was under a cement pavement. The mischief was traced to a cable which was pulled tight against a mitred corner of the troughing. This must have been due to bad workmanship or subsidence; in view of the main having been down for 11 years, and the fact that subsidences are not uncommon in the district, the latter is the more probable. There must have been something abnormal about these mains or the district in which they were laid, as faults occurred at the rate of two or three per week. The most recently laid cables had been placed in separate earthenware troughs, with an inch space between adjacent troughs filled with earth. This practice is probably the origin of one of the recommendations of the Committee which we mentioned last week.

Boy Scouts as Engineering Apprentices.—The British Westinghouse Electric and Manufacturing Co. has forwarded a cheque for £100 to the Manchester effort in aid of the Boy Scout Endowment Fund. Mr. Philip A. Lange (managing director), in a covering note, states: "For some time past we have been watching with the keenest interest the good effect of the Boy Scout training on the general character of the boys belonging to the movement in comparison with others not so attached, and we issued instructions some time ago that preference should be given to Boy Scouts in selecting candidates for engineering trade apprenticeships. We are firmly convinced that Scout training increases the all-round capacity for learning a trade, and must result in producing a better class of skilled workmen."

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THE FULLAGAR GAS ENGINE.

The single-acting principle in heat engines, optional this hundred years so far as regards the steam engine, has been, to a great extent, a matter of compulsion in the gas engine. In all single-acting engines the crank shaft has been made the clearing house of energy. It has been called on to absorb all the energy of the explosions and to distribute such energy to the fly-wheel, and back again from the fly-wheel into the engine parts; to perform not only the external work but also the internal work of the engine.

The single-acting principle and the four-stroke cycle have made of the gas engine the heavy machine it is, and, as said above, it has appeared inevitable that such things should be. In the Clerk, the Körting, the Nuremberg, the Oechelhauser, and other engines, we have seen what has been done to get more power out of less weight of engine, but so far with very little success, and in engines of 2,000 H.P. the weights of the crank-shaft and other details are very imposing. We were present on July 8th at the demonstration at Newcastle of a totally new type of internal combustion engine, designed to reduce the gas engine to proportions more nearly in accord with what fits the notions of steam engineers. This engine was designed by Mr. H. F. Fullagar, and built some two years ago by Messrs. W. H. Allen, Son & Co., of Bedford, and it is at work in the power station in Gateshead of the Durham Electric Supply Co., where for three days last week it was to be seen motored round at 250 and at 300 R.P.M., and also running on a load of over 500 H.P. It was showing 575 v. and 700 amps. on the board. Put as briefly as possible, the engine is so designed that only the net work or B.H.P. gets into and goes through the crank-shaft. All the internal work of the engine, the inertia stresses of acceleration and of deceleration and the compression of the charge are performed between the four pistons, which constitute the "element," and the engine is very simple in construction.

In fig. 2 the engine is diagrammatically illustrated. It possesses two closely-set side by side vertical cylinders and eight pistons. Taking one element of two cylinders, there are in one cylinder two pistons A, B, and in the other also two pistons C, D.

The two lower pistons B and D are each bolted to crossheads, and drive two connecting rods and cranks set at 180°, thus balancing each other very closely. To complete the balance as well as to obtain the other desiderata of the engine, the piston B is coupled to piston C by means of a pair of inclined side rods, which are firmly bolted to the crosshead below B and to the top of piston C; and piston D is similarly connected to the piston A. Gas mixture is admitted to the cylinder by the uncovering of a ring of ports through the cylinder wall by one piston, and the exhaust escapes at the other end of the cylinder by similar ports uncovered by the other piston. The charge is compressed between the two pistons and, the two cranks being opposite or 180° apart, compression is at its full pressure in one cylinder when the entry and exhaust ports are fully open in the other cylinder. Assuming that the charge is fixed between A and B, these two pistons are driven apart, the force of the explosion being charge is fired between A and B, these two pistons either directly or through the side rods. The remainder of the energy of explosion goes into the crankpin, and the bringing to rest at the end of the stroke of all four pistons is swallowed up either in compressing the charge between C and D or in driving the crank-shaft. But energy put into the crank-shaft does not come back again into the pistons. In the discussion which took place on the papers read at the meeting of the North-East Coast Institution of Engineers and Shipbuilders, at Newcastle, on Wednesday last week, doubts were expressed as to these side rods. But their inclination is much less than the obliquity of the connecting rods, and they are always in tension. The lateral pressure is defined by tan θ. W, where θ is the obliquity angle of the rods and W is the force on the pistons. And this side pressure is taken upon well lubricated slides which bear on the two sides of a vertical double-faced plate or side-bar, whch stands between but above the top of the two cylinders, the lower slides being similarly placed relatively to the lower ends of the cylinders. As with the side rods of a locomotive, these rods set up in themselves a bending moment by their own momentum, but the equiva-

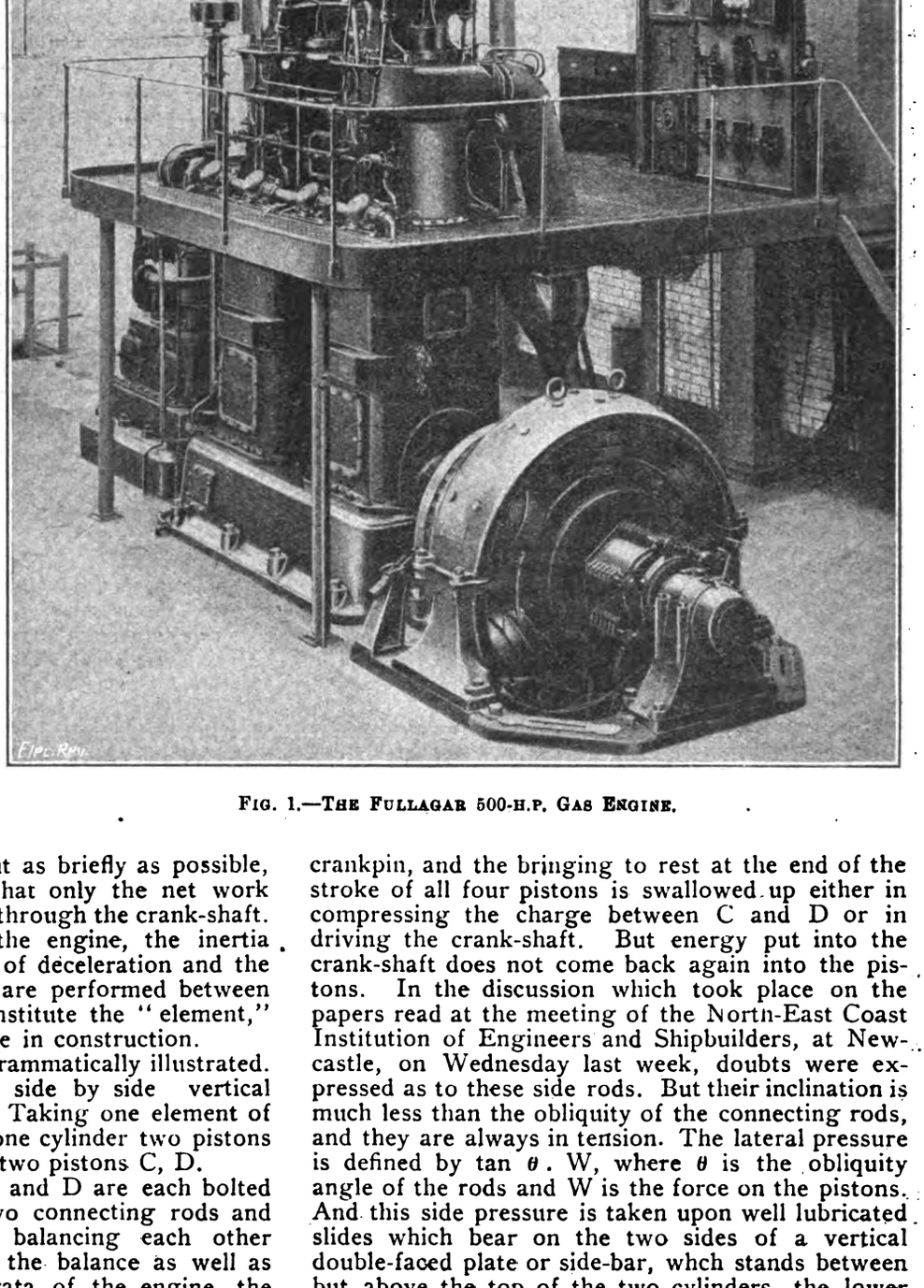

Fig. 1.—The Fullagar 500-H.P. Gas Engine.

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lent length of the rods which tends to be bent by such momentum is not the rod length L, but a length which is $\sin\theta \cdot L$, and is little more than the diameter of one cylinder. Moreover the rods, unlike locomotive side rods, are fixed rigidly at each end.

In order that the two pairs of rods may clear each other, the crossheads to which they are bolted are asymmetrical to the extent of fully the diameter of a rod, but to make up for this the rod on the short arm of the crosshead is larger than that on the longer side, so that the stress and the balance are correct. Scavenging air, at Gateshead, is supplied by a motor-driven fan, but may be supplied by pumps driven off the engine like a marine air pump. Gas is supplied from a compressor, and is intended to be admitted late enough to avoid risk of escaping at the exhaust ports by turbulent mixing. Except for the disturbing effect of connecting rod obliquity, the balance of an engine element is perfect. The slight disturbance, due to obliquity, occurs twice in a revolution, but in a four-cylinder engine with cranks at 90° even these small disturbances are neutralized as regards vertical balance, though they may give a very slight moment along the longitudinal centre line of the two elements. But certainly this is so small as to be of no moment, as could plainly be seen in the running engine.

The pistons are oil cooled, oil being led through a telescopic sliding pipe into the hollow trunk piston, and being let out again into the crosshead slides on the sliding face of which is a + channel, which receives the oil, spreads it on the slide face, and delivers it to a hole in the slide, which is always in communication with a hole in the vertical channel of the cross. By this hole the oil finds its way back to the cooler, whence it is redrawn. As was demonstrated, a very few minutes served to disconnect one upper piston and lift it out upon the gallery floor, The lower piston being also unbolted from its crosshead, was then lifted out by a magnetic block. With a hand-worked crane, the whole of the eight pistons can be taken out in an hour.

The pistons are 12 inches diameter and the stroke is 1ft. 6in., and the piston speed is 750 feet per minute. The mean effective pressure is 70lb. per sq. in., and the stresses in the steel parts do not go beyond 4 tons per sq. in. and three-fourths of a ton in cast iron. The cylinders are free to expand, being single plain tubes, and they bear no engine or mechanism stresses. Some will have it that the engine is a mere variant of the Junker or Oechelhauser idea, but to this we cannot subscribe. That idea, with its cumbrous long side rods and with the crank-shaft made the receptacle of all stresses, has nothing in common with the Fullagar principle. Many attempts have been made to obtain perfect balance in engines, and some of these were given in Mr. Fullagar's paper at the Paris meeting of the Institution of Mechanical Engineers. These attempts include a variety of oppositely moving pistons, with pairs of similarly moving pistons at equal distances from a neutral centre. Then there is the case of the two cylinders inclined 90° from each other and working on one crank. There is the Oechelhauser principle and others, but in all the crank-shaft is made the clearing house of stresses. In the Fullagar engine the C.G. of a coupled pair of pistons moves up and down on the line PQ, and the two sets of coupled pistons balance in this common line. The connecting rod obliquity produces only a slight disturbance as in fig. 3, the C.G. of the whole mass rising and falling through a very small distance vertically, which happens twice in a revolution as stated.

In the engine at Newcastle the weight with flywheel is under 21½ tons, the four pairs of pistons weigh altogether about 2 tons, and the mechanical efficiency is over 90 per cent. Professor Hopkinson finds the two efficiencies I.H.P. and B.H.P. to be 37.6 and barely 30 per cent. respectively. Thus the B.H.P. efficiency is but little less than that of the Diesel, but the I.H.P. efficiency is several per cent. less, and shows therefore how much more mechanically efficient is the Fullagar engine. And the figures show also that the making direct of the stresses and avoiding the use of the crank-shaft as a general reservoir of torque has sufficed to bring the Fullagar engine very nearly up to Diesel efficiency. The four-cylinder engine is remarkably compact, and yet it can be dismantled promptly, and it occupies a very moderate space.

Professor Hopkinson made an attempt to put the theory of the two-cycle engine generally upon some sort of mathematical basis, but it can hardly be regarded as a subject for mathematical investigation. We may agree that two-cycle engines do lose fuel by way of the exhaust ports, but we can scarcely agree that it should be so. It is merely a matter of time and supply pressure. With oil and with coal gas of high calorific value, it should easily be pos-

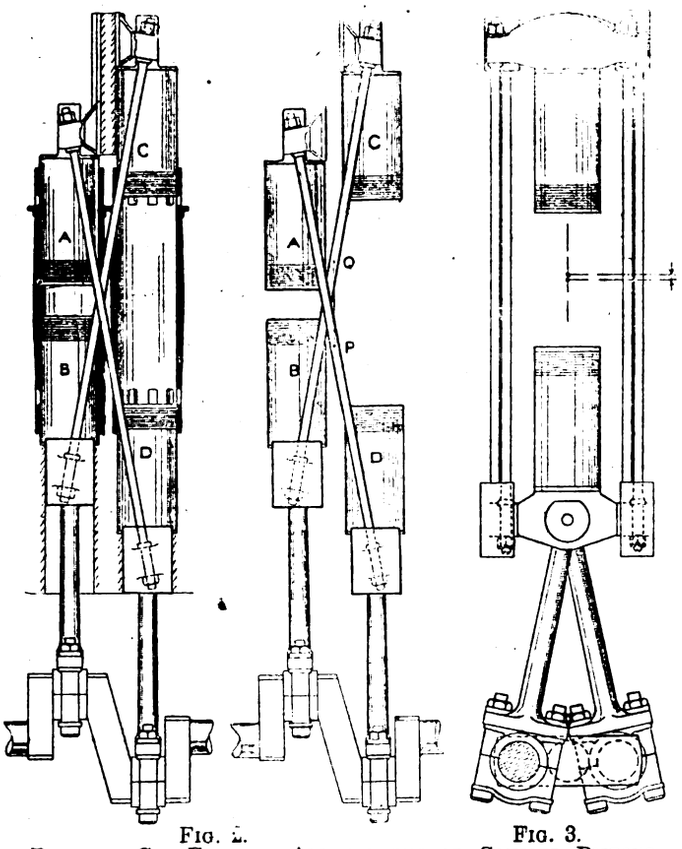

Fig. 2. Fig. 3.

Fullagar Gas Engine: Arrangement of Coupled Pistons.

sible to inject the fuel after the exhaust port has closed. With producer gas there might be greater difficulty. It is, of course, certain that no stratification takes place. Stratification was perhaps suitable for "my learned brother" to make play with in the Courts, but its existence is entirely negatived by the rapidity of combustion which could only be possible in the presence of turbulency. Gas very quickly finds its way to an exhaust opening, and it is best to admit it if possible after the valve closes. We can hardly think there can be much fuel loss in the Fullagar engine if its efficiency is so nearly 30 per cent. This figure hardly squares with a loss of 21 per cent of fuel. But apparently the efficiency figure already given is only based on the allowance of 21 per cent. loss and not upon total gas consumption.

On the basis of the behaviour of water being like the behaviour of gas in an engine at 13 times the speed of the water, Professor Hodgkinson has tried to analyse the behaviour of a gas engine by employing fresh and salt water and comparing the relative losses at the exhaust on the basis of salinity, but the water model does not appear to have given any reliable results. Somehow we are inclined to doubt some of the rather far-fetched methods of probing

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the behaviour of engines, and attempting to tie them up with rigid formulae. Nothing could surpass the excellent way in which the engine ran, and incidentally it may be remarked that the inclined side rods form an excellent and accurate indicator driving gear, a lever end armed with a little pulley being driven by contact with the rod. The inclined rod gives perfectly true movement to a pulley sliding in a straight path and very nearly the truth with a lever, the end of which moves in a curve.

The engine is well made and well arranged for overhaul and inspection, and it is purely a mechanical novelty and embodies no new combustion principle. But the novel arrangement of mechanism has most important effects on size, weight and space, as well as in the direction stress as already noted.

It may be added that the upper crossheads and guides may be made to act as air pumps in light high-speed types, thus economizing still further in weight and space, also that by slight variation in the timing of the ignition, the engine may be made to run equally well in a reversed direction.

On a test lasting 30 hours the following figures were obtained:—

		Corresponding Mean Pressure
Average B.H.P.	510 ...	50.5
Fan power	50 ...	4.9
Gas pump	14 ...	1.4
Engine friction and gas pump ...	67 ...	6.6
Total I.H.P.	641 ...	63.4

Gas consumption 18.1 cubic feet per B.H.P. hour measured at engine-room temperature. Calorific power 470 B.TH.U. per cubic foot.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Mica and Micanite.

May we claim the hospitality of your columns to call attention to the growing carelessness in drawing the distinction between mica and micanite insulation?

The distinction is important; micanite is an inferior and cheaper insulator, and, although ranking next to mica in value for this purpose, it is yet a very long way behind; the cement in it is liable to decompose under the action of ozone and to carbonise under the action of heat, whilst the breakdown strain of micanite under test is only about one-tenth to one-twelfth that of the mica from which it is made.

It is evident, therefore, that if micanite insulation is carelessly called "mica insulation," and is used in place of mica when mica insulation has been specified by the designer, a great source of weakness is introduced into the insulation of the machine—dynamo, motor or whatever it may be—that was never intended or calculated for by the designer, and this may lead to very serious trouble, besides saddling mica with faults that do not belong to it. The present careless methods are open to many grave and serious objections; for instance, let us suppose that "A" invites tenders for the construction of important electric motors, "mica is specified for the insulation of the commutators," "B," "C," and "D" quote. "B" and "C" quote for, and intend to use, mica for the commutators, "D" quotes intending to use micanite, sheltering himself under the careless use of the term "mica insulation," and is, of course, able to underquote "B" and "C"—all other things being equal—and so obtain the order. This is unfair to "A," who does not receive what he requires, and may even be a very serious matter if the motors are required for, say, a submarine, and a burn-out occurs during some important manœuvre, and it is also unfair to "B" and "C," who have correctly quoted for what was required.

It cannot be too strongly emphasised that mica should be kept as free from cements or organic material as possible, as these are only a weakness and operate against its splendid insulating properties. There seems to be an erroneous impression, too, amongst buyers that mica cannot be obtained for commutators, &c., in lengths of more than 6 in. or so. This, of course, is utterly wrong; mica can be obtained in lengths of 20 in., or more, quite readily. If anyone interested cares to call at our warehouses in the Minories, London, E., we can very quickly convince them that large mica is freely obtainable; we can show them tons of it.

Again, great confusion is caused by referring to micanite tubes as "mica tubes." A mica tube is a tube made of rolled mica all in one length, that is, a 12-in. mica tube is made from pieces of mica 12 in. long rolled up without any cement of any kind. A micanite tube is made up of innumerable little pieces all cemented together, and is, of course, a totally different thing, open to all the objections mentioned above in drawing the distinction between mica and micanite. Further confusion is caused by miscalling a micanite-and-paper tube a "micanite tube." The proper specifications for the various tubes are as follows:—

A "Paper tube."—A tube made of various impregnated papers generally specified by some fancy name according to the maker.

A "Micanite and paper tube."—A tube made up of alternate layers of micanite and paper.

A "Micanite tube."—A tube made of micanite only.

A "Baked micanite tube."—A tube made of micanite only and then baked.

A "Mica tube."—A tube made of rolled mica only without cement.

Surely this is the only common-sense designation! It would certainly obviate the confusion that reigns at present, and as any other method such as calling a micanite-and-paper tube a "micanite tube," or a micanite tube a "mica tube," is incorrect and liable to lead to the substitution of an inferior quality of tube to that required, we would suggest the adoption of the above correct designations by everyone concerned.

We do not know whether this is within the scope of the Electrical Standards Committee, if so, perhaps you would be good enough to draw their attention to the matter; if not, perhaps the I.E.E. would take up the question of the proper standards for the various insulating materials used by the electrical industry, as some such standard is very greatly needed.

We supply both mica and micanite in large quantities, as is well known, so it is immaterial to us which material an engineer wishes to use, but we feel that it is to the interests not only of the buyers and users, but also of the responsible members of our own trade that specifications should be drawn up more carefully, the material required more accurately stated, and a more careful supervision exercised to see that the specified material is supplied, not some lower quality.

Wiggins & Sons.

London, E.C., *July 8th*, 1914.

Difficulties in Canada.

I read with interest your leading article and notes from your correspondent on difficulties in Canada, in connection with which I shall be glad if you can spare me some of your valuable space in which to make a few remarks. May I point out, as one solution of the case that you give, viz., the meter contract, that in Canada very large corporations are, in a lot of cases, governed by practically the same directorate. To anybody who knows the electrical business in this country, this hint should be sufficient.

Now, dealing with your remarks and those of your correspondent, with reference to the British manufacturer, my experience shows me that the fault is entirely with the British manufacturer himself. I will give you an instance. I had an introduction to a large firm of manufacturers of electrical specialities for which there should be a good market in Canada if properly pushed. I wrote these people asking for their terms, and this is what they offered me: I have to guarantee to take a certain quantity of their goods to the value of a goodly sum within the first year,

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also I have to buy about £200 worth of goods as samples. For this they are going to allow me 20 per cent. discount and I have to pay cash against shipping documents in London.

In return for this, all I have to do is to put a new article on the market, send a man over a further distance than from London to Montreal, viz., Montreal to Vancouver, to do my utmost to advertise their goods, and probably take some orders on which I have to give at least 90 days' credit. You will see from this how British manufacturers show their complete ignorance of trade conditions out here. In this instance especially, the "cash against shipping documents in London" is amusing, as I am only representing English houses out here, the names of which appear at the head of my paper, so it would not have been very difficult for this house to have found out whether I was a substantial man or otherwise.

If the British manufacturer only knew the opportunities he is losing in this country, I feel sure that some progressive firms would get live agents out here, and although they would probably have to sink a year's expenses before seeing any results, the ultimate end would not only mean satisfaction to them, but the establishment of a permanent business in the Colony. In conclusion, I would say that if the British manufacturer took a lesson from the American manufacturer, who first decides on his agent, and having done so trusts him and supports him in every conceivable way, I do not think there would be the necessity for the continual cry both from over there and over here of: "Why are there not more British electrical goods on the Canadian market?"

I trust you will excuse this trespassing on your valuable space, but as an Englishman in Canada I feel that we are not being done justice by our home manufacturers, in a country which without doubt has greater possibilities for the electrical industry in general than any other country in the world.

Michael S. Parnell-Smith.

Montreal, *July 2nd*, 1914.

Switchgear Contracts: Expenses of Tendering.

By direction of my Council, I have the pleasure to enclose a copy of a letter which I addressed to the Secretary of the Incorporated Municipal Electrical Association on May 25th, together with a copy of his reply, dated the 13th ult.

D. N. Dunlop, *Secretary,*
British Electrical and Allied Manufacturers' Association.

London, W.C., *July 13th*, 1914.

[COPY.]

H. Faraday Proctor, Esq.,
Hon. Secretary, I.M.E.A.,
The Exchange, Bristol.

Dear Sir,—I am directed to inform you that the Association is proposing to send to the Press a letter having reference to the difficulty and expense which contractors are asked to incur in tendering for switchgear, with particular regard to the form of tender recently issued by Dundalk U.D.C., which involved the apparently unnecessary splitting up of the price into 80 separate items.

In this connection I am to recall to you the letter (copy enclosed) from the Association, dated October 25th, 1912, which appeared in the ELECTRICAL REVIEW for November 1st, 1912, dealing with another branch of the same subject; and I am, before writing to the Press, to ask you to be kind enough to state whether an appeal by the Association to municipal switchgear purchasers asking that more care be given to avoiding unnecessary expense and trouble in this connection would have the sympathy and support of the I.M.E.A.

Very truly yours,
(Signed) D. N. DUNLOP,
Secretary.

(Copy of letter above referred to.)

October 25th, 1912.

To the Editors of the ELECTRICAL REVIEW.

SWITCHGEAR DRAWING OFFICE EXPENSES.

Dear Sirs,—I am directed by my Council to invite, through the medium of your valued paper, the attention of municipal and consulting engineers and other principals interested in the purchase of switchboards, switchgear, and apparatus, to the burden at present imposed upon manufacturers by demands for drawings, the cost of preparing which is, in many instances, largely disproportionate to the value of the orders for which they are prepared.

It appears to be customary—the custom originating, no doubt, in competition, and now sanctioned by use—in every instance, at the inquiry stage of a switchgear order, for purchasers to ask each tenderer for special drawings, irrespective of the size or value of the apparatus inquired for; and it is, thus, not unusual for a maker, when acting as sub-contractor, to be requested by a dozen different firms to supply, for tendering purposes, of each section of the order, a dozen sets of drawings in duplicate, together with blue prints and diagrams of connections and dimensions, the order itself being of the value of, perhaps, not more than £10. In the case of intermediate sub-contractors making the demand on behalf of some main contractor, the work is doubled, and may even be quadrupled.

It is submitted by members that while, in the case of large special switchboards, detailed lay-out drawings may reasonably be required, in the majority of cases an immense wastage of time and labour takes place in the manufacturers' drawing offices, most of the drawings demanded being unnecessary for the immediate purpose; and that simple illustrations of the apparatus offered would, in the first instance, be amply sufficient to enable purchasers or their engineers to decide as to the tenderer, or tenderers, to whom they will, in the first instance, give the preference, who could then be required to submit the necessary drawings.

The grievance is, moreover, as it appears, not confined to the tender stage. In the contract stage also the drawings required are, members submit, frequently excessive in number and variety, and unnecessarily detailed. In the case of motor panels, for example, of which a large number are sometimes ordered at one time, it is not unusual for three or more dimensional prints of each panel to be asked for.

My Council conceive that, in many instances, excessive demands for drawings may arise from thoughtlessness or lack of knowledge on the part of purchasers' assistants, who habitually, and, perhaps, excusably, make them as a matter of routine, with every inquiry or order passing through their hands, specifications usually embodying "covering" provisions as to the drawings which shall be supplied if required.

From whatever cause arising, however, my Council feel assured that a remedy will be found for the grievance, and that, so far as it lies within the power of purchasers to apply it, the remedy will be applied. The interests of both parties are obviously served in the end by keeping down charges for unproductive labour; and the total amount of drawing-office charges incurred yearly by manufacturers as a body is, under the present system, very large indeed, having regard to the fact that only one or two out of the 20 or more tendering firms can possibly get any order.

Your obedient servant,
(Signed) D. N. DUNLOP,
Secretary.

INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

[COPY.] *June 13th*, 1914.

D. N. Dunlop, Esq.
Secretary, B.E.A.M.A.,
36, Kingsway, W.C.

EXPENSES OF TENDERING: SWITCHGEAR CONTRACTS.

Dear Mr. Dunlop,—With reference to your letter of May 25th: There has not been an opportunity to bring this matter before the I.M.E.A. Council, and I fear that an opportunity will not arise for some little time owing to the holding of the Convention next week.

I feel sure that the Council would sympathise with the expressions contained in your letter to the Press dated October 25th, 1912. Indeed, if I remember rightly, this matter has already been dealt with by the Council and publicity given to their views, although I cannot at the moment remember the exact reference in the Press. I think that probably you will be able to turn up the reference as well as we can, as the matter was, I think, brought forward at your instigation, referring to the expense of tendering, more particularly in connection with switchgear.

Yours faithfully,
H. FARADAY PROCTOR,
Hon. Sec. I.M.E.A.

The Policy of the A.E.S.E.

Some time ago I was instructed by the Executive Committee of the A.E.S.E. to write the electrical Press emphasising the peacefulness of the methods of the A.E.S.E., and the great abhorrence of a strike, and the fact that the A.E.S.E. would plough a lonely furrow and not take action with or combine with any other association or Trade Union.

Now I have to record the following episode; there have been several somewhat similar:—

Recently I stated in these columns regading the Coventry Corporation electricity department that, although this department had the lowest working cost per unit in the country, they paid the lowest average salaries to their charge engineers compared with stations of about similar capacity.

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Subsequently, the A.E.S.E. had occasion to write the Coventry Electricity Committee, asking that an increase of salary be granted to the charge engineers and switchboard attendants. A copy was also sent to the chief engineer asking him to support the application.

The salaries at Coventry, at the time of sending this letter, were as follows:—(1) One charge engineer, £3 per week, with about 14 years' service; (2) One charge engineer, £2 10s. per week, with about eight years' service; (3) One charge engineer, £2 10s. per week, with about eight years' service; (4) One charge engineer, £1 15s. per week, with about five years' service; switchboard attendants, £1 5s. (No fixed scale of increase.)

No. 4 was designated on the books of the department as a switchboard attendant, but has actually taken turn with No. 3 with exactly similar duties for the last three years; Nos. 2 and 1 take turn with each other, and duties are similar. The stumbling block to the chief engineer seems to have been No. 4 at 35s. per week.

Within two days of the receipt of this application, and before the Electricity Committee had considered it, an order was issued in the station that the charge engineer, referred to above as No. 4, should be ranked and take duties with the switchboard attendants, whose money was increased to 27s. 6d. per week, and who were to act as charge engineers on certain specified occasions, which rendered the situation absurd, owing to the fact that at times the charge engineer No. 4 would be acting as switchboard attendant under the charge of a youth under 21 years of age, with only a few months' experience in the station. Evidently this was done to try and get rid of the charge engineer No. 4, and keep down the salaries, whilst making the rates paid to the charge engineers appear higher.

The charge engineer concerned protested to the chief engineer, who made the usual reply under such circumstances that "he was manager of the undertaking and would do as he liked."

On the advice of the A.E.S.E. the charge engineer appealed to the Electricity Committee, protesting against the order and asking for an interview. The same day as the chairman of the Committee received the letter the charge engineer was dismissed at a moment's notice. I may here remark that the station superintendent refused to dismiss the man, and the chief engineer, perforce, had to do it himself by letter, enclosing a week's money in lieu of notice.

In the meantime the A.E.S.E. had written the Committee *re* the above order issued at the works, and also wrote and protested against the dismissal. It was pointed out to the Committee that the order issued at the works was contrary to the Home Office electricity regulations; consequently the order has been withdrawn, but the Committee refuses to reinstate the engineer who was discharged.

Now I come to the victimisation part of the case. The charge engineer has been dismissed at a moment's notice for protesting to the Committee (after an abortive interview with the chief engineer) against an order which was contrary to the Home Office electricity regulations, and which has since been withdrawn.

The chief engineer has verbally given the reason for dismissal as "over-riding the manager of the undertaking." He also stated that if the charge engineer was dissatisfied he should quietly give notice and leave. I wonder if the chief engineer would have done this if the Electricity Committee had issued an order with which he was dissatisfied? From what I know of him the answer would be decidedly in the negative.

The chief engineer's reply in writing, in answer to the inquiry as to the reason of the dismissal, is: "You surely have the necessary intelligence and common sense to understand the reason of your discharge."

An inquiry for a testimonial resulted as follows: "I am in receipt of your letter of the 8th, and note that it was on advice you received you acted, which necessitated your dismissal, and by which I am prevented from granting you a testimonial."

These replies speak for themselves, and need no comment.

The inference from this episode is obvious. The A.E.S.E. must seriously consider the adoption of a policy to protect its members and station engineers generally from such victimisation. At first it was thought that very similar cases were isolated cases, but they have been so numerous that the word isolated does not now apply.

As some of the supply authorities take up a fighting attitude, the A.E.S.E. must consider a strong policy to counteract this. The Association, to be effective in a case like the foregoing, will have to reverse its previous decisions as enumerated in the first paragraph of this letter and be prepared to co-operate with other organisations represented in electrical stations, and adopt a more aggressive policy.

A number of members with whom I have consulted, including the acting sub-committee of the executive, have reluctantly come to the above conclusion, and the matter is to be put to the whole of the members at an early date.

This decision has been forced on us, and if there is anyone who can see any other way of preventing this kind of victimisation by chief engineers and their committees, the Association will be glad of the advice.

The large number of gentlemen who so kindly wrote me in February last advising the Association to proceed on peaceful lines and keep clear of other organisations perhaps will write to the chief engineer and committee at Coventry, advising them to proceed peacefully, as they have taken the most drastic action possible.

It seems to me unfair that the citizens of Coventry may have to be inconvenienced before the injustice meted out to one man can be righted.

I appeal to all station and mains engineers, members and non-members of the A.E.S.E. to support us in this particular case (one never knows who may be the next to be victimised), and stand by a colleague who has been victimised in a struggle after that fetish, the lowest working cost.

Station engineers must choose now, once for all, between a fighting organisation that can protect its members from victimisation, or a passive one that cannot.

Read Mr. Ashmore Baker's article entitled "The Organisation of the Electrical Industry" in last week's Electrical Review, and think out how such an ideal organisation as he suggests could get the modern Corporation Electricity Committee to agree to and adopt any findings agreed to by say, the I.M.E.A. and the A.E.S.E. without sometimes using the element of force. (The I.M.E.A. has refused to deal in any way with the rates of pay and hours worked in electrical stations.)

All station and mains engineers must in future stand shoulder to shoulder and honourably support their colleagues in all cases of victimisation and unjust conditions; otherwise they will be pushed out of their places by the better organised labourer, as has already happened in a number of stations.

W. J. Ebben,
Hon. Gen. Sec. of the A.E.S.E.

London, N.E., *July 14th*, 1914.

The Qualifications of a Consulting Electrical Engineer.

In your issue of May 15th, and your article on "The Liabilities of Consulting Engineers and Architects," page 810, you state:—

"So far, then, the facts of the case appear to be that an important electrical installation is to be carried out on a system which is not in accordance with the rules of the Institution of Electrical Engineers . . . . and the work is to be supervised by a consulting engineer who is not a member of the Institution of Electrical Engineers.

"It is distasteful to have to refer to this point, but we feel bound to do so in the interests of a large body of qualified consulting electrical engineers, &c."

I infer from this that you consider that only members of the I.E.E. are qualified members of the electrical profession, and should be glad if you would inform me, through the medium of your paper, if I am correct.

Unqualified.

Borneo, *June 15th*, 1914.

[Our correspondent's inference is not correct. If he will again read our remarks carefully, he will see that we referred only to consulting electrical engineers. No doubt there are many electrical engineers of first-class ability who do not belong to the Institution of Electrical Engineers;

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that is their own affair, and we do not criticise their decision. But when a man offers his services to the public as a consultant, whether he be a physician, an architect, or an electrical engineer, he ought to avail himself of such means as are open to him to prove that his qualifications are recognised by the members of his own profession.—EDS. ELEC. REV.]

ELECTRICAL ACCIDENTS IN 1913.

THE report of the electrical inspector, Mr. G. Scott Ram, on electrical accidents in 1913 was issued last week. The following are extracts from his statement:—According to the latest tables showing the position of electric motive power at the end of the year, the increase during the year was again a record one. No less than 181,000 H.P., representing an increase of 20 per cent., was added during the year, the total amount for the undertakings included in the returns being now well over a million horse-power (1,081,500). As many as 22 undertakings do not give any returns, and with one exception the large electrical power companies are not included. The supply to mines is mostly from the latter. Factories having their own generating plant are also not included, so that it is safe to conclude that the horse-power of motors on factory premises is well over a million.

TABLE I.—ACCIDENTS AT ELECTRICAL GENERATING STATIONS AND SUB-STATIONS IN 1913.

(The small figures relate to fatal accidents, and are included in the principal figures.)

Description.	Public supply stations and electric railways and tramways.	Other stations.
Non-Electrical:—		
At engines, pumps and generators	30[1]	9
At boilers and steam plant	84	4
At coal-handling plant	15[2]	5
Falls...	111[4]	10
Struck by falling bodies	43	3
Miscellaneous	109	16
Total	392[7]	47
Electrical:—		
At switchboards when engaged in ordinary routine work	12	7
Cleaning, repairing, &c., at "live" switchboards or other "live" conductors	31[1]	15[1]
Cleaning, repairing, or other handling of switchboards supposed to have been made "dead."	6	—
Adjusting brushes and cleaning commutators, and flashing at commutators	5	2
Miscellaneous, ...	11[1]	5
Total	65[2]	29[1]

The mechanical accidents show an increase of 68, or 18 per cent., over the previous year's totals. The accidents are such as are liable to occur in engineering works generally. The increase is mostly under the heading of falls, although there is a considerable addition (25) to the accidents connected with boilers and steam plant.

The electrical accidents are remarkably few in view of the large number of electrical stations now in operation. Although the number of accidents is greater than in the previous year, it is no larger than it was five years ago. Under the first heading, eight of the accidents were due to mistakes on the part of the switchmen, the others being due to faulty apparatus. The next class—cleaning, repairing, &c., at live switchboards—is, as usual, the largest, accounting for no less than 46 of the total, and includes a number of accidents which are clearly of a preventable nature. Six of them occurred to men working on or near high-tension apparatus without taking proper precautions, and it is remarkable that none of them had fatal results. In one case, in a sub-station, two men were about to connect up a transformer in a chamber in which all the conductors had been made dead. They took in a length of bare copper wire, and were connecting one end of this to the transformer; the other end being free curled round the doorway and made contact with a bare conductor at 10,000 volts in the adjoining room. Another accident was due to the man assuming that a conductor at extra-high-pressure being heavily taped up with insulating tape was safe to handle, but the insulation broke down. In another case, three experienced engineers were discussing some proposed alterations in an extra-high-tension chamber, one of them standing so close to the apparatus that he inadvertently touched it with his elbow. In another case a man was cleaning switchgear in a sub-station and touched the terminals of the incoming main, which, through inadequate supervision, had been left live. Of the accidents at medium-pressure switchboards two had fatal results. In one case a new transformer had to be connected up in a large sub-station in place of one which had failed, and the engineer was making a test at the oil switch on the secondary (440 volts) to ascertain if the transformer was correctly connected. This oil switch was in a narrow chamber into which the man had to crawl below other oil switches, and was not intended for use as a switchboard passage-way. In this confined space he made a short-circuit and was killed. There was no necessity to make the test in the chamber at all. It could have been safely made in the transformer room, and should have been made there in accordance with the instructions given by the engineer in charge of the work. In the other fatal case the man was working on a live switchboard contrary to standing instructions, and was connecting up a new cable. He was standing on an earthed transformer case, and touched a live conductor, 420 volts alternating. In this case the man was rendered insensible and was brought round by artificial respiration. He was then at his own request allowed to get up and walk, when he again collapsed and succumbed to heart failure. Of the non-fatal accidents 13 were due to the use of ordinary engine-room spanners, pliers, &c., on live switchboards, and need not have occurred had proper insulated tools been provided; short circuits resulted, inflicting severe burns. In a further case a short circuit was made on the switchboard by the wire guard of a hand-lamp. Hand-lamps having guards of non-metallic material are available, and should be kept for use behind switchboards and in battery rooms and other places where portable lights are required close to live conductors. Two accidents occurred in removing oil switch tanks from live switches. Short circuits occurred, and in one case the burning oil was shot out, injuring two persons. Three accidents occurred to persons engaged in cleaning live switchboards.

The six accidents due to working on switchboards supposed to have been made dead were all on high tension, none, however, having fatal results, although the injuries were in some cases very severe. With one exception, they occurred to skilled men and were due to forgetfulness or carelessness. In one case the charge engineer of the station had had one cell of a large switchboard made dead for examination and inadvertently opened the door of the adjoining cell, which was live, and took hold of the conductors (6,600 volts). He was rendered unconscious and was badly burned. He was brought round by the Schäfer method of artificial respiration. In a second case of a man opening the wrong door, he had not taken the trouble to turn on the light in a dark passage-way and the mistake was probably due to this. In the case of the unskilled man, a bricklayer had been fixing some insulators in a dead cell. Later on he opened the cell to ascertain if the cement had set firmly, the conductors in the meantime having been made live. In another case the man opened a feeder cell without having ascertained whether it was live from another station. In another case a generator oil switch failed to act properly when the remote-control switch was operated, and two engineers went to examine it and made a short circuit, forgetting that the generator was still running and excited; one of them was severely burned.

Of the seven accidents at commutators, five were due to flash-overs causing burns or "flash blindness."

Amongst the miscellaneous accidents, the fatal case occurred to a man scaling a boiler. He received a shock (230 volts alternating) from the flexible conductors of a hand-lamp, the insulation being practically worn out and in a dilapidated condition. In another case a boiler cleaner was rendered unconscious by contact with the conductors of an improperly constructed connector used within the boiler for connecting a hand lamp.

TABLE II.—ELECTRICAL ACCIDENTS IN FACTORIES, OTHER THAN ELECTRICAL STATIONS, 1913.

The small figures relate to fatal accidents and are included in the principal figures.

Arcing of switches	56
Arcing of fuses	17
Shock or burns when replacing fuse wires	35[1]*
Portable apparatus, connectors and flexible wires	66[3]
Unprotected conductors, switches, terminals, fuses, &c. ...	42[5]
Working on or near live conductors—skilled persons ...	42[3]†
Working on or near live conductors—unskilled persons ...	43[2]
Miscellaneous accidents in electrical manufacturing and repair work—mostly in testing operations	66[1]
Adjusting brushes and cleaning commutators and flashing at commutators	10
Miscellaneous	41[2]‡
Total	418[17]

* Fatality due to blood poisoning following burns. † One fatality due to fall. ‡ Both fatalities due to falls.

The number of accidents reported in regard to factory premises other than electrical stations, as shown in the above table, presents a considerable increase over the total for the previous year—418, as against 283, with 17 fatalities, as against 15. Although for several years the number has been practically stationary, it is hardly surprising that an increase should have to be recorded, consequent upon the enormous extension in the use of electrical energy. Examination of the circumstances of the accidents indicates generally that a large number are due to inadequate skilled supervision both as regards the initial selection and installation of the plant, and as to its subsequent working and maintenance. In many works of considerable size operated and lighted by electricity, there is no one employed who is technically qualified to look after the plant. Even if the plant is good and well-installed in the first instance, it is often run without technical supervision until trouble arises and accidents occur. Thus, under the first heading in the table, the accidents from arcing of switches have arisen from 23 in 1912 to 56 in the year under review. Nearly all these accidents are due to neglect of proper maintenance of the plant, either of the switches themselves or of the apparatus which they control, by reason of the lack of skilled attention. Trouble naturally comes sooner where the apparatus is of a flimsy and cheap character in the first instance. Many of these accidents occur at

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motor starting panels, through the failure, due to poor construction, of the starting rheostat. This becomes burned at the contacts, which, not being attended to, get into such a condition that the automatic release fails to operate on shutting down. The workman, not noticing this, switches on again at the main switch with all the starting resistance cut out, producing a flare-up at the switch and getting his hand, and perhaps his face, burned. Switches having covers with slots for the handles to work through offer no protection under these circumstances, the flash coming through the slot.

The accidents from arcing of fuses were due to the absence of proper protection, some of the fuses, consisting merely of bare wires, being placed close to switch handles, an arrangement which invites accident.

The accidents in renewing fuses are almost entirely due to the use of unsuitable and dangerous types of fuse mountings or holders unprotected by switches.

The accidents incidental to the use of portable apparatus include three fatalities, all being due to the use of hand-lamps of obsolete type having the lampholder in connection with the other metal work and the metal work not being earthed. Each occurred with alternating current of low pressure. A similar fatality occurred on premises not under the Act (theatre) and was investigated, but is not included in the table. In another case a man had a remarkable escape from death in the use of such a lamp. He was standing on a damp brick floor holding the lamp when he received a shock and, as is usual in such cases, was unable to drop the lamp or otherwise release himself. He was able, however, to call to another man working near to switch off the current. This was done at an ordinary tumbler switch in one conductor of the circuit. The second man then went to the assistance of the first, who had fallen over, and took hold of him to lift him up, but himself received a severe shock. Two other men then came up and received shocks from the first man on trying to assist him. They then went to find the man in charge of the electrical plant who was in some other part of the works. This man having eventually arrived at the scene of the accident, pulled the wires out of the connector and broke the circuit. The victim of the accident was unconscious for a long time, and his hands were severely burned where he had held the lamp. The current was alternating and nominally of 110 volts pressure, but actually 440 volts, the "reduction" in pressure being obtained from an "auto" transformer, so that whilst the difference of pressure between the two lamp wires was only 110 volts, the pressure to earth was actually 440 volts. The switch being in one wire only, did not of course cut off the pressure. The case is interesting as showing the utter disregard of requirements of the Regulations and of elementary provision for safety, and unfortunately affords an example of a good deal of work which has been put up during the last few years. Another shock accident occurred from a portable lamp, but without serious consequences. In this case the portable lamp consisted only of a lamp in a metal lampholder attached to the flexible conductors. This improvised form of portable lamp is very commonly used where a properly constructed hand lamp is not at hand and by persons who ought to realise the danger. Several fatalities due to the use of this temporary expedient have occurred in the past. In the case of two of the hand lamp accidents, proceedings were taken for breaches of the Regulations, and heavy fines were imposed. Other accidents occurred in the use of flat irons and drills. The accidents occurring actually with the portable apparatus, although few in number, are generally shock accidents and consequently liable to be dangerous to life. The majority of the accidents in the use of portable apparatus occur, however, in the handling of the connectors (27) and the flexible conductors (26), and the injuries are usually burns from short circuits. In the case of the connectors, they would be avoided by the use of connector-plugs of the hand-shield type described in my earlier reports or other safety types, or connectors protected by a switch so arranged that the plug can only be put in or out whilst the switch is in the "off" position. The accidents from short circuits in the flexible conductors are due to the use of worn-out and dilapidated wire, or to the fact that the protecting covering in the first instance has not been adequate either as to thickness or material. Considerable trouble is often experienced with the flexible conductors for electric irons, short circuits occurring at the point where they are led away from the iron, due to constant bending of the wire and insulation and to the heat from the iron.

Under the next heading—unprotected conductors—there were five fatalities. The first occurred in a shed in a motor-car works. The lighting was by 200 volts alternating current. In order to provide for the use of a portable lamp, two wires about 4 ft. in length had been connected to the circuit at a ceiling rose of a pendant fitting. Instead of using a "properly constructed connector" the ends of the flexible wires for the portable lamp were twisted on to the ends of the wires from the ceiling rose by a man standing in a car whenever the lamp was required. At the time of the accident there was no portable lamp connected, and the wires from the ceiling rose were hanging down, the live ends being unprotected. Three men were pushing a car into the shed when the metal frame of the wind screen came into contact with the live wire. Two of the men received shocks, one being killed. The second fatality occurred in an engineering works. A connector socket for use with a portable lamp, 200 volts alternating, was fixed to a drilling machine. The protecting cover of the connector had been broken, leaving the live contacts exposed. The machinist climbed up to do some oiling, and put his hand on the live contacts and was killed. The third fatality was due to the non-earthing of the guide wires and winch of the raising and lowering gear of an arc lamp (220 volts alternating). A leakage occurred in the lamp, rendering the framework live and also the guide wires. A man took hold of the latter and was killed. The fourth fatality was due to the want of protection of the trolley wires of a travelling crane close to the driving cabin, the driver putting his hand on the wires whilst leaning over the side of the cabin (440 volts alternating). The fifth fatality was due to the inadequate protection and maintenance of wires on a coke oven compressor exposed to the weather and subjected to severe vibration. The outer protection of the wires had entirely disappeared, and the insulating covering of the wire was cut through where it entered a metal lamp standard attached to a wooden rail. On a wet day a man leaning on the rail close to the metal tube received a shock which killed him (400 volts alternating). Another man in attempting to pull him away also received a shock. Of the non-fatal accidents, 10 occurred at electric cranes from the absence of proper protection of the conductors in or about the driving cages. In five instances the crane drivers fell to the ground from considerable heights when getting in or out of the cage, due to touching the live conductors. The remaining accidents under this heading do not admit of classification. One is interesting on account of the low voltage. A man was severely injured by shock and burns by contact with a terminal block of an electric furnace working at 60 volts alternating. Apparently he was unable to release himself.

(*To be concluded.*)

ELECTRIC SIGNALLING ON FRENCH RAILWAYS.

At the recent meeting of the Institution of Mechanical Engineers in Paris, a number of papers by French engineers were read, describing the methods of signalling to railway trains in motion which are employed in France.

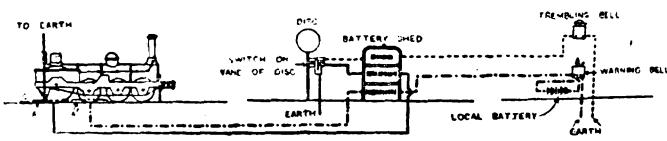
Mr. A. Sartiaux, engineer-in-chief of the traffic and working department of the Chemin de fer du Nord, explained the system now being used experimentally on that railway.

A fixed ramp is set in the centre of the track, parallel to the rails at a distance from the signal, varying, as the case may be, from the foot of the signal itself to 200 m. Fig. 1 is a diagram of the electric circuit.

The ramp consists of an oak beam 2 m. long, resting on two wrought-iron supports, and carries a cover-plate of brass connected to the wire from the battery.

If the speed of the train exceeds 50 km. (31 miles) per hour, two such ramps are used, to increase the duration of contact.

A shield is provided to protect the nose of the ramp from being caught by any piece projecting from the engines or the carriages. The surface of the brass plate should be 10 cm. above the level of the rails.



Full lines show connection from signal to blow whistle.
Dot and dash lines show connection from engine to warning bell.

Fig. 1.—Diagram of Electric Circuit.

An electro-automatic whistle warns drivers that they are reaching a distant signal set at "danger." This apparatus is installed on all locomotives, with a strong spring continually tending to pull the lever down, and let steam or compressed air into the whistle. The lever is held up by a Hughes electro-magnet; if a current be sent through the coils in a certain direction, the magnet immediately ceases to attract its armature, the lever comes down and the whistle keeps going until the driver resets the lever.

One of the wires of the electro-magnet working the whistle connects with the body of the engine and goes to earth through the wheels and the rails; the other wire goes under the engine through an insulated cable, and connects on to a brush consisting of a series of small brooms of hard but elastic copper wire, soldered on to a metallic plate, and making contact with the ramp.

The signal vane is provided with a switch which is worked by a finger keyed on the signal post. This switch serves to control the position of the signal vane as well as to release the whistle. It is adjusted so as to work the bell registering at the station the position of the signal, and to release the whistle the moment the disk has turned 70° round from its normal position of "line clear." The brass plate having been connected with the positive pole of the battery placed near the disk, the negative pole joins on to the switch, which sends the current to earth when the disk is turned to danger, and disconnects it the whole time the line is clear.

The battery registering at the station the position of the signal vane has eight cells, the one connected to the fixed ramp has 12 cells. Both batteries are protected in a little cement shed built at the foot of the signal post.

The indicator for trains passing distant signals is intended to give audible and optical warning to the station officials and the pointsman that a train is approaching. It consists of two fixed ramps AA', fig. 1, the first of which works the electro-automatic whistle as aforesaid, and the second the warning bell every time a

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train or an engine goes over it, irrespective of the position of the signal vane.

The warning apparatus installed in the signal box consists of a loud warning bell provided with a little vane which becomes visible when the Hughes electro-magnet, which is inside the apparatus, has been released by the brush going over the second fixed ramp. The appearing vane closes the circuit of a local battery, in which is a loud trembling bell.

Mr. F. Langrenon, locomotive and rolling-stock superintendent, described the electrical warning and recording apparatus in use upon a number of locomotives on the Chemins de fer de l'Est.

In this case also a ramp of similar design is placed in the centre of the track, at a distance from the signal-post, varying from the foot of the post itself up to 400 m. to suit the requirements.

Two fixed ramps are used, fig. 2. The first is placed at the origin of a "field of vision" determined for the signal; the second at the foot of the signal itself. In this way, the position of the disk will be known, not only when the driver passed the signal, but also when he passed over the first ramp on entering the "field of vision."

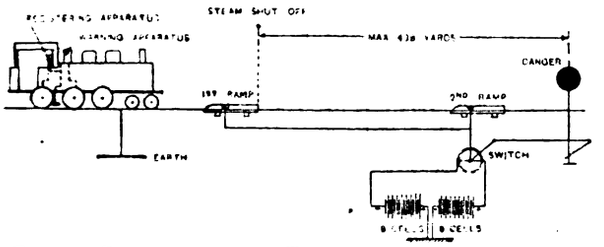

Fig. 2.—Diagram of the Electric Circuit (Eastern Railway).

The switch at the signal disk, which connects the two sets of batteries with the ramp, is in a cast-iron box. When the disk is at danger, the positive pole of one of the batteries is connected with the ramp. When the disk is at safe, the negative pole of the other battery connects with the ramp.

The warning apparatus is similar to the apparatus described for the Nord, but a horn is used instead of a bell-whistle. In order to provide for this an additional device called a Servo-motor is introduced, and in certain cases a second Servo-motor which brings the armature of the magnet back into position, so that the driver has nothing to do with the re-clutching and cannot stop the warning too suddenly.

A record is made on the tape of the speed-indicator itself (Flamand system). A third stylo-nib is fixed between the two others recording the time and the speed, and dots down the positions of the signals passed. The apparatus consists of two Hughes electromagnets with their poles reversed, so that one is demagnetised by a positive current and the other by a negative current. The two magnets are in series and join on at one end to the wire from the brush. The other end is connected to the engine and thence goes to earth. Under these conditions, supposing the disk is at "danger," one of the magnets will be demagnetised (the other keeping its armature), and the stylo will make a mark on one side of the normal line. If the disk be at "safe," the other magnet will be demagnetised, and a mark will be recorded on the other side of the normal line.

After experimental trials, the two batteries installed at the disk have been replaced by a single battery, each pole of which is connected alternately to the "ramp" and the earth.

The ramps described have been replaced by a ramp in the shape of a gridiron, and composed of bars or angle-bars parallel to the track. The object of this modification is to eliminate failure due to hoar frost.

Instead of a collector consisting of copper wires, a very rigid brush is used, made of steel blades with a section 1 mm. by 3 mm. These blades are made up in bundles of four. Their passage between the bars of the ramp scrapes off the hoar-frost, and a good electric contact is ensured under all conditions.

In future the release of the armature at the registering apparatus (signal being at "danger") will be used to work the warning apparatus, and the Servo-motor and corresponding electric circuit will be dispensed with.

The release of the armature at the registering apparatus sets a bell ringing when the engine passes a signal at "safe." The driver thus knows if his apparatus is in working order.

The apparatus used on the Chemins de fer du Midi was described by Mr. A. Herdner, locomotive and rolling-stock superintendent. The warning and registering apparatus, which is now being experimented with on 20 engines and 30 automatic signals, differs from the preceding, in that the battery is placed on the engine instead of on the track. Moreover, the original apparatus does not possess an appliance by which the driver's vigilance may be controlled.

The apparatus mounted on the engine consists of a metallic brush collector fixed on an insulated support under the rear platform of the engine; a special steam-whistle controlled by a Servo-motor; an electro-automatic contrivance fixed on the screen of the cab, and working, on a shaft, two special stylo pens of the Haushaelter speed-indicator, as well as the valve admitting steam to the Servo-motor of the warning whistle; an insulated conductor connecting the brush to the electro-automatic apparatus, which is itself earthed through the body of the engine and the rails; and an appliance controlled by a hand-lever within reach of the driver, and working one of the special pens of the speed-indicator.

The appliances mounted on the track comprise for each disk, an electric battery; a fixed ramp near the disk, insulated from earth, and connected by an insulated wire to one of the poles of the battery; and a switch disposed so as to establish the connection between the second pole of the battery and the rails when the disk is turned to "danger."

The moment the driver of a train sights a disk turned to "danger," he must immediately work the handle of the control apparatus, which then causes the special pen to trace a particular mark on the paper of the speed indicator.

When the engine arrives at the stop-signal, the collector rubs on the ramp, and the circuit becomes closed, on one side through the switch of the disk, and on the other through the brush in contact with the ramp. The current then passes through the electro-automatic apparatus and releases it, so that its shaft works simultaneously the two special pens of the Haushaelter indicator, and the steam valve of the Servo-motor. The two pens trace on the same vertical on the paper of the speed indicator two particular marks, which must follow the single mark made by the controlling device; the valve, admitting steam to the Servo-motor, sets the warning whistle going.

The driver stops this by pressing on the lever of the shaft, thereby closing the valve and bringing back the armature of the magnet, and thus closes the steam valve.

Mr. A. Claveille, general manager of the State Railways, states that four safety devices are being subjected to comparative tests on the Chemins de fer de l'Etat. The Cousin system has been installed on 55 locomotives; it involves the use of a mechanical device actuated by a ramp, which is raised or lowered in accordance with the position of the signal disk. The device is used to operate a horn, and to close an electric circuit which actuates the recording apparatus, as on the Eastern Railway.

Mr. L. Marechal, locomotive and rolling-stock superintendent of the Chemin de fer de Paris à Lyon et à la Mediterranée, said that he could not for the present make any definite statement regarding warning and signal-recording apparatus on the line, as these had but recently been fixed. Experiments were being carried out on 140 express locomotives and on 415 km. of double track with 316 disks fully equipped.

The warning and registering system was based on the combined use of electricity and compressed air, using switches and ramps similar to those adopted on other railways where the system was entirely electrical. In the Paris, Lyons and Mediterranean system, electricity comes into play, only to release the armature of the electromagnet of the relay and close a circuit on the engine itself, without doing any mechanical work. Through this local circuit of the electro-pneumatic relay (which is fed electrically from the battery on the engine and pneumatically from the receiver) being closed, compressed air becomes the agent which definitely provides the mechanical power required for unclutching and reclutching.

Mr. E. Solacroup, locomotive and rolling stock superintendent of the Chemins de Fer de Paris à Orléans, stated that for more than 50 years the Orléans Railway had adopted a signalling system consisting of signals placed at a distance in advance of the danger point, the unclutching of which, when set at "danger," was revealed by the explosion of two cartridges placed automatically on the track when the signal was at "danger." These signals, which are placed at a great distance from the point they protect, are the order for "stop dead" when set at "danger."

If, on account of atmospheric conditions or a moment's inattention, a driver does not notice the stop-signal, he will be warned of its presence at the moment he passes the post by the explosion of the two cartridges.

This system has the advantage not only of warning the driver himself of the presence of a stop-signal but also the officials on the train; it therefore constitutes a safety device which is just as efficient as, if not better than, a locomotive-cab signal. There is no accident on record on the Orléans Railway due to a driver having passed a stop-signal.

LEGAL.

Overhead Wires in Aberdeen: Postmaster-General and Town Council.

Sheriff Young has issued his award in the matter of the difference between the Postmaster-General and the Aberdeen Town Council with regard to the erection of overhead telegraph wires at Hardgate, deciding against the Council and finding that the Postmaster-General is at liberty to erect the overground line. For their unwillingness to agree to the proposed line the Council had put forward various reasons, and the position that they had taken up was in substance this, that an overground line would involve danger to the public, impede traffic, prejudice the amenity of the road, and depreciate the value of the property in the vicinity. The Sheriff held that there was no good reason to apprehend danger or obstruction. On the question of amenity and the objection which was founded on possible injury to it, his Lordship states that much has been said of the disfigurement caused to roadways by the presence of poles and wires; and one was readily disposed to be in sympathy with municipal authorities who were naturally and properly jealous for the appearance and pleasantness

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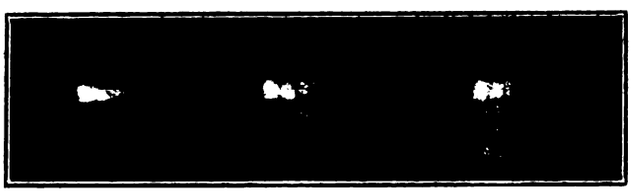
of the roads under their charge. But unless the loss of amenity was truly of a serious kind, it could not be regarded as a consideration adequate to outweigh the importance of a general scheme. Continuing, the Sheriff said: As explained by the engineers who attended as witnesses, a trunk line was constructed mainly overhead, and it was essential for the efficient working of the system that this should be the construction as far as possible. There were serious objections to short sections of underground lines in combination with the open, and the effect of linking up the underground with the overhead wires was that the efficiency of the trunk service was impaired and reduced through what was known as electric induction and reflection. Besides, it was explained as a fact which was of importance in long-distance telephony, that the nearer the wire was to the earth the more inefficient was the wire, while on the overhead line the effect of the earth on the current was not so great. This evidence, said the Sheriff, as to the establishment of trunk lines went a long way to show that in relation to such services it was extremely desirable to restrict where possible the use of underground lines.

Marconi and Marconi's Wireless Telegraph Co., Ltd., v. Helsby Wireless Telegraph Co., Ltd.

(*Continued from page 52.*)

Dr. Erskine-Murray continued his evidence upon the day after the demonstration at the defendants referred to. The witness said that after the demonstration he photographed the spark in the primary current of the apparatus seen there, taking it by means of a revolving mirror running at as high a speed as could conveniently be got. He immediately took a resonance curve from the same circuit; the decrement amounted to 0·34, which indicated seven whole oscillations up to the point at which the amplitude had become one-tenth of the initial amplitude.

Mr. Jaffe (examining): What was the circuit you were actually testing?—The circuit was the primary of the apparatus at the defendants' at Lennox House, which is intended to represent approximately the ship's installation. The extra spark gaps were in.



Photographs of Sparks, showing Train of Oscillations.

How many oscillations does the negative taken from the sparks show?—One of these sparks shows about 18 half oscillations, about nine whole oscillations. That was a few more than the number given by the logarithmic decrement method.

Have you any inference to draw as to the sensitiveness of the spark?—That the spark photograph method usually takes in waves which are less than 10 per cent. of the initial amplitude in this case.

What was the installation like when you tried the first mirror experiment?—The installation was arranged in its ordinary working arrangement, with a choking coil connected, and the discharge gaps open. The spark was observed under those conditions. I then disconnected the aerial, and observed that the spark became longer, that there was less damping owing to the fact that no energy was being taken from the spark circuit. The next experiment was to attach the aerial again, and to put the aerial out of tune with the primary, in order to show a similar, though not quite so great, lengthening of the primary wave train. I then returned to the first condition, the working condition, and showed again the short wave train of the spark under working conditions.

That is to say you made three experiments, in each case starting with the working conditions, first showing that uncoupling the aerial lengthened the spark, and next that throwing out of tune lengthened the spark, and, thirdly, that removing the gaps and the choking coil lengthened the spark?—Yes. In the last experiment we showed very much longer wave trains.

Did the learned assessor point out anything about the load on the antenna when the ship was in the working condition, in the two positions of the last experiment?—He pointed out in the case in which the apparatus was working comparably with that of the ships, the antenna current was 0·9 ampere, and that in the case where the gaps were shorted, and the choking coil disconnected, the antenna current was 0·8, and, therefore, the energy in those two cases was in the ratio of 9 squared to 8 squared; in the case of the ship arrangement 81 and in the case of the gaps being shorted and the choking coil disconnected 64; so that there was more energy, though not quite the same ratio as we obtained by actual observation on board the ships.

Then was the further experiment carried out of short-circuiting the quenching gaps, leaving in the choking coil?—Yes, there was no appreciable effect that one could measure.

Would you expect any other effect?—No, because the other gaps were not in.

You would never suggest that a choking coil would have any effect when the gaps were cut out?—No.

Mr. Walter then cross-examined, taking the witness over the details of the installations on the ships. Witness stated that the aerial was not a vertical antenna, as specified in the 7,777 patent, but mainly horizontal; the vertical antenna had a very large decrement, and a good selective wave could not be obtained with a shock-excited antenna which had too large a decrement. The antenna was connected to earth through an auto-transformer, and means were provided for tuning the primary and secondary circuits; these were tuned together so that energy in one might build up the energy in the other.

What apparatus can you point to before the date of Marconi's 7,777 that did anything of the kind?—The Tesla apparatus.

Will you enumerate them all?—In Ducretet's experiment, if the Oudin resonator were used as an Oudin resonator, there would be tuning up.

The coupling of your primary and secondary are loose?—Comparatively.

Should I be wrong in suggesting that the percentage of the coupling is material in considering the speed of the transfer of energy from one circuit to another?—You would not be wrong in suggesting it, but you would be wrong in suggesting that the mere increase of coupling would accelerate the transference of energy; because if you have a short wave train there are a series of maximum best couplings, which are separated by stretches of coupling which are not so good if the primary has a short wave train.

During the time that the oscillations are going on in the primary, whether the spark gaps are there or not, the building up of the oscillations of the secondary is taking place?—Yes, as long as you kill your primary spark before that energy begins to return.

Your are, in fact, transferring the energy to the secondary and building up the energy in the secondary by oscillations in the primary?—During those two or three swings.

According to your view you cut off the oscillations in the primary. Have you got enough energy into the secondary by that time for the work you want to do?—Certainly.

Now, you adopt means at that moment to cut off the energy and to build up the secondary by the oscillations in the primary?—Yes.

But for the fact that you adopt means to cut it off, it would go on building up?—It might come back again.

Mr. Justice Eve: If the secondary was radiating, would it then come back?—It depends on the rate of radiation.

Mr. Terrell: If you did not quench it you might get Marconi.

Mr. Walter: What beneficial object can you suggest is attained by this?—The beneficial object of obtaining the natural wave of the antenna, and of excluding your waste of energy from your persistent circuit, the waste of energy in the spark; the antenna has now become the persistent circuit, and there is no spark in the antenna. In the other method there is a persistent circuit, the primary, in which there is a spark that lasts a considerable time and wastes considerable energy.

There is no spark in a Marconi aerial?—Certainly not.

You have a spark in your primary circuit. no spark in your secondary?—My primary circuit does not waste the energy to the same amount that the other spark wastes it, the persistent spark.

Having got over enough oscillations, do you mean that you have improved Marconi by cutting off the oscillations of Marconi when you have got it over, or what is it?—Most certainly I do. It is well known that shock excitation systems are 50 per cent. more efficient than any system that has a permanent primary.

Do I understand you to mean that in a single primary oscillating circuit it is possible to have only two or three oscillations?—It is possible to have half a one; that is to attain Lodge's ideal.

Where has the energy gone in your curve?—Into the secondary, as it was intended to do in that particular case.

That is, the whole of the energy has gone?—No, there is probably a little left.

You told us before that substantially all the energy has gone over?—All the energy that you can get over under these circumstances, obviously.

That is what I put to you, all the energy you could get over has gone over, but no more than would have gone over in the ordinary Marconi with the same coupling. You have identically the same amount over then as you would get in Marconi with the same coupling and the same swings. Do you suggest that you are going to get more energy over than you would in the ordinary Marconi coupling in the same number of swings?—I do not see what that has to do with it.

The Assessor: You say you would get a higher spark frequency with your quenched spark than without?—In general, one does. In Lepel's system you get up to 10,000 sparks per second.

Mr. Walter: You agree with Mr. Pletts that if you had a double wave transmitted you can have an aerial which will take the whole of the energy of the two waves?—I am afraid it is not a very efficient aerial.

If you had two you can use one instrument and have two stations, one of which will be in tune with one wave and one of which will be in tune with the other?—Each of these waves will have less energy than if you radiated on a single wave.

Assume you have a good radiating aerial, is it not the fact that if you want to transfer the energy rapidly you tightly couple?—Not essentially.

When you want to get it transferred very rapidly, is it the fact

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that the more tightly you couple the more rapidly you get it over?—No, certainly not. The fact is, you would find the right coupling. If you increase the coupling, at times you might make the transference of energy less rapid.

Will you give an example in which you say you hasten it by loose coupling?—If I take these ship installations and couple them up too tightly, the energy will be certainly transferred to the aerial, but it will come back again.

MR. WALTER: Do you suggest that the experiment you showed my Lord yesterday was a fair representation of the conditions on board the ship?—It was a fair representation in the sense that an artificial antenna was used instead of the real one.

Was it a fair representation from the point of view of the sparks we saw?—They were not so highly resolved as the ones I saw on the ship; we were not running the mirror at so high a speed.

Did the photographs you showed us show beats?—No. We, I believe, showed you beats in the case where the gaps were shorted, and the discharge coil was off.

There were beats, that is to say, at the time it was working as an ordinary Marconi?—It was an imitation of an ordinary Marconi.

You do not suggest that would not be working exactly in accordance with the 7,777?—That is a different thing from the Marconi conditions.

As it was working then, there was nothing that could distinguish them from the ordinary Marconi?—It was practically indistinguishable.

The ASSESSOR: I think you said that the effect of opening the spark gaps was to give you higher spark frequency?—I believe so. It should be so.

You would hear that if you were listening at the receiving end?—You would hear a slightly different tone in your telephone.

It detects group frequency?—Yes, it is the group frequency which determines the telephone tone.

MR. WALTER: I have understood it to be said that the defendants' is Lodge. Do you say that is the case?—I cannot see how I can answer yes or no to that. You have to define Lodge first.

No, I have not. Do you say the defendants' is Lodge?—I say that the defendants' apparatus is constructed according to Lodge, Fig. 4, with that central gap left out, and as it happens in the present arrangement with one of the condensers left out, and with a different shape of antenna from what is in Lodge.

Do you know the theory upon which Lodge works?—The only satisfactory way in which I can know the theory upon which Lodge works is to make the apparatus as nearly as possible to Lodge's specification and then to find out how it works.

Have you done so?—This apparatus on the *Cambria* and the *Scotia* is made as nearly as I can see to Lodge's specification.

Then in order to be quite clear you do say that the defendants' is Lodge?—With the qualifications I gave.

Is there any hint or suggestion in Lodge of two circuits, one of which inductively acts on the other?—Most certainly.

Had anybody before Marconi, and before the 7,777, suggested the use of two circuits with a common inductance between the primary and the secondary, an inductance in the aerial, the two being capable of being tuned together for wireless telegraphy?—I think Braun's patent, one of them, is dated before.

No further evidence was called for the defendants, and at this stage the hearing was adjourned until Monday, July 13th.

On resuming Counsel for the respective parties summed up the case, the hearing of which was concluded on Tuesday. MR. JAFFE summed up the case for the defendants, and MR. WALTER, K.C., replied on behalf of the plaintiffs.

At the conclusion of the arguments, his LORDSHIP reserved judgment.

POSTMASTER-GENERAL *v.* DARLINGTON CORPORATION.

IN the Railway and Canal Commission Court on July 8th, Mr. Justice Banks, the Hon. A. E. Gathorne Hardy, and Sir James Woodhouse heard the appeal of the Postmaster-General against the refusal of the Corporation of Darlington to allow him to erect a distributing telegraph and telephone pole in a thoroughfare at Darlington.

MR. FRANK RUSSELL, who appeared for the Postmaster-General, said the case was of some importance because it affected a matter of public policy. It appeared that a pole holding a number of wires stood for a long time in a yard owned by Ald. Benson, of Darlington, for which the Postmaster-General paid a rent of 10s. annually. Mr. Benson raised the rent to £3, which was considered to be preposterous, so the Postmaster-General, exercising his right under the Telegraph Acts, asked the sanction of the Corporation to erect the pole on the edge of the pavement of Northumberland Street. The Council objected on the ground that the pole would be an obstruction to the public, a danger, and an extra expense on the rates, because it would entail extra lighting of the road by night. The Postmaster-General received an offer—which was probably prompted by the Corporation—from a Mr. Blackett, that the pole should be placed in his yard at a rental of £1 a year, with three months' notice to terminate the agreement, but the Postmaster-General objected to the length of notice, as it gave him no security of tenure. The Postmaster-General, continued counsel, always endeavoured to place telegraph and telephone poles on the highways, because of the easy access that was afforded for repairs, and in addition he objected to so many private rentals. At the present moment he was paying £118,000 a year for private rentals. Counsel said he could prove that the contention that the post would be a danger and an obstruction could not prevail, for the post would be placed against a wall, leaving the pavement free, and there would be no stays or supports.

Evidence was given by MR. J. K. ELLIOTT, superintendent engineer for the Northern district, who said the Postmaster-General objected to so many private wayleaves because of the great expense and the difficulty of gaining access for quick repairs. Replying to counsel for the Corporation, he agreed that the Corporation had been very reasonable and had allowed 149 poles to be erected in the streets.

Counsel: And you think they are unreasonable over the 150th pole?—Yes.

MR. WM. SLINGO, engineer-in-chief to the Post Office, said that the Post Office had 1,665,000 poles, for which they paid rentals, and some payments, he considered, were exorbitant. They objected to pay the rent demanded by Mr. Benson, because they thought they should save the rates.

Counsel: And to save the rates you fight this small matter out in the High Courts?—We do.

After MR. H. G. STEVENSON, town clerk of Darlington, had given evidence, stating that the Council did not wish to be unreasonable, the Court dismissed the Postmaster-General's appeal, SIR JAMES WOODHOUSE observing that he thought the Post Office had, in this case, adopted an attitude such as should not be taken up by a Government Department.

VANDAM *v.* ARMORDUCT MANUFACTURING CO., LTD.

IN the City of London Court, on Tuesday, before his Honour Judge Atherley-Jones, K.C., an action was brought by Mr. Albert Vandam, commission agent, Caxton House, S.W., who made a claim against the Armorduct Manufacturing Co., Ltd., for £5 15s. 8d. commission due at the rate of 2½ per cent. on certain electric cable supplied by them to Mr. Kerr, South Africa. Mr. Hurd appeared for the plaintiff and Mr. G. E. Tong for the defendants.

MR. HURD stated that the plaintiff was an agent for electrical accessories, and in the course of his business he visited foreign countries throughout the world and came across various orders which firms wanted to place in this country. In September, 1911, plaintiff knew a Mr. Kerr, of Johannesburg, South Africa, who wanted to place large orders for electrical cables. Plaintiff went to the defendants and asked them if they would undertake the business with Mr. Kerr. An agreement was made between the parties by which the defendants agreed that if plaintiff introduced Kerr to them they would pay him a commission of 2½ per cent. on all business resulting from the introduction. It was mentioned that the commission would be payable so long as business continued to be done between plaintiff and defendants. A further letter was written in November, by which the defendants rendered a monthly statement of the account showing that it was a continuing account. Defendants had been continuing to supply electrical goods to Mr. Kerr, and had sent proper statements to the plaintiff of the goods so supplied, and had been paying him his agreed commission at 2½ per cent. Last year a difficulty arose. Defendants thought that instead of paying 2½ per cent. they would pay half of it. Plaintiff refused to accept that, and defendants paid the plaintiff at the full rate. Now defendants had sent in an account showing that Kerr had given orders for £231 worth of goods, and they had paid into Court £2 17s. 10d., being 1½ per cent. commission instead of 2½ per cent. Plaintiff could not understand why. Defendants now said that a year ago they told the plaintiff they would reduce the commission. That was a one-sided contract. Defendants suggested that the orders came to them through shipping agents, which had nothing to do with the plaintiff. Defendants could not get rid of their obligation under the first contract.

MR. TONG said that a subsequent contract was made with Mr. Kerr.

JUDGE ATHERLEY-JONES could not see how that affected the plaintiff.

MR. TONG said that Kerr started dealing direct with the defendants, and plaintiff had 2½ per cent. commission. Kerr then sent his orders through Hales, Caird & Co., and plaintiff's commission was not due. There was nothing to identify Kerr's orders that came through Hales, Caird & Co.

MR. HURD said that as the defendants had paid half the commission into Court, defendants were out of court. That was an admission *pro tanto* with the contract sued on. The only question was whether it was 1½ per cent. or 2½ per cent. Plaintiff said he never agreed to vary the rate of commission.

DEFENDANTS' secretary said that where Kerr's business came to them through Hales, Caird & Co., no commission became due to the plaintiff.

JUDGE ATHERLEY-JONES found for the plaintiff, with costs, and said that an agreement to pay 2½ per cent. had never been varied with the consent of the plaintiff.

A Lightning Sketch.—Whilst a servant girl was cleaning a window of a house in Toronto, a flash of lightning passed, leaving the imprint of her hand on the glass. We are informed that the fingers and wrist were quite plainly to be seen on the glass, and heavy rubbing failed to remove the imprints. Other details are lacking.

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BUSINESS NOTES.

Catalogues and Lists. — The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Illustrated priced leaflet describing various speed or revolution counters. Also G.E.C. Bulletin No. 1, a revised list of important plant. This is a 52-page publication, the contents of which consist almost entirely of photographic reproductions of turbo-alternators, continuous current generators, rotary converters, motor-generators, switchboards, &c., supplied for power and sub-stations in this country and abroad, and for collieries, breweries, steelworks, &c. The pages of motor installations show colliery haulage gear, shipbuilding equipments, &c. Some pages at the end of the book are filled with tabulated particulars of such plant and the destination of same.

The Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.—Leaflet No. P. 1,391 shows some of the company's specialities for picture theatres, including their air washer, air turbine vacuum cleaner, and propeller fans.

Mr. H. Moss, 116, Horton Grange Road, Bradford.—We have received a batch of publicity literature which is being used by Mr. Moss as ammunition in connection with a determined advertising campaign which he has in progress and will have for the next few months, boosting electric suction cleaners, electric fans, flat irons, domestic heating and cooking apparatus, and telephone message counters.

Messrs. Steinbach & Hohn, 669, Mansion House Chambers, Bucklersbury, London, E.C.—48-page catalogue of electrical accessories (lampholders, hand lamps, adapters, wall plugs, ceiling roses, tumbler and other switches) made by Messrs. F. W. Busch Aktien-Gesellschaft, of Lüdenscheid, for whom they are agents.

The British Thomson-Houston Co., Ltd., Rugby.—List No. 4,202 describes B.T.H. automatic circuit-breakers with magnetic blow-out, and gives prices and dimension drawings of same. Twelve-page list (No. 2,270) describing continuous-current crane motors with detailed tables of ratings. List No. 4,610 (24 pages) particularises and prices porcelain parts stocked by the company and used in connection with B.T.H. standard apparatus.

Allgemeine Elektricitats - Gesellschaft, Berlin. — Brochures relating to the electric driving of waterworks and drainage installations, high-pressure cables (up to 60,000 volts), automatic domestic water-pumps, cast-iron installation-material for railway workshops, and measuring instruments (recording).

Messrs. Wakelins, Ltd., 5 and 7, Tottenham Street, Tottenham Court Road, London, W.—Thirty-two-page illustrated price list of plant and apparatus for country house lighting installations—small combined electric lighting sets, electric light fittings, electric sets for cinematograph work, "Hydrobenoid" pumping plant with automatic electric motor, &c. A separate 10-page list shows examples of the firm's art metal work for gates, railways, illuminated signs, &c.

The Korfund Co., 431, Bank Chambers, High Holborn, London, W.C.—New illustrated circular detailing the merits and purposes of "Korfund" as a vibration and noise preventer.

Messrs. R. H. Patterson & Co., Ltd., Forth Street Works, Newcastle-on-Tyne.—July stock list of new and second-hand machinery.

The Electrical Engineering and Equipment Co., Ltd., 109-111, New Oxford Street, London, W.C.—Sixteen-page illustrated list (No. PM 12) giving tabulated details and prices of high-tension oil switches, oil switch fuses, isolating switches, H.T. fuses, lightning arresters, relays, switch pillars, &c.

British Prometheus Co., Ltd., Salop Street Works, Highgate, Birmingham.—Non-technical leaflet, entitled "Ironing by Electricity," giving information for the domestic user regarding the various points of superiority possessed by the electric iron. Contractors and others can have supplies of copies over-printed with their own names.

The Electrical Co., Ltd., London.—The *E.C. Journal* for June: also leaflets relating to small motors and dynamos for driving wireless telegraph models, and to new type liquid starters.

Messrs. Feld Bros. & Co., Ltd., 25, Budge Row, London, E.C. —Twenty-page booklet (No. 250) respecting their various insulating materials—mica, micanite, Carta material, asbestos press materials, insulating cloth, insulating varnishes, enamelled wire and ready-wound coils.

Messrs. Mather & Platt, Ltd., Manchester.—Finely-produced catalogue of 24 pages, illustrating in excellent style, and describing the construction of, the firm's high-lift turbine pumps and other pumps for various classes of service. A companion pamphlet gives a full list of collieries which are using the M. and P. high-lift turbine pumps.

Messrs. Pope's Electric Lamp Co, Ltd., Hythe Road, Willesden.—New 16-page catalogue of Pope carbon-filament lamps, of British manufacture. Full sized drawings of the lamps appear, together with particulars of candle-powers, voltages, dimensions and prices of various shapes and types—standard, traction, ships' side-light, tubular, fancy battery, crinkled flame, radiator, resistance and coloured glass.

Messrs. Alfred Herbert, Ltd., Coventry.—The July issue of the "Monthly Review of Modern Machine Ship Practice" contains admirably illustrated articles on high-power milling machines, steel bars, truing grinding wheels, continuous milling, selling guarantees, and other subjects, as well as a monthly stock list of machines.

Pitter's Ventilating and Engineering Co., Ltd., 20, Bishopsgate, London, E.C.—Appropriate to these July days is a remark on a folder from this company to the effect that there's a commercial value in keeping cool. Inside are given illustrations and prices of the firm's "Multiblade" type electric fans.

British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—For the convenience of aluminium users the company have issued for hanging on the wall a sheet of tabulated matter relating to aluminium tube, sheet, wire, bar and strip, strand, round rod, alloys, &c.

Edison & Swan United Electric Light Co., Ltd., Ponder's End.—Advance copy of eighth edition of Section IX Catalogue (Part 2) of 40 pages, giving illustrated matter and prices relating to Ediswan telephones and accessories, domestic telephones, telephone arms, battery ringing and magneto wall 'phones, "Primax" and magneto interphones, lamp signalling, mining telephones, electric blasting machines, &c.

Messrs. Whittaker & Co., 2, White Hart Street, E.C.—Catalogue of scientific and technical books for 1914.

Dissolutions and Liquidations.—British Power Co., Ltd.—At a meeting on June 24th, a resolution was passed to wind up the company voluntarily.

E.M.F., Ltd.—A meeting will be held at 57, Moorgate Street, E.C., on August 17th to hear an account of the winding up from the liquidator, Mr. G. Little.

Cheap Power Supply and Engineering Co, Ltd.—A meeting will be held at the offices of Messrs. Grover, Smith & Moss, 77, Fountain Street, Manchester, on August 20th, to hear on account of the winding up from the liquidator, Mr. W. T. Green.

Consolidated Diesel Engine Manufacturers, Ltd.—An order was made last week at the London Bankruptcy Buildings, appointing Sir William Peat, chartered accountant, special manager to conduct the business pending the statutory first meeting of the creditors and shareholders.

Fell & James, consulting engineers and chartered patent agents, 1, Queen Victoria Street, E.C.—Messrs. J. C. Fell & R. W. James have dissolved partnership. Mr. James attends to debts and continues the business under the same style.

The "Dac" Accumulator Syndicate, Ltd.—A meeting of creditors is called for July 24th, at the offices of Messrs. Chantrey, Chantrey & Co., 61-62, Lincoln's Inn Fields, W.C., by the liquidator, Mr. H. C. Bound.

Isaac Storey & Sons, Ltd.—With reference to the paragraph in our last issue respecting this company, we are asked to state, in order to avoid giving a wrong impression, that Isaac Storey and Sons, Ltd., went into voluntary liquidation for the purposes of amalgamating with United Brassfounders and Engineers, Ltd., Empress Foundry, Cornbrook, Manchester, in 1910.

Trade Announcements.—Mr. D. Neill-Keith has been appointed switchboard representative for Messrs. Ferranti, Ltd., for the Lancashire district and Ireland.

The Schniewindt Electric Co., 40 and 41, Staniforth Street, Birmingham, have appointed Mr. Wm. Riley, 3, Haydon Street, Minories, London, E.C., as their sole London and district agent for their electrical resistance materials, &c. A stock of nets, wire, &c., will be held at his address.

The Valor Co., Ltd., have rearranged their offices at 120, Victoria Street, S.W., adapting them for the display of chemical fire extinguishers, oil cabinets, oil filters, E.P.S. electric lighting sets for motor vehicles, &c. Readers are invited to call.

Mr. A. E. Goodman, electric goods dealer, 60, Herbert Road, Plumstead, S.E., announces that he is giving up business.

Mr. J. G. Bomford, late of Ellis & Ward, Ltd., Birmingham, has commenced business as an electrical engineer and contractor, at Shakespeare Chambers, Stratford-on-Avon.

Annual Outings.—On Saturday, July 4th, a large number of the employés of Messrs. Laurence, Scott & Co., Ltd., of Norwich, held their annual outing, the party dividing up into three sections. The main body (about 170) joined forces with the Norwich Corporation outing, making London their objective, where, thanks to an early start, a long day was available. About 50 travelled to Brighton by the Norwich Workers' outing, and a further contingent of about 70 made a circuitous road journey to Great Yarmouth. All those taking part in the outing greatly appreciated the action of the directors in generously contributing towards the day's expenses. The arrangements were in the hands of a joint committee, comprising Messrs. Bacon, Francis, Hammond, Jefferies, Johns, Rix and Webster, with Mr. H. Minister as hon. secretary and treasurer.

The 12th annual trip of the Potteries district of the British Electrical Friendly Society recently took place, the parties consisting of just over 200, divided between the two days. A visit was paid to Liverpool.

The 14th annual outing in connection with the recreation club of the St. Helens Cable and Rubber Co. took place recently, 450 employés and friends spending an enjoyable day at Blackpool.

On Saturday, July 4th, the Linolite Co.'s office and works staffs went for their annual outing, travelling from Victoria Station to Herne Bay. In favourable weather the party, after indulging in boating and swimming, partook of luncheon at the Tea Gardens on the Lees. In the afternoon, tennis, bathing and rambles were enjoyed by various members of the party. Tea was served on the lawn of the above gardens. Mr. A. S. E. Ackermann, the company's engineer and manager, and Mr. R. L. Matthews, the assistant manager, were both present, together with Mrs. Ackermann and family.

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The BRIMSDOWN LAMP WORKS held their annual outing on Saturday last, when the staff and employés and a number of friends travelled to Great Yarmouth. At the luncheon, which was served at the Arcade Restaurant, Mr. Scharrer proposed the health of the managing director, Mr. Reiss, who suitably responded, thanking the workers for their co-operation and support. He said that the company had made steady progress during the past year, and trusted that they would continue their course along the road of progress.

The employés of the KINGOLITE CO., LTD., and W. B. COUPIER had their first annual excursion on Wednesday, July 8th. The party, numbering between 50 and 60, went by train from Waterloo to Windsor, where they embarked on the S.L. *Countess* for Marlow. Luncheon and tea were served on board, and the musical programme was provided by the employés. Responding to the toast, "Success to the Company," Mr. Owen, the managing director, said he felt sure that they were doing business on the right lines, and with the continued co-operation of the staff, they were bound to make their presence felt in the trade. On the following morning, the forewoman, Mrs. Palmer—who was unable to be present at the excursion—was presented with a gold bracelet watch, suitably inscribed, and Mr. Owen, in making the presentation, said that he hoped Mrs. Palmer would preside over the works for many years to come.

Book Notices.—We have received from the Port of London Authority an extremely interesting and instructive brochure of about 100 pages, dealing with the past and present history of the Thames and its docks. The letterpress is by Mr. Douglas Owen, and the illustrations, which are numerous and artistic, and in a number of cases in colours, are by Mr. Charles J. De Lacy. The book briefly traces the rise of the Port of London from its earliest days, and relates the circumstances which eventually led up to the creation of the Port of London Authority. The first enclosed dock area was the Howland Dock at Rotherhithe, which flourished as early as 1703. Its site now forms part of the Surrey Commercial Docks. It was, however, nearly a century later that the value of enclosed docks for the handling and protection of cargo came to be fully appreciated, and the West India Dock, the precursor of many others, was opened for trade with the active support of the great William Pitt. In addition to dealing with the many-sided activities of the Port Authority, the book deals fully with their great scheme of improvements now in course of execution, and in particular indicates by pen and picture the general character and importance of the fine new deep-water dock which is now being constructed between the Royal Albert Dock and the river. Several of the illustrations effectively suggest the great part which the enterprise is likely to play in the future commercial history of London.

"The Physical Society of London: Report on Radiation and the Quantum Theory." By J. H. Jeans. London: The *Electrician* Printing and Publishing Co., Ltd. Price to non-fellows, 6s. 8d. net.

Ragged-Staff Rhymes. By A. Sedgwick Barnard. Birmingham: Cornish Bros., Ltd. Price 6d. net.—This little collection of poems is from the pen of a well-known central-station engineer (who, by the way, has just abandoned municipal work for a commercial career); the verses are mainly cast in a melancholy vein, but they are charged with the true poetic fire, and are well worth perusal. Some of them hang in the memory in mournful cadence—one in particular, obviously inspired by the *Titanic* disaster, pays a noble tribute to the heroic engineers who did their duty to the last without thought for their own safety. We hope the versatile author will continue to produce "Ragged-Staff Rhymes," for which he possesses a marked aptitude.

Boksburg Railless Trolley.—With reference to the article on the Boksburg, Transvaal, railless trolley system, which appeared in our issue of April 24th, 1914, we are informed that the contract for the supply, delivery and erection of the whole of the converting machinery and switchgear in the converter station was carried out for the Boksburg municipality by MESSRS. S. SYKES & CO., LTD., of Johannesburg. Messrs. Sykes are the sole representatives of Messrs. Bruce Peebles & Co., Ltd., and also of Messrs. A. Reyrolle & Co., Ltd., with which companies they placed the orders for the two Peebles-La Cour motor-converters and the H.T. and L.T. switchgear respectively. The erection was carried out by Messrs. Sykes under the supervision of their chief electrical engineer, who, incidentally, happens to have been connected in the past for a considerable period with Messrs. Bruce Peebles and Co., Ltd.

Rubber Wires and Cables.—THE LIVERPOOL ELECTRIC CABLE CO., LTD., of Bootle, announce reductions in the prices of their rubber-insulated wires and cables, consequent upon the continued low price of materials. Altered discounts are announced for prices given in their January, 1914, list of Association and non-Association qualities.

Bankruptcy Proceedings.—CHAS. HENRY KITCHING, 172, Beverley Road, and 42, Chariot Street, Kingston-upon-Hull, electrical engineer, &c.—This debtor applied to his Honour Judge Fossett Lock at the Guildhall, Hull, last week, for his discharge from bankruptcy. The debtor failed in October, 1898. The Official Receiver stated that the debtor estimated his liabilities expected to rank for dividend at £2,283, of which £465 was due to four moneylenders. The assets realised £821, the difference being accounted for mainly by the debtor having considerably overestimated the amount likely to be realised from his stock-in-trade and book debts. The balance available for costs and distribution amongst the unsecured creditors was £713, instead of £136, estimated by the debtor, and a dividend of 2s. 9d. in the £ was paid. Debtor's premises were styled the City Electric Light Works. He commenced in May, 1896, with no capital, obtaining a loan of £200 from a moneylender. No trading or profit and loss accounts were kept, and no balance-sheet was got out until July, 1898. Debtor was then shown to be on the wrong side, and he executed a deed of assignment, an act of bankruptcy on which the receiving order was made. Mr. Harry Wray, the debtor's solicitor, said the debtor was a man of a very sanguine temperament, and he had allowed his ambitions to over-ride his discretion. He embarked very largely in trade taking contracts and buying large stocks, especially of electrical appliances, which at that time were becoming very much in request. Replying to his Honour, Mr. Wray said that the debtor was now in Sheffield. There was no opposition to the application, and he submitted the debtor had been already sufficiently punished. Debtor was granted his discharge, subject to a two years' suspension.

FRANK HERBERT WATTS, electrical engineer, 40, Mincing Lane, E.C.—Under a receiving order made on June 25th, against this debtor upon the petition of Veritys, Ltd., creditors for £209, the statutory first meeting of creditors was held on July 9th, at Carey Street, W.C. Mr. Egerton S. Grey, Official Receiver, who presided, said that, according to the debtor's statement, he was an electrical engineer. Until the year 1901 he was engaged as a marine engineer, but in that year began as an electrical engineer in partnership; in 1904 there was a dissolution, and the debtor afterwards traded alone until April last. He was then compelled to execute a deed of assignment. He attributed his failure to loss on contracts, to insufficient capital, and to the loss of £200 in connection with a company. The debtor had lodged a statement of affairs showing liabilities £725, and assets consisting of cash, £72, in the hands of the trustee under the deed, and book debts £92. There was no offer of composition before the meeting, and the Official Receiver said that the Court had already adjudged the debtor a bankrupt. No resolution was passed, and the estate remained in the hands of the Official Receiver as trustee for administration.

G. BURGESS, electrical engineer, 27, Museum Chambers, W.C.—Receiving order made July 7th, on creditor's petition. First meeting, July 23rd; public examination, August 25th; both at Carey Street, W.C.

Electric Mains Explosions.—Referring to the recent inquiry into the causes of explosions on electric mains, and our comments on the report, with which they are in general agreement, the DUSSEK BITUMEN CO. write to us stating that they drew the attention of the Committee to the danger arising from the fumes and gases given off by the burning of the vulcanised bitumen insulation of the cables, which they consider much more serious than that due to gases from the ordinary refined bitumen used for filling the troughing. We pointed out that although the report made it clear that all serious explosions in houses had occurred in connection with vulcanised bitumen cables, it was tacitly assumed that the whole of the danger arose from the bitumen filling. As manufacturers of both vulcanised bitumen and ordinary refined Trinidad bitumen, the company think they could have given the Committee useful information if they had been invited to give evidence. They point out that bitumen "leaves the Court with an enhanced reputation," the continuance of its use being approved of by the Committee, and its superiority to pitch, which becomes soft in summer and brittle enough to crack in winter, whereas bitumen never softens and never cracks, is demonstrated also as regards the danger of explosion by the evidence of Dr. Wheeler, which we reproduced in our last issue. We understand that in none of the cases of explosion dealt with by the Committee was the bitumen manufactured by the Dussek Co.

Holidays.—Another new holiday handbook, entitled "Evenings by the Sea," has been issued by the GREAT EASTERN RAILWAY, depicting by means of water-colour sketches, some of the attractions of the 20 seaside resorts served by the company. Copies can be obtained from the Superintendent of the Line, Liverpool Street Station.

The works of the RECORD ELECTRICAL CO., LTD., will be closed from Friday, July 31st, until Monday, August 10th, for the annual holidays. Letters of extreme urgency will receive attention.

The works of the MIDLAND ELECTRIC MANUFACTURING CO., LTD., Birmingham, will be closed from Friday, July 31st, until Monday, August 10th, for the annual holidays.

The works of MESSRS. W. A. STEVENS, LTD., Victoria Works, St. Peter Street, Maidstone, will be closed for the summer holidays from August 1st to Monday, August 10th.

MESSRS. ELLIOTT BROS., Lewisham, announce that their works will be closed from July 30th to August 8th, inclusive, for the holidays.

For Sale.—MESSRS. P. HUDDLESTON & CO. have been instructed to sell by auction, on July 23rd, at Dalling Road, Hammersmith, W., a large quantity of electrical apparatus, including motors, switchboards, &c. The Directors of the Empire Theatre, London, W.C., invite offers for an electrolier, 178 lamps. Particulars are given in our advertisement pages to-day.

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LIGHTING and POWER NOTES.

Ashton-under-Lyne.—EXTENSION OF SUPPLY.—The Standing Sub-Committee of the T.C. is to consider the question of supplying electricity to the Hurst Council.

Australia.—The financial statement of the Sydney (N.S.W.) City Council's electrical undertaking for the year 1913, shows a revenue of £285,743, and a total gross profit of £163,116. After meeting interest and sinking fund charges £98,712, depreciation, &c., £45,413, the surplus balance remaining was £53,299, or including certain balances brought forward, a total of £55,243. During the year 14,964,034 units were sold for lighting, and 17,022,809 units for power.

The Lane Cove Municipal Council, North Shore, Sydney, whose lighting contract with the North Shore Gas Co. expires at the end of 1915, has decided to enter into a contract with the Sydney City Council for the supply of electricity for a period of 10 years, commencing January 1st, 1916. The Council has also given the Sydney City Council permission to erect at once the necessary appliances for electric lighting purposes in connection with the supply to the other municipalities, and this will enable the City Council to carry its mains when necessary from Willoughby across Lane Cove into Mosman and North Sydney.

Barmborough.—PUBLIC LIGHTING.—Electricity for lighting the village is now being supplied by the Manvers Main Colliery Co., and an extension is to be made to Harlington.

Bedford.—NEW LOANS.—The T.C. is applying to the L.G.B. for sanction to a loan of £8,300 for E.L. mains for three years. The result of the last year's working of the electricity undertaking was a surplus of £511; the units sold numbered 2,649,080.

Boston.—PROV. ORDER.—The R.D.C. has been informed by Mr. Robert A. Smith that he intends applying to the B. of T. for a prov. order for electric supply within the area of the Council.

Bradford.—YEAR'S WORKING.—The report of the year's working of the electricity department shows a profit of £14,900. The income was £144,000, as against £130,000 last year, the increase being equally divided between lighting, power, traction and bulk supplies. The cost of generation was £39,000, equal to ·335d. per unit, which compares with ·345d. in the previous year; the cost of coal increased by £3,000. The gross profit was £75,000, £14,900 being left after payment of £22,000 interest on loans and contributing £38,000 to sinking fund. From this profit £7,000 has been spent on capital works outside the borrowing powers, and £5,000 has been devoted to relief of rates, leaving £2,900 to carry to reserve and renewals account, which amounts to £22,400. A total of 28,000,000 units were sold during the year, as compared with 24,500,000 in the previous year. The consumers increased from 3,600 to 4,100.

The city architect is to prepare a scheme and estimate for the lighting of the Technical College hall on modern lines; both the electricity and gas departments of the Corporation have been requested to supply estimates.

Buckie.—PROPOSED E.L.—Mr. Hogarth, of Edinburgh, has conferred with the Lighting Committee of the T.C. with reference to a scheme for the electric lighting of the town.

Chester.—YEAR'S WORKING.—The Corporation electrical department during 1913-14 sold 2,531,709 units, including 378,158 for the tramways and 640,076 for bulk supplies; the total compares with 2,372,393 units in the previous year. The total revenue amounted to £24,251 and the balance to net revenue to £12,950; after meeting interest and sinking fund charges, £1,094 was contributed in aid of the lamp rate, £500 to "city improvements," and £3,347 to reserve. The reserve fund in hand amounts to £13,733; some £3,339 was transferred during the year for capital expenditure, bringing up the total amount of capital expenditure defrayed from revenue to £18,020. During the year the hydro-electric scheme has contributed a considerable proportion of the output, and it may be noted that the works and management costs were ·839d. per unit as against ·889d. in the previous year, the coal item dropping from ·331d. to ·281d. per unit.

Coleraine.—E.L. PROPOSALS.—The Urban Council has received reports on the relative merits of gas and electricity from Mr. Langlands, Glasgow, and Mr. May, Londonderry. The matter has been deferred.

Continental Notes.—GREECE.—A scheme is reported to be under consideration for the establishment of a central electric lighting station in the town of Mitylene.

HOLLAND.—In connection with the approaching completion of the overland central station near Groningen, which is to supply the three northern provinces of Holland—Groningen, Drenthe and Friesland—with current for lighting and power purposes, arrangements are in hand for the holding of an electrical exhibition in the town of Groningen during the month of September next.

TURKEY.—A scheme is under consideration for the establishment of a central electric station in the town of Cavalla; a project has also been drawn up to utilise certain available water-power at Vodena in the generation of electrical energy for lighting and power purposes in the district.

GERMANY.—The Berlin suburb of Lichterfelde has made a 30-year contract with the Berlin electricity works to purchase energy in bulk for distribution. The company apparently supplies all the electrical plant, mains, &c., which may be purchased by the Council at an agreed time. The Council fixes the prices to be charged.

Coxhoe (County Durham).—STREET LIGHTING.—The Kelloe Colliery Co. has offered to light the district for £2 per post of two 25-C.P. lamps, the Council to provide poles, labour, &c., and connect to the company's plant. In addition the Colliery Co. reserves the right to supply current to private customers.

Crayford.—The West Kent Electric Co., Ltd., has applied to the B. of T. for consent to overhead lines for the supply of current at a pressure of 10,000 volts to Messrs. Vickers' works.

Criccieth.—STREET LIGHTING.—The Council at a special meeting, last week, decided in favour of electricity for lighting the streets, at an estimated cost of £5,500. It was stated that a gas lighting scheme would cost £9,000.

Douglas (Isle of Man).—A L.G.B. inquiry was held last week into the application of the T.C. for loans of £1,700 for the electric lighting of the sea front at Douglas, and £600, balance of the cost of the E.L. installation at Villa Marina.

Dublin.—L.G.B. INQUIRY.—Mr. P. C. Cowan held an inquiry on June 7th into the application of the T.C. for sanction to loans of £77,800 for electrical extensions, and £5,000 for the conversion of public lighting from gas to electricity. A large portion of the former loan is for switchgear and mains, while £30,000 is set apart for short extensions, services, &c. It was agreed that only half the street lighting loan should be taken up now; it is intended to adopt the Barrow suspension lighting system in certain streets, with an overhead feeder along the street.

Ealing.—SHOW ROOM.—The Electricity Committee has decided that Ealing contractors shall have facilities to use the new show room at the Town Hall; any contractor may purchase fittings at cost price plus 5 per cent., and commission will be paid to any Ealing contractor who introduces a customer for hiring fans, heating and cooking apparatus, or outside arc lamps, at the rate of 10 per cent. on net value up to £1 and 5 per cent. for higher values.

Easingwold.—E.L. SCHEME.—The U.D.C. has approved an amended agreement with Mr. Chas. H. Best, of Bradford, for an electric lighting scheme for Easingwold.

Glasgow.—The first section of the new Dalmarnock generating station is to contain one 15,000-KW. and two 10,000-KW. turbine units, with boiler houses, in three floors, placed at right angles to the turbine room. It is stated that the plant will not be ordered for six months.

Gravesend.—YEAR'S WORKING.—The accounts of the electricity undertaking for the year ended March 31st last show a profit, after payment of instalments of loans and interest, of £1,158.

Great Harwood (Lancashire).—PROPOSED E.L.—The D.C. is endeavouring to arrange for the Electricity Committee, the engineer, Mr. Watson, and the Rishton U.D.C., to interview the Blackburn E.L. Committee to discuss terms for the supply of electricity to the town.

Grimsby.—NEW BATTERY.—The electrical engineer has reported to the Electricity Committee in connection with the extensions next year, the necessity to install a new battery with booster, &c., the cost of same with the building being estimated at £5,000. It has been agreed to reduce the price for street lighting from £3 12s. 10d. to £3 per lamp.

Guisborough (Yorks.).—E.L. SCHEME.—The U.D.C. has engaged Messrs. May & Hawes to prepare a scheme for the supply of electricity in the district.

Heckmondwike.—YEAR'S WORKING.—The annual report of the electricity undertaking is not as satisfactory as that of a year ago. The balance to profit and loss account is £1,563, £310 less than last year's figure, and nearly the whole sum is required to meet sinking fund and interest charges. Two large consumers have been lost owing to them putting in their own generating plants. There was a decrease of 107,514 units sold for power and of 28,065 units for lighting. Public lighting and traction demands showed a slight increase.

Huddersfield.—E.L. PROPOSALS.—The Slaithwaite U.D.C. has asked the terms for a supply of electricity in bulk; a sub-committee has been appointed to report on the matter.

India.—According to an Indian paper, owing to the delay in completing the Tata hydro-electric plant, the Lonawali dam only being unfinished, certain of the Bombay mills have taken a supply from the tramway system. It is expected that the Tata supply will be available before the end of the year.

Leigh.—LOAN SANCTION.—The L.G.B. has sanctioned the borrowing of £10,000, repayable within 15 years, for additional plant at the electricity works.

The Electricity Committee has fixed ·7d. per unit net as the price of electricity supplied to the Anchor Cable Co., Ltd., for power purposes, from April 1st, the minimum supply to be 250,000 units per annum.

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Leek.—The U.D.C. Electricity Committee, on the report of the engineer, has decided to have the gas engines at the electricity works overhauled by the makers and put in an efficient state.

Lindley.—STREET LIGHTING.—Owing to the failure of negotiations with the Longwood Gas Co., the Huddersfield Corporation has decided to light by electricity those roads which had hitherto been lit by the Gas Co.; the current will be transmitted by overhead cable. The change is said to be welcomed locally because the gas lamps were often blown out.

Llanfairfechan.—E.L. SCHEME.—The U.D.C. has decided to obtain by the middle of September next tenders for the necessary plant for generating and distributing electricity, using oil or steam plant; or for the supply of plant to take power from the North Wales Traction and Power Co.

London.—MARYLEBONE.—YEAR'S WORKING.—From time to time during the past year we have dealt with the progress of this undertaking. The annual accounts for 1913-14, which summarise the results, show that 17,038,516 units were sold, the total revenue amounting to £218,592, and the gross balance to £120,217; after meeting interest and loan charges, a net surplus of £4,524 remained. The total generating plant capacity increased from 12,000 to 19,000 KW., and the maximum load was 10,497 KW.; the number of consumers reached 9,755. The total connections to the mains increased by 2,759 KW. to 28,315 KW., which figure includes—lighting, 15,492 KW.; motors, 3,694 KW.; heating, cooking and "other uses," 8,656 KW.; and public lamps, 473 KW. The heating, cooking and sundry apparatus is classified as follows:—Radiators, 2,903 of 3,946 KW.; cooking apparatus, 769 of 3,001 KW.; irons, 706 of 238 KW.: medical, 594 of 481 KW.; and sundry, 1,041 of 989 KW. The motors numbered 1,322 of 4,852 H.P. It will be seen that the heating and cooking connections are increasing at a great rate, some 4,700 KW. having been added in two years. Particulars of the new turbine and three-phase plant installed during the year have appeared in our pages. We gather that the turbine units were bought as 3,000-KW. sets to run on 13½ lb. of steam per unit, but that in reality, these machines are running with loads of 4,700 to 4,800 KW. on steam consumptions as low as 11·8 lb. per unit generated.

HAMPSTEAD.—YEAR'S WORKING.—The accounts for the year ended March 31st last, of the electricity undertaking, show a total income of £72,103, and a gross surplus of £36,819, or 8 per cent. on the capital outlay. The net surplus was £6,258, of which £1,406 was applied to reduction of capital, £1,574 to reserve, £2,162 to rate relief, and a balance amounting to £3,872 was carried forward. The units sold amounted to 5,872,308, as compared with 5,320,761 in the previous year. The generating plant capacity was 5,884 KW., and the maximum load 3,673 KW.

B.C. BULK SUPPLY SCHEME.—The Metropolitan B.C.'s Standing Joint Committee is appointing a special Committee to consider the question of taking immediate steps to provide a joint supply of electricity for the London area. The local authorities are apparently tired of waiting for the L.C.C. bulk supply scheme to materialise.

WESTMINSTER.—The Works Committee recommends that the offer of the Charing Cross Co. to replace existing arc lamps in a part of the area by Johnson & Phillips flame arcs be accepted, the Council to contribute a quarter of the cost.

Loughborough.—YEAR'S WORKING.—The returns for 1913-14 of the electricity undertaking shows that 779,600 units were sold, or rather less than in the previous year, the decrease being due to a falling off in the power demand. The B.H.P. of motors connected, however, rose from 664 to 881. The total revenue was £6,017, as against £5,563; the gross surplus was also higher, amounting to £2,759, and after meeting financial charges, &c., a balance of £392 was transferred to renewals.

Melksham.—STREET LIGHTING.—The U.D.C. has consented to the Electric Light Supply Co. giving a demonstration of street lighting by electricity free of charge, with an intimation that electricity would only be adopted on condition that the cost would be no more than for gas.

Mexborough. — YEAR'S WORKING. — The annual accounts of the electricity undertaking show a gross revenue of £5,766, and expenditure of £3,141, leaving £2,624 gross profit. On the whole year the net balance was £1,043, of which £600 was handed to relief of rates, and £443 placed to reserve. The total number of units generated was 635,782, of which 565,254 units were sold.

Monmouth.—LOAN PERIODS.—The T.C. has decided to apply to the L.G.B. for a longer period than 10 years for the repayment of the £1,600 loan required for the renewal and extension of the Corporation's electricity mains.

Normanton (Yorks).—The U.D.C. has instructed Mr. E. M. Lacey to report on the proposed electricity scheme.

Norwood Green.—PROPOSED E.L.—The R.D.C. is to obtain particulars of the cost of the electric lighting of Norwood Green and Coley in connection with a scheme proposed by the Yorks Power Co.

Plympton St. Maurice.—STREET LIGHTING.—The P.C. has received tenders for public lighting from both the Electric Lighting Co. and the Gas Co., and has decided in favour of electric lighting, at a cost of £1 17s. 6d. per 75 C.P. lamp per annum, the tender being submitted by Messrs. Heath & Co., of Plymouth.

Scremerston.—At a pit of the old colliery at Scremerston, near Berwick-on-Tweed, which is to be re-opened, electric plant for pumping is being installed.

Skelton and Brotton.—E.L. SCHEME.—The tender of Graham Bros., Middlesbrough, at £6,171, has been accepted for the installation of electricity for public and private lighting in the district; the street lighting is to be converted from gas to electric lighting.

Southampton.—NEW PLANT.—The Electricity Committee has adopted a report recommending the construction of concrete coal bunkers at the electricity works at an estimated cost of £370, and for the supply of the conveyors at £1,330. Sanction has been received to the borrowing of £4,383 for a turbo-alternator and condenser, and £3,178 for a boiler and converter. The L.G.B. has deducted £1,263 of the Council's application in respect of the outstanding debt on a 250-KW. set.

South Wales.—TURBINE EXPLOSION.—Considerable damage, estimated at £4,000, was done by the bursting of a turbo-generator at the Powell Duffryn Co.'s Penalltau Colliery, on Wednesday last week. Fortunately no personal injuries were sustained, and a duplicate plant enabled work to be resumed in a short time.

Stalybridge.—YEAR'S WORKING.—The annual returns of the Joint Board's electrical undertaking show a profit on the year's working of £8,257, as compared with £911 in the previous year. The total units generated amounted to 24,598,200, an increase of, roughly, 4,000,000 on the previous year. Of this quantity no less than 18½ million units were supplied for power purposes, traction and lighting taking 1,833,166 and 827,318 units respectively. The total revenue amounted to £62,413; working expenses amounted to £27,175, and expenditure on motors and meters, to £8,909, leaving a balance to net revenue of £26,328. After meeting interest and sinking fund charges, &c., the surplus remaining was £8,257, which was utilised in the purchase of a 3,000-KW. turbine set. It will be noted that the profit has been earned on the sale of cheap units; the average revenue obtained was only ·609d. per unit for all purposes, and the works, distribution and management cost only amounted to ·308d. per unit, coal figuring at ·18d. per unit.

St. Mellons.—PROV. ORDER.—The South Wales Electrical Power Co. has informed the Council that it intends applying for a prov. order for E.L. in this district.

Taunton.—YEAR'S WORKING.—The statement of the electricity undertaking shows a gross profit of £5,183, and after meeting interest, sinking fund, &c., transferring to renewals £304, to capital £140, a balance of £173 was carried forward.

Teignmouth.—The U.D.C. has decided to enter into an agreement with Messrs. Purves, for a refuse destructor in connection with the new electric light scheme for the town.

Wadebridge.—STREET LIGHTING.—At the monthly meeting of the U.D.C. tenders were received from the Gas Co. and the Electric Light Co. for the town lighting, and it was resolved to accept the Electric Light Co.'s tender for electric lighting for seven years, at £1 8s. per lamp per annum for 88 lamps.

Walsall.—NEW GENERATING STATION. — The Electricity Committee has entered into an agreement with the Birmingham Canal Navigations in regard to canal water for the proposed new generating station; the Committee has also arranged for a new wharf at the station at an estimated cost of £500.

A railway siding is under consideration and a plan and estimate for a double line at a total cost of £1,020 has been submitted. The sanction of the B. of T. has been received to the erection of the new works on the site proposed by the T.C.

Wells.—PROV. ORDER.—Messrs. Christy Bros., Ltd., of Chelmsford, have informed the T.C. of their intention to apply for a prov. order to supply electricity in the district.

West Ham.—There was a surplus on the working of the electricity undertaking for the year ended March 31st last of £751. The total working expenses amounted to £91,026, as against £71,611 last year, an increase of £19,414. The total income was £133,505, as compared with £110,154, an increase of £23,350; the gross profit was £42,479, against £38,542 in the previous year. The total units generated were 40,969,428, of which 34,404,791 were sold. The total maximum supply demanded during the year amounted to 12,225 KW.

The Electric Lighting Committee recommends the purchase of an electric vehicle from the Edison Co., at a cost of about £700.

Wimbledon.—YEAR'S WORKING.—During the past year the output of the Council's electrical undertaking reached 3,786,000 units. The maximum load was 2,197 KW. and the connected load nearly 9,000-KW. The total revenue was £37,417, and after meeting working and financial charges, the net surplus was £3,471. This was transferred to a suspense account, which now amounts to £10,262. The reserve fund also has £14,296 to its credit, and the undertaking appears to be generally flourishing.

Wolverhampton.—YEAR'S WORKING.—The result of the working of the electricity undertaking for the year 1913-14 was a net profit of £8,677—the highest yet made. This was allocated, £6,552 to reserve, and £2,125 to the rates; the reserve fund stands at £19,161. The units sold were over 13 millions, an increase of 720,000. The motors connected represent 8,764 H.P. The destructor works supplied 1,472,530 units, for which £1,227 was paid. The Committee points out that it will be necessary to draw on the reserve fund shortly for capital purposes.

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TRAMWAY and RAILWAY NOTES.

Bradford. — RAILLESS TRACTION. — Certain of the authorised railless trolley vehicle routes are now approaching completion, and the Tramways Committee has decided to recommend that application be made in each case for early inspection by the B. of T.; that each route be opened as soon as the formal sanction has been received and that the fares on each route be 1d. for the through journey, and ½d. between the centre of the route and either terminus.

Chile.—The Commission appointed to report on the proposed railway from Santiago to Valparaiso *via* Casa Blanca, has advised the construction of an electric railway of the same gauge as the State line now connecting the capital with Valparaiso. The Commission further proposes the construction of branch lines to Melipilla and Talagante, thus linking the line with the Central and Southern State systems. It is suggested that the former proposals for the electrification of the present steam railway system should be abandoned for the time, and the £2,300,000 intended for this undertaking could then be utilised in the construction of the proposed new line.

Continental Notes.—GERMANY.—The concession for the Schöneiche to Kalkberg electric tramway, Berlin, has been sanctioned, the period up to 1940 being covered. The line must be completed within two years under a penalty of £250.

HOLLAND.—A strike has occurred on the Hague tramways, and strike breakers have been imported from Berlin, a partial service being maintained.

Croydon.—ANNUAL REPORT.—In his annual report, Mr. T. B. Goodyer, general manager of the Corporation tramways department, states that the total receipts for the year ended March 31st last were £87,026, and the working expenses £69,744. The net balance was £1,362, from which £1,132 was taken to cover the alterations at the chief depôt, and £230 was carried to the renewals fund, as compared with £7,586 for 1912-13. Compared with the previous year the traffic receipts decreased by £5,617, the car-mileage increased by 150,371, and the passengers carried decreased by 1,276,265. Working expenses went up by £3,525. The decreased net balance—from £10,586 to £1,361—was very largely attributed to motor-'bus competition, coupled with unfavourable weather, and by reason of the extra mileage run to meet competition. The total receipts per car-mile decreased by ·92d. The passengers carried totalled 19,227,878.

Dartford.—Messrs. Balfour, Beatty & Co., Ltd., have applied to the B. of T. for an extension of time until August 18th, 1916, for the completion of the tramways authorised by the Dartford and District Order of 1911.

Denton (Lancs.).—A meeting of the various local authorities interested was recently held to consider the steps to be taken for acquiring the undertaking of the Oldham, Ashton, and Hyde Tramways Co., which traverses the district. Two miles of route are situated in Ashton, and a special meeting of the Ashton T.C. is to consider the future of this section.

East Ham.—The West Ham Union has decided not to object to the assessment of the tramways being reduced; the proposed reduction on rateable value is £1,950, to £4,700. This figure, however, the Finance Committee considers should be still further reduced.

Horbury.—'BUS SCHEMES. — The Yorkshire (Heavy Woollen District) Electric Tramways Co. contemplates the establishment of a service of motor-'buses between Dewsbury and Wakefield, through Horbury, and has applied for sanction. The National Electric Construction Co., which already runs motor-'buses in other parts of this neighbourhood, attempted to establish such a service between Ossett and Wakefield, but it did not meet with success.

Huddersfield.—The financial statement of the tramways for the three months ended June 30th last shows a net surplus of £7,197, or 2·59d. per car-mile, compared with £4,309, and 1·70d. last year. The tramway manager is to report on the following suggested tramway extensions:—From Outlane to Stainland; from Ashbrow Road to Bailiff Bridge; and from Huddersfield to Brighouse *viâ* Rastrick.

Mexborough.—The Mexborough and Swinton Tramways Co. has purchased a site at Mexboro' Toll Bar, for a car-shed to accommodate the railless trolley cars for the new service.

Radcliffe.—The D.C. has declined to revise the price charged for electricity in connection with the Bury tram service.

Stalybridge.—YEAR'S WORKING.—The returns of the Joint Board's tramway undertaking show a deficit on the year's working of £5,870, which, however, was less than in 1912-13, when the loss was £9,124. Nearly 10 million passengers were carried, the revenue amounting to 8·4d. per car-mile, as against 7·8d. in the previous year.

South Africa.—The East London (Cape Province) Municipality proposes to borrow a sum of over £12,000, of which amount £7,814 is to be utilised for the extension of the tramway system, covering duplication of the existing track and rearrangement of the overhead equipment, and £775 for electric supply extensions.

Southampton. — After considering a report by the tramway manager, the Committee recommends the purchase of three 'buses, at a cost of about £2,600. Repair work to 21 tramway cars in the near future will cost about £3,500, to be spread over three years. The borough electrical engineer is to obtain two motor vehicle chassis and to fit one up for battery traction.

Stretford. — After lengthy negotiations, the Trafford Park Estates, Ltd., has now liquidated the outstanding district rates in respect of the tramways and light railways situated in the Stretford portion of Trafford Park, on the basis laid down in the Tottenham case, which included payment in full in respect of non-statutory railways.

West Ham.—YEAR'S WORKING.—The working of the tramways last year resulted in a deficit of £14,421; it is proposed to meet this by levying a 2d. rate and by contributions from reserve.

West Hartlepool.—An order has been made by the Light Railway Commissioners, modified and confirmed by the B. of T., authorising the Corporation to borrow money for the light railway authorised by the West Hartlepool Light Railways Order, 1897, and by the West Hartlepool Light Railways Deviation Order, 1901, and for other purposes.

TELEGRAPH and TELEPHONE NOTES.

Automatic Telephones.—Replying to a question in Parliament as to the result of the experimental employment of the automatic telephone system at Epsom, the Postmaster-General stated that it had proved "fairly successful." This is a remarkable statement, especially as Mr. Hobhouse went on to say that it was clear that the automatic system was applicable to large areas, and arrangements had been made (as stated in this column some months ago) to install automatic exchanges in nine provincial towns, including Leeds. We are under the impression that the exchange at Epsom, so faintly praised by the P.M.G., has in fact been found entirely satisfactory in all respects, and this is confirmed by the decision to go ahead with the other automatic exchanges—for who, in his senses, would install costly apparatus that was only "fairly successful," for public service in large towns like Leeds and Portsmouth?

Fire Alarms.—As the result of a visit to America by two officials, the Fire Brigade Committee of the L.C.C. is considering the installation of a new system of fire alarms in London, subject to the completion of certain experimental work.

Greece.—A wireless telegraph station has recently been completed at Syra, in the Cyclades group of islands, by the Greek Government, and is now open to the public, principally for messages to Samos.

International Commission for Radio-telegraphic Research.—The Commission held a sitting on April 6th, 1914, at Brussels, under the presidency of Mr. Duddell (London), at which the Commission was definitely constituted; the results already obtained were discussed, and arrangements were made with regard to future experiments. National Committees have been constituted in Belgium, France and Great Britain. In Germany, many stations have agreed to receive the signals, and a more complete organisation will be formed very soon. National Committees are also in course of formation in Austria, Russia, Italy, Switzerland, &c. At the last meeting the Statutes of the International Commission were drafted in a definite form and adopted.

It was decided to co-operate as far as possible with the Committee for Radiotelegraphic Investigation of the British Association for the Advancement of Science.

A demonstration of the methods of emission and measurement in use at the high-power station at Laeken-Brussels took place before the Commission, and reports were read by Messrs. R. Goldschmidt and R. Braillard, on the changes that had been made and on future alterations. Mr. Lutze read a report on the measurements he had taken at the transmitting station as well as those made at the control station, and several of the delegates reported the results of the reception of the signals which were sent according to the programme agreed upon at the preliminary meeting in October, 1913.

The reports led to a general discussion on the strength of the signals received at the various receiving stations, and the Commission expressed the wish that the experimenters should send in with the results of their experiments the characteristics of their antennæ, and that whenever possible they should employ photographic registration.

A paper was read by Mr. Duddell with regard to the methods and instruments to be employed at the different stations. One of the propositions was to employ a closed circuit to receive the signals at the control station, similar to that used by Mr. Braun (Strassburg). Communications were also read by other members.

A general programme of future work was proposed by Mr. R. Goldschmidt, and was adopted after discussion with slight modification.

Dr. Eccles read a report on the steps that had already been taken in connection with the B.A. Committee, in view of the solar eclipse of August 21st. It was decided to nominate a special committee

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to consider the matter, consisting of Messrs. Benndorf, Eccles, Ferrié and Wien.

The statutes in their amended form were ratified, and the financial statement of the Commission was discussed and approved.

The officers of the Commission, provisionally elected at the first meeting, were confirmed as follows:—Mr. Duddell, President; Mr. Wien, Vice-President; Mr. Goldschmidt, General Secretary; Mr. R. Braillard, Assistant Secretary.

Italy.—A wireless station has been set up at Tarento, chiefly for the use of the Italian fleet. The range of the station is 2,000 km., so that the whole of the northern coast of Africa, the western coast of Europe as far as the Canary Islands, the northern and southern coasts of England, and eastward as far as Russian Poland are embraced.

Manchester.—Good progress is being made with the improvement of telephone facilities in the Manchester district. During the six months ending April 30th, 39 miles of underground ducts and 26 miles of cable have been laid for local service, and the number of telephones in use has increased from 34,904 to 36,087.

Norway.—The report for 1913 of the Spitzbergen Wireless Telegraph Station has been published, and shows that the number of inland telegrams forwarded to Norway amounted to 489; to other countries were sent 353 messages, in addition to 267 messages for which no fees were paid. The number of paid telegrams received was 261 from Norway and 130 from abroad, besides 309 unpaid messages. The total number, with 37 service messages and 365 meteorological reports, was 2,208 in all. The Spitzbergen station is the most northern in the world, and although the number of messages is not very imposing, it is, nevertheless, a very important station, especially on account of its meteorological reports, which are exceedingly valuable to science from that high latitude.

Telephone Poles.—The P.M.G. has issued an appeal to British timber growers to meet the heavy demand of the Post Office for poles in connection with the development of the telephone system. He recently had to place contracts for over 100,000 poles, in addition to the normal supply, for which 65,000 poles a year are required. He desires to use British timber, but hitherto hardly any suitable poles have been obtainable from home sources. Scotch pine and larch are the most suitable trees, and are easily grown here. Full particulars of the Department's requirements can be obtained from the Controller of the Post Office Stores Department, 17-19, Bedford Street, Strand, W.C.

The Imperial Wireless Chain.—The Indian station will be situated at Kirkee, near Poona, 120 miles inland from Bombay. The *Daily Telegraph* reports that two Marconi engineers have arrived on the spot, and that the work of construction will take two years.

The Telephone Service.—Referring to the Postmaster-General's statement in Parliament last week that inquiries had been made of 135,000 telephone subscribers in London, and 128,000 replied, 87 per cent. of whom reported that the service was perfectly satisfactory, Mr. C. S. Goldman, chairman of the Parliamentary Telephone Committee, has written to the Press pointing out that the inquiries were purely verbal, and were limited to the question: "Is your line working all right"? He himself had answered the question in the affirmative, not knowing that it represented a formal inquiry as to the efficiency of the service as a whole. On the other hand, his Committee had circulated forms containing 24 questions to 2,500 of the largest telephone users in London, and of the 1,000 replies already received, not ten expressed satisfaction with the service. The whole profit on the telephone system, he says, is now less than the royalty paid by the National Telephone Co. to the State before declaring their dividend of 6 per cent.

The Finance and General Purposes Committee of the Bradford Corporation last week decided to summon a conference of Corporation representatives on Telephone Advisory Committees in Leeds, Halifax, Sheffield, Huddersfield and Bradford, to consider a scheme under which those municipalities should take over complete control of the telephone services in their areas.

The Telephote.—A recent communication to the French Academy of Sciences by Mr. Georges Rignoux describes apparatus which he has developed for transmitting pictures with two wires only. The device employs selenium cells, and the inventor has so far succeeded in reproducing letters of the alphabet.

Wireless on Board Ship.—On Tuesday a Committee of the House of Commons commenced the consideration of the Merchant Shipping (Convention) Bill, which gives effect to the recommendations of the International Conference for the Safety of Life at Sea.

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—August 4th. U.D.C. One natural-draught chimney-type cooling tower. See "Official Notices" July 10th.

Ashton-under-Lyne.—Corporation. July 29th. Arc lamp globes, lamp carbons, D.C. motors and D.C. motor starters. See "Official Notices" July 10th.

Australia.—SYDNEY.—August 31st. Sydney Harbour Trust. Four electrically-operated semi-portable travelling cranes. Forms of tender from Mr. H. F. Norrie, Secretary to the Trust, Sydney.

PERTH.—August 19th. Electric lamps and fittings, for P.M.G. See "Official Notices" to-day.

August 19th. Telephone switchboards, galvanised iron and steel stranded wire, for Postmaster-General. See "Official Notices" to-day.

September 2nd. Telephone instruments and parts, glassware, battery material, chemicals for batteries, wire—cotton, silk or wool covered—telegraph and telephone insulators, for Postmaster-General. See "Official Notices" to-day.

MELBOURNE.—October 7th. Victorian Railway Commissioners. Four motor-driven air compressors and electrical equipment (motors, &c.) for the new workshops at Ballarat and Bendigo. Specification may be seen at the Board of Trade Commercial Intelligence Department in London.

July 29th. (Contract No. 49) Wheels and axles; (50) maximum traction trucks; (51) single-type trucks; (55) motor equipments and magnetic brakes for maximum traction trucks; (56) motor equipments and magnetic brakes for single-type trucks. For the Prahran and Malvern Tramways Trust. Specifications (£2 2s.) from the Secretary, 59, William Street.

RICHMOND.—Nov. 30th. Refuse destructor and auxiliary plant. Specification, &c., from Mr. C. C. Blazey, Town Clerk, Richmond, Victoria.

BRISBANE.—September 2nd. Switchboards, parts and accessories, for the P.M.G. See "Official Notices" to-day.

ADELAIDE.—September 2nd. Telephone material, bells, &c., condensers, diaphragms, generators, for the Postmaster-General. See "Official Notices" to-day.

Blackburn.—August 1st. Twelve months' supply of steam coal for the Electricity Department. Mr. P. P. Wheelwright, Engineer and Manager.

Bolton.—July 19th. Corporation. Converting plant, sub-station E.H.T. and H.T. switchgear. See "Official Notices" June 12th.

Bradford.—The Corporation Technical Education Sub-Committee is inviting tenders for motors to drive the workshop and mechanics' and testing laboratories; also for a surface condenser suitable for the heat engine laboratory, and for apparatus required for heat treatment of steel.

Chichester.—July 18th. Refrigerating and electrical plant and wiring, for Chichester and District Co-operative Bacon Factory. Messrs. Horace Boot & Partners, 7, Victoria Street, S.W., consulting engineers.

Dartford (Kent).—July 20th. Telephones, extension bells, &c., at Joyce Green Hospital, for Metropolitan Asylums Board. See "Official Notices" July 10th.

Dewsbury.—July 18th. Steam coal for the electricity works, Bradford Road. Mr. R. H. Campion, Borough Electrical Engineer.

Eastbourne.—August 18th. Corporation. Main machine and feeder switchboard for the electricity works. See "Official Notices" to-day.

Edinburgh.—July 20th. Corporation Electricity Supply Department. Extension of steam and exhaust pipe work at McDonald Road station. Town Clerk, City Chambers.

Greenock.—July 23rd. School Board. Electrical installation at the Greenock Academy. Specification from Mr. A. F. Neven, Clerk, Municipal Buildings, Wallace Square.

July 27th. 20,000 tons of steam coal (washed singles and pearls) for the Corporation electricity works. Mr. J. H. Parker, Engineer.

Grimsby.—July 23rd. Corporation. 790 ampere-hour battery, reversible booster and switchgear. See "Official Notices" to-day.

Kingston-upon-Hull.—August 22nd. Corporation. Electrical fittings for the Guildhall Council Chamber, &c. See "Official Notices" to-day.

London.—L.C.C. July 30th. 10,000 or 5,000 driving and pony wheel tramcar tires, 300 axle forgings for tramcars. Chief Officer, Tramways Department, 62, Finsbury Pavement, E.C.

Manchester.—July 21st. Corporation. Two steam boilers, for the Tramways Department. Specifications from Mr. J. McElroy, General Manager, 55, Piccadilly.

July 24th. Corporation sub-station. 6,600-volt switchgear (one year's requirements); fuse boxes (two years' requirements). See "Official Notices" July 10th.

New Zealand.—NEW PLYMOUTH.—August 28th. 6,600-volt sub-station switchboard, additions to 2,300-volt sub-station switchboard, for the New Plymouth B.C. Specifications may be seen at the Commercial Intelligence Branch of the Board of Trade, London, E.C.

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Salford.—Flame arc lamps and lowering gear, for electricity works. See "Official Notices" to-day.

Southampton.—August 6th. Installation of lighting plant, cables, &c., at the Farm Institute, Sparsholt. See "Official Notices" to-day.

Stockton-on-Tees.—July 24th. Corporation. Coal for use with mechanical stokers, for the Electricity Department. Forms of tender from Mr. J. J. Smith, Borough Electrical Engineer.

Tavistock.—Public lighting for one, three or five years, for the U.D.C. Mr. E. Warran, Clerk.

Torquay.—July 20th. Corporation. 5,000 tons of coal for use with mechanical stokers, for the Electric Lighting Committee. Specification from Mr. F. S. Hex, Town Clerk.

Turton.—July 23rd. U.D.C. Overhead lines and underground cables. See "Official Notices" July 10th.

Walsall.—August 11th. Corporation. Coal conveyor and measuring apparatus, jib coaling crane, ash-handling plant, travelling crane. See "Official Notices" to-day.

Warrington.—July 21st. Extra-high-tension switchboard feeder panel and low-tension switchboard feeder panel, for Borough Electricity Dept. See "Official Notices" July 10th.

West Ham.—July 20th. Lighting installation at Rosetta Road School, for Education Committee. See "Official Notices" June 26th.

Worthing.—July 20th. Corporation. Twelve months' supply of Welsh and other steam coal for the electricity works, &c. Particulars from Mr. J. K. Allerton, Town Clerk.

York.—July 20th. Twelve months' supply of coal to the electricity generating station, Foss Islands Road. Mr. J. W. Hame, Engineer and Manager

CLOSED.

Ashton-under-Lyne.—The tenders of the New Moss Colliery Co., Ltd., and Mr. H. Johnson, for six months' supplies of coal for the Electricity Committee have been accepted.

Atherton.—The U.D.C. has accepted the following tenders:—

Callender's Cable & Construction Co., Ltd.—2,300 yards of cable, with conduits.
General Electric Co., Ltd.—Switchgear.
G. Hanchett Barratt & Co., Ltd.—Transformers.

Australia.—The following contracts have been placed:—

P.M.G.'s Department, Victoria:—
Portable engine and dynamo, £330.—Russell & Co.
16 cable jointer's trucks, £88, 20 linemen's trucks, £240.—Coffey Bros.
P.M.G.'s Department, South Australia:—
6,000 insulators, porcelain, pattern "A," 6½d. each.—Warburton, Franki (Melbourne), Ltd.
4,350 protectors for use at subscribers' telephone stations, 3s. 4d. each.—British General Electric Co., Ltd.
P.M.G.'s Department, Tasmania:—
18,000 insulators, porcelain, pattern "A," 6½d. each.—Warburton, Franki (Melbourne), Ltd.
3,000 insulators, porcelain, pattern "A," brown, 7½d. each.—Warburton, Franki (Melbourne), Ltd.
Royal Naval College, Jervis Bay:—
Material and plant for the installation of electrically-driven pumping set, £475 12s. 6d.—Haes & Eggers, Ltd.
Electric wiring of buildings, £1,488.—Handley & Lewis.
Victorian Railway Department:—
Sulphate of copper (best quality) for battery maintenance, at £24 8s. per ton.—S. Cohen, Sons & Co. Ppty., Ltd.
One 15-ton electric crane for Ballarat, £2,005.—Babcock & Wilcox, Ltd.
Sydney Municipal Council:—
Bare copper cable, £2,190.—Standard Cable Manufacturing Co.
Insulated cable, £212.—B.I. & H. Cables.
Underground feeders (11,000-volt cable), £10,119.—Western Electric Co.

—*Australian Mining Standard.*

Bradford.—The Corporation Electricity Committee has accepted the tender of Messrs. Ferranti, Ltd., for two 250-K.V.A. transformers, at £131 each, and four 150-K.V.A. transformers, at £102 each.

Bristol.—The Bristol Tramways and Carriage Co., Ltd., has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for carbon-filament lamps.

Gravesend.—The tender of the Western Electric Co. has been accepted, at £1,044, for the supply and laying of H.T. cables.

Horsham.—The U.D.C. has accepted the tender of Messrs. Bradbury, Son & Co., for 700 tons of coal for the electricity works, with the option of small Glyncorrwg, at £1 0s. 2d. per ton, and small Newbury, at 16s.

London.—L.C.C.—The Fire Brigade Committee recommends "That owing to the failure of the 'Cedes' Electric Traction Co., Ltd., to complete and deliver, under the terms of the contract, by June 14th, the petrol-electric chassis for an escape van, the contract with the company be determined, and that the offer of Leyland Motors, Ltd., for the supply of a motor escape van, similar to 11 now on order, for £641, be accepted."

The Highways Committee reports having accepted the tender of Messrs. Steel Peech & Tozer, Ltd., for the supply of 250 steel axle forgings, and 50 steel axle forgings, at 48s. and 36s. 3d. each forging respectively, also the tender of Messrs. S. Bowley & Sons, for the supply of finishing insulating varnish for the Council's tramways.

METROPOLITAN ASYLUMS BOARD.—For the purchase of abandoned electrical plant at the Brook and Park Hospitals the following tenders were received:—

J. Levy & Sons	(accepted)	£675
A. Learoyd		503
J. T. Learoyd & Sons		442
J. Hyams		421
A. Brown & Sons		389

(The Engineer-in-Chief's estimate was £1,000.)

EALING.—The T.C. has placed contracts for supplies for the year with the following:—

Pipes, bends, &c.—Sankey & Co. and Wiggins & Co, alternate months.
Cylinder oil, crank-chamber oil, and bearing oil.—Stern Sonneborne Oil Co.
Paraffin oil.—Bruce Wallace & Co.
Coal.—E. Foster & Co.

HACKNEY.—The Electricity Committee reports that, in consequence of the strike in the building trade, the erection of the electricity sub-stations has been considerably delayed, and in order to expedite the work and enable the sub-stations to be finished in time for the next winter's load, the contractors desire to sub-let a portion of the work. The Committee recommends the Council to agree to the request.

SOUTHWARK.—The tender of the General Electric Co., Ltd., is recommended for acceptance to supply 14 Angold magazine flame lamps during the ensuing 12 months.

Skelton and Brotton (Yorks.).—The U.D.C. has accepted the tender of Messrs. Graham Bros., of Middlesbrough, for the complete works included in the specification of Messrs. May & Hawes, the Consulting Electrical Engineers to the Council, for overhead lines, underground cables, transformers, switchgear, and public lighting fittings, amounting to £6,170.

Southampton.—The tenders accepted by the Electricity Committee for supplies of coal are as follows:—

Bradbury, Son & Co., Ltd.—3,500 tons Tamworth beans, 15s. 10d. per ton.
Southampton Steamship Coal and Patent Fuel Co.—500 tons Denaby washed peas, 16s. per ton.
Cory Bros. & Co., Ltd.—3,500 tons Scotch washed pearls, 15s. 7½d. per ton.
Rea Transport Co., Ltd.—1,000 tons Scotch single nuts, 14s. 10d. per ton.
Albert Usher & Co.—7,000 tons Tamworth beans, Measham beans, and Newdigate peas (seller's option), 15s. 6d. per ton.

The following tenders have been received by the Town Council for 200 tons of tramway rails:—

Lorain Steel Co., £7 per ton.
Walter Scott, Ltd., £7 per ton.
North-Eastern Steel Co., £6 18s. per ton (accepted).
Frank Mott, £6 14s. 8d. per ton (three months' delivery).
Dick, Kerr & Co., £6 12s. per ton (German rail).
Barrow Hematite Steel Co., £6 10s. per ton (informal).

Swansea.—The T.C. has accepted the tender of the Main Colliery Co. for a year's supply of coal to the electricity station.

Winchester.—The T.C. has accepted the tenders of Mr. R. G. Gifford and Messrs. Bradbury, Son & Co., for the supply of coal to the Electricity Works, the former about 1,250 tons of Writhlington coal, and the latter about 750 tons of Camerton coal. The prices were appreciably lower than the previous contracts.

Wolverhampton.—The Corporation Electricity Committee has accepted the following tenders:—

G. & J. Weir, Ltd.—Turbine-driven pump, £235.
J. Spencer, Ltd.—Steam and feed-water piping, £234.
Dorman & Smith.—Alterations to generating-station switchboard, £68.

The offer of Messrs. Mossay & Co., Ltd., is recommended for acceptance for the supply of a Lloyd electric 2½-ton chassis on hire for three months, at £42.

Worksop.—The U.D.C. has accepted the tender of Messrs. Glover & Co. for cable, at £82.

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FORTHCOMING EVENTS.

Tramways and Light Railways Congress.—Friday, July 17th. At Newcastle-on-Tyne. Second and concluding day of proceedings. For papers to be read see page 1095 of our issue of June 26th.

Junior Institution of Engineers.—Saturday, July 18th. At 2.30 p.m. At Purfleet. Visit Tunnel, Portland Cement Works.

Monday, July 20th. At 7.45 p.m. At 26, Corporation Street, Manchester. Meeting of North-Western Section. Paper on "Gassing," by Mr. E. Eaves.

Nottingham Society of Engineers.—Saturday, July 18th. Ladies' day: Visit Sherwood Forest.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION.)

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued :—

Headquarters will be opened daily for the transaction of regimental business from 10 a.m. till 4 p.m., except Saturdays, on which days the opening will be from 10 a.m. till 12 noon. Headquarters will be closed for all purposes on August 3rd and 4th, 1914.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

NOTES.

Electrical Contractors Combining.—At a meeting of the Blackburn Chamber of Trade, on Monday last, a letter was read in which it was stated that the electrical contractors of the town proposed forming a protective association, and an inquiry was made as to whether the Chamber were prepared to accept them as a separate section. A resolution was carried accepting the new association and expressing the hope that it would be very successful.

The Goods Clearing-House System.—Mr. A. W. Gattie has received a letter from Mr. H. C. Long, of Boston, who has been sent as a Commissioner on Transportation to this country, in search of means to solve the terminal problem in Boston, where the question has become acute. Mr. Long is satisfied that Mr. Gattie's system can be used, although with less advantage than in London, and regards the adoption of some such central sorting station as inevitable, because it is an absolute economic necessity.

Tyneside Scientists Honoured.—Sir Charles A. Parsons, K.C.B., F.R.S., the inventor of the steam turbine, was honoured at Newcastle-on-Tyne on the 10th inst., when the honorary freedom of the city was conferred on him in recognition of his distinguished services in the cause of science, particularly in the invention and development of steam turbine engines. There was a distinguished company at the ceremony, over which the Lord Mayor (Mr. Johnston Wallace) presided. The scroll was contained in a silver-gilt casket.

In making the presentation, the Lord Mayor said that in Sir Charles Parsons they had an example of hereditary genius, encouraged and developed by wisely-planned vocational teaching. In 1884 he patented the steam turbine. The first one was about 10 H.P., and ran at the astounding rate of 18,000 R.P.M. At that time there was a need for a high-speed engine for driving electrical machinery. The invention of the turbine necessitated also the invention of a high-speed dynamo to be driven by it. In those early days—30 years ago—little was known of the theory of the dynamo; in fact, it was not until two years afterwards that the late Prof. John Hopkinson put the theory on a firm footing, and the invention at that date of a high-speed dynamo running at 18,000 R.P.M. was a great achievement. It was safe to say that without Sir Charles Parsons's invention they would not have had the great development of electrical power, and at the present time there was not a single reciprocating steam engine of large size being put into any power station in the world. The Lord Mayor also referred to marine turbines, and to the marvellous manner in which they had superseded reciprocating engines.

Sir Charles Parsons, in reply, expressed his appreciation of the honour conferred upon him. He said that when he commenced to work on the steam turbine with a hope of making it a practical success it seemed to him that, in spite of the fact that many had failed in their endeavours, yet it was right in principle, and that after a thorough experimental investigation it should be possible to realise success. In short, he thought it was worth trying; encouraging results followed, one improvement led to another, and it gradually became an efficient motor. When it had beaten the compound engine at driving a dynamo, his old friend, Dr. J. B. Simpson, said why not try it at driving a ship, and he replied that he thought that the time was ripe for an attempt. That was the beginning of the marine turbine and of a strenuous time. Sir Charles closed with an appreciative reference to many valued friends who had helped him in his efforts.

It had been the intention of the Newcastle-on-Tyne Council to confer a like honour on Sir Joseph W. Swan, the inventor of the incandescent electric lamp, but although the resolution of the Council had created him an honorary freeman, he was not spared to receive the tangible indication of the honour; the scroll containing the resolution of the Council was presented on the 10th inst. to Mr. Kenneth Swan, together with a service of silver plate.

The Lord Mayor, in handing the resolution to Mr. Swan, specially referred to Sir Joseph's work in electricity and photography.

Mr. Kenneth Swan, acknowledging the gifts, said it was there in Newcastle that his father dreamed his dreams of science, and foretold the end of the age of darkness and the coming of the era of light. His dreams had become realities, and his prophecies had been fulfilled.

Institution and Lecture Notes.—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—At the annual Convention of the Institute at Detroit last month, the President, Mr. C. O. Mailloux, said that engineers had not paid enough attention to their relations with the outside world. As a professional class they were entitled to a higher place than had been accorded them by the public. Tasks of social re-arrangement were ahead of the body politic, and they provided a field of work where the technical training of the engineer should be almost indispensable. The lawyer, the politician, the agitator and the Utopian dreamer pressed forward, while the engineers held back. The members of the Institute should show that engineers were well qualified to discuss and deal with public questions; they must take a social plane parallel to those occupied by the older professional classes.

Mr. D. M. Mahood stated that the great new vessels, like the *Vaterland*, *Imperator*, *Aquitania*, *Oceanic* and others, had electric heating for the first and second cabins.

Mr. H. C. Ford said that the gyro-compass was now being installed on all the battleships and submarines of the United States Navy where the magnetic compass could not possibly be used. On submarines, where the gyro-compass was exceedingly important a three-phase, 90-volt generator of special design was required to drive the heavy balance wheel at a speed of about 8,600 R.P.M So exact was the gyro-compass that the maximum error must not exceed 0·5° in azimuth when swung for six days under conditions of rolling, pitching and yawing of an artificial ship. The stabilising gyro would require one-tenth the space and weight of the equivalent best designed water pendulum.

In the Industrial Motor Session, Mr. R. R. Tschentscher spoke of the extensive use of electricity in the iron and steel industry. Statistics from 170 plants showed an aggregate of 400,000 KW. in generator rating and 1,400,000 H.P. in motors now in operation in these steel mill plants. The electrical plants of steel mills were usually very large, and averaged outputs of 10,000,000 KW.-hours yearly.—*Electrical World.*

INSTITUTE OF MARINE ENGINEERS.—On July 4th the members of the Institute visited the foundries of the Manganese Bronze and Brass Co., Ltd., Millwall, where bronze propellers for the largest ships in the world are cast, to say nothing of the many other branches of the company's business.

Educational Notes.—UNIVERSITY COLLEGE, LONDON.—In the faculty of engineering the following awards have been made :—Chadwick Medal and Prize, J. A. Parker; Andrews Scholarship (second year), J. Mould; Goldsmid Scholarship (second year), H. P. Gardham; (third year), P. L. Capper; Archibald P. Head Medal and Prize, Z. S. Quai. Diplomas in Electrical Engineering :—A. Arias, G. G. Lawson and D. G. Trouton.

NORTHAMPTON POLYTECHNIC INSTITUTE. — The Aitchison Memorial Scholarship, established by the friends and colleagues of the late Mr. James Aitchison, in consideration of the valuable services rendered by him to the optical industry, is tenable in the full-time day courses in technical optics at the Institute, and is of the total value of £30. The first will be awarded in September, 1914. Inquiries should be addressed to the Hon. Secretary, Mr. Henry F. Purser, 35, Charles Street, Hatton Garden, London, E.C.

IMPERIAL COLLEGE OF SCIENCE.—The Governors have appointed Dr. A. N. Whitehead, F.R.S., to the new chair of Applied Mathematics.

Appointments Vacant. — Assistant lecturer in the department of Electrical Engineering at Birmingham Municipal Technical School (£150); lecturer in electrical engineering (£180), for East London College; test room assistant and meter mechanic for Newport Electricity and Tramways Department; assistant mains superintendent (£150), for Derby B.C. Particulars are given in our advertisement pages.

Fatalities.—On Monday last Samuel Dorsett, 28, Wolverhampton, was killed at the works of Messrs. Jordan & Sons, Bilston, where he was employed as an electrician. He was removing a belt from a pulley connected with a dynamo to another pulley, when one hand became locked. His mate, John Butler, released him, and both received severe electric shocks. Butler recovered.

A Birmingham paper states that at Immingham Dock on Monday a labourer, John Joyce, was engaged painting a ship's bottom in the dry dock, when he came in contact with a live wire and was instantly killed. The inquest was held on Tuesday. In picking up a flexible cable Joyce broke it, according to the evidence. The jury found that he died from electric shock, but declared that there was not sufficient evidence to show how it was caused.

Inquiries. — A correspondent asks for the name and address of the maker of the "Hubble adjustable gallery for shades"; another wants the addresses of suppliers of tramway tokens in celluloid or aluminium.

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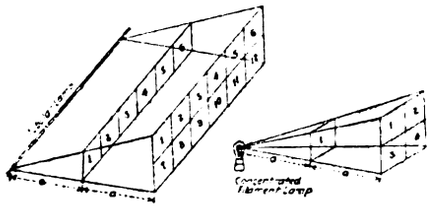
Parliamentary.—ROYAL ASSENT.—The following Acts have received the Royal Assent :—

Electric Lighting Orders Confirmation (No. 1) Act, 1914.
" " " " (No. 3) "
" " Order Confirmation (No. 8 Kingstown) Act, 1914.
Tramways Order Confirmation Act, 1914.
Western Valleys (Monmouthshire) Railless Electric Traction (Extension) Order Confirmation Act, 1914.
Glasgow Subway Railway Order Confirmation Act, 1914.
Colinton Tramways Extension Order Confirmation Act, 1914.
Stone Gas and Electricity Act, 1914.
London Electric Railway Act, 1914.
Central London Railway Act, 1914.

THIRD READING.—In the House of Commons on July 9th the North Metropolitan Electric Power Supply Bill was read a third time.

Tubular Light Sources.—While the familiar law of inverse squares holds for the intensity of illumination surrounding a point light source, it must be remembered that different conditions exist when the light source has considerable area or length.



GRAPHICAL REPRESENTATION OF LIGHT FLUX FROM POINT AND LINE SOURCES OF LIGHT.

The light flux from a tubular or straight-filament lamp to the surface illuminated thereby may be considered as forming a solid wedge, therefore the intensity is inversely proportional to the distance from the line source of light. The accompanying drawings illustrate diagrammatically how the intensity varies with point and line sources of light.—*Electrical World.*

Woking Technical Institute.—On Wednesday evening, the Rt. Hon. Lord Moulton, P.C., F.R.S., opened the County Secondary School for Boys and Technical Institute at Woking. The proceedings were presided over by Mr. Patrick White, chairman of the Education Committee, who made most appropriate and otherwise excellent introductory remarks in which, among other topics, he reviewed Lord Moulton's career. A full statement by Mr. T. Ivor Moore, the chairman of the Higher Education Committee, on the objects of the Institute, followed. Lord Moulton then addressed the gathering, delivering a first-rate dissertation on education generally and technical education in particular, in which he compared the advantages available to the youth of the present day with the lack of them which characterised his own (Lord Moulton's) early days. After votes of thanks and the national anthem an inspection of the building took place. The Woking Musical Society, under the conductorship of Mr. Patrick White and Mr. W. D. Boseley, Mus. Bac., rendered a full programme of music in fine style. The ELECTRICAL REVIEW desires to thank the following gentlemen and electrical firms who, in response to its invitation, so generously contributed some of the electrical machinery and apparatus which form part of the equipment of the Institute :—

A well-known firm of electrical instrument makers (anonymously).
Mr. H. Bevis (Messrs. Pirelli, Ltd., London).
Mr. Justus Eck (Union Electric Co.).
Messrs. Evershed & Vignoles, Ltd., London.
Mr. M. H. Gray (the India-Rubber and Gutta-Percha Co., Silvertown).
Mr. Hugo Hirst (chairman of the General Electric Co., Ltd., London).
Mr. Robert W. Paul, London.
Messrs. Scholey & Co., London.
Mr. Hugo Stephens (the Premier Accumulator Co., Northampton).

Municipal Conference.—An International Municipal Conference is to be held at the Anglo-American Exposition, Shepherd's Bush, next week (July 20th to 25th).

The Tramways Congress.—Yesterday morning the Congress of the Tramways and Light Railways Association was opened at Newcastle. The proceedings will be concluded to-day, and will be reported in our next issue.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Torquay Council has resolved to increase the salary of MR. SALT, the borough electrical engineer and manager, from £350 to £400 now, and to £450 from midsummer, 1915, on condition that he gives an undertaking to remain with the Corporation until the works, now contemplated, are completed.

The proposal to advance the salary of MR. TEAGUE, the city electrical engineer, as mentioned in our last issue, was the subject of a long discussion at the Bath Council meeting, and it was eventually carried by 25 votes to 22. One of the arguments against the increase was that the Diesel engine was obtained largely on Mr. Teague's recommendation.

At Bolton Town Council on July 8th, Councillor Knowles moved an amendment to a resolution of the Electricity Committee that the salary of MR. H. E. ANNETT (generating station engineer), on appointment as resident engineer at Back-o'-th'-Bank generating station, be £200 per annum instead of £250, as resolved by the Committee. This was seconded by Councillor Kearns, but lost on a vote being taken.

Mr. F. K. Smith, canvassing engineer in the installation and motor department of the Sheffield electricity works, has resigned his appointment, and in order to fill the vacancy, the general manager (Mr. S. E. Fedden) has suggested a rearrangement (which has been accepted by the Committee), whereby MR. A. W. BUSH, at present canvasser in the publicity department, will be appointed as canvassing engineer at his present salary of £110 per annum ; and MR. A. E. FLETCHER will be appointed to the position vacated by Mr. Bush at a salary of £100 per annum.

In revising salaries the Rotherham T.C. has arrived at the following decisions :—MR. E. CROSS, tramways manager and electrical engineer, present salary of £500 to rise to a maximum of £600 by £50 on January 1st, 1915, and £50 on January 1st, 1917 ; MR. J. WILLIAMS, assistant electrical engineer, £200 maximum reached, with house and light.

On Saturday last the Mayor of Walsall, on behalf of a number of members of the Corporation, presented MR. A. SEDGWICK BARNARD with a heavy silver salver, as a token of their respect and esteem, on the occasion of his resignation of the post of borough electrical engineer. Mr. Barnard also received a large oak clock with Westminster chimes from the heads of the municipal departments, which was presented on their behalf by the town clerk, as well as a suit case and a silver rose bowl from the electricity department, together with other items. He is leaving municipal service in order to take up an appointment with the Chloride Electrical Storage Co., Ltd., and commenced his duties with the latter on July 1st ; his address remains at 5, Victoria Terrace, Walsall, as before.

The Limerick Corporation has granted an increase of £50 per annum to MR. BADHAM THORNHILL, the borough electrical engineer.

MR. A. C. TICEHURST, assistant engineer at Bexhill Corporation electric light works, has resigned. The filling of the vacancy has been referred to Electric Light Committee and Ald. Paton.

The Heywood Corporation has increased the wages of MESSRS. W. A. H. PARKER, HERBERT POTTS and W. A. IRELAND, mains superintendent, steam superintendent, and shift engineer in the electricity department.

With reference to the announcement in our last issue to the effect that Mr. E. Atkinson had been appointed to the position of shift engineer in the Manchester Corporation electricity department, we are informed that Mr. Atkinson withdrew his application, and MR. JOHN A. VICE, along with MR. J. H. NIVEN, was appointed, the commencing salary being £175 per annum, and not £171 as stated by us.

The Ealing T.C. has raised the following salaries of the staff at the electricity works :—P. F. Anley, installation inspector, 50s.—2s. 6d. per week. C. B. Heaviside, shift engineer, 50s.—2s. 6d. per week. S. F. Riddel, shift engineer, 47s. 6d—2s. 6d. per week. F. W. Davey, assistant meter test room, 32s. 6d.—2s. 6d. per week. A. J. Jaynes, assistant meter test room, 32s. 6d.—2s. 6d. per week. T. Southgate, assistant meter test room, 27s.—2s. per week. F. Warwick, meter reader, &c., 27s.—3s. per week.

Tramway Officials.—MR. R. O. PICKMERE has resigned his appointment as general engineering assistant to the West Ham tramways undertaking. The tramways manager (Mr. J. S. D. Moffett) reports that it is not necessary at present to fill the vacancy, but that the case would be met by increasing the wages of the foreman (MR. A. BECKWITH) for the additional duties which would devolve upon him.

The Southport Town Council is to be recommended to increase the salary of the tramways manager from £200 to £250 per annum.

The Ashton Tramways Committee proposes to increase the salary of MR. ERNEST HOLT, tramways manager, from £200 to £250 per annum. An increase is also proposed for MR. F. H. CROSSLEY, storekeeper and general clerk in the tramways department.

General.—MR. E. DOCHERTY, machine shop foreman at the Arc Works, Chelmsford (Crompton & Co., Ltd.), who has resigned his position, has been presented by the employés in his department with a silver flower vase.

MR. W. STANLEY LONSDALE, who has for the past two years been London representative for Messrs. Siemens Bros. Dynamo Works, Ltd., Caxton House, has accepted the appointment of electrical engineer to Messrs. Huntley & Palmers, at Reading. Mr. Lonsdale, who has been with Messrs. Siemens for the last 10 years, four of which were spent in the Far East, takes up his new position early in September.

At St. Paul's Church, Blackpool, on July 9th, Miss Nellie Fielding was married to MR. PERCY J. FRAMPTON, a member of the electrical engineering firm of Bottomley & Frampton, of Blackpool.

MR. A. R. UPWARD has resigned his position as chairman and technical adviser to the Magneta Time Co., Ltd., and has entirely severed his connection with the undertaking.

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MR. R. A. PANK, of Messrs. A. Pank & Sons, electricians, of Castle Hall Works, and Bedford Street, Norwich, and his wife, have celebrated their golden wedding, and have been presented by the employés of the firm with an inscribed gilt fruit and flower stand.

Obituary.—MR. S. W. NEWINGTON.—We regret to learn of the death, which occurred on Monday, of Mr. Samuel W. Newington, the borough electrical engineer of Oldham, who had occupied that position since the establishment of the electricity works, over 20 years ago. The deceased, who was 45 years of age, had been ill since last February. He was the son of the late Dr. R. S. Newington, of Goudhurst, Kent.

Wills.—According to the *Financial Times*, the late Mr. A. B. Anderson, (Chairman of the B.E.A.M.A.), who was lost in the wreck of the *Empress of Ireland*, left £6,260 gross, £6,059 net.

CITY NOTES.

Victoria Falls and Transvaal Power Co., Ltd.

THE annual general meeting was held on Wednesday, July 8th, at Salisbury House, E.C., under the chairmanship of the MARQUESS OF WINCHESTER.

The CHAIRMAN, in proposing the adoption of the report (ELEC. REV., p. 1084), dealing first with the balance sheet, said it would be seen that the creditors amounted to £399,447, showing an increase of some £70,000 over the amount owing at the end of 1912. Of this amount £90,656 was in respect of the sums owing to contractors which was retained as a guarantee that the work contracted for should be carried out in the terms of the agreement. The item of £151,315 represented monies in their hands as managers of the Rand Mines Power Supply Co., Ltd. As they knew, the Victoria Falls Co. managed entirely the undertaking of the Rand Mines Power Supply Co. On the other side of the account it would be seen that the Rand Mines Co. owed them £146,666 in respect of profits earned during 1913, since received. The item of leases and concessions and purchase of undertakings again showed a decrease over last year's figure, being £1,561,302 as compared with £1,606,251, the difference being accounted for by the usual charge for depreciation, by certain small items which had been written off, by sales of sundry obsolete plant and by the transfer to its proper account of certain plant and machinery which they thought should not be included under this heading. The item "expenditure on and in connection with power stations, buildings, equipment and land," had been increased during the year by £213,209, and was mostly in connection with the extension they had made to the Simmerpan station; it included buildings, new generating plant and new boiler house and boiler house plant, consumers' sub-station equipments and the necessary overhead transmission lines. The machinery and plant unerected stood at £55,155 as compared with £48,587 at the end of the previous year. This sum represented expenditure on apparatus such as transformers, switchgear and overhead line material which had been ordered to meet the notified demands but which had not at the time of the balance sheet been passed out to the erection department. General stores and spare parts figured at £76,984 as compared with £44,055 last year. It was very necessary in a business such as theirs to keep a large stock of general stores and spare parts in reserve so that the same were always on hand in the case of emergency. Turning to the profit and loss account, the year's operations resulted in an increased profit over the preceding year. In 1912 they carried to the appropriation account £446,380; in respect of the year 1913 they had been able to take £467,823 to the credit of that account, an increase of £21,443. The interest on debentures accounted for £203,920 of this sum and the directors have applied £135,491 towards depreciation, etc., carrying forward £128,411 to the credit of the profit and loss account, increasing that account to £225,198. Out of this amount they had paid a dividend at the rate of 6 per cent. per annum for the six months ended 30th June, 1912, on the preference shares on the 6th January, 1914, and a further dividend at the same rate for the six months ended 31st December, 1912, was paid on the 17th June, 1914. Those two payments accounted for £120,000, so that they had to the credit of the profit and loss account as a reserve at the beginning of the year the sum of £105,198 as against £96,787 last year. The increase in profits of this year could be compared fairly with that which they had the pleasure of laying before the shareholders last year, when the increase in profits was £123,286. This year the increase was represented by only £21,443, a not inconsiderable sum, except by comparison with the previous year. This sum would have been largely increased had normal trading conditions existed on the Witwatersrand during the year under review. In the first instance, they had had a year of abnormal drought; but the first and chief factor in the reduction of increase was the result that in 1912 they brought into commission 34,500 KW. of new plant, whilst in 1913 only 24,000 KW. of new plant came into operation. There was a further cause, and one which was quite beyond their control—the labour trouble which occurred in the previous month of July. In May of the year under review, or for the first five months of that year, their revenue was highly progressive, culminating in May with the high-water mark of power demands by the mines. The actual outburst in the beginning of July was preceded by considerable unrest, which made a perceptible difference to the June returns. Since July, when the exodus of native labourers occurred, the demands of the mines fell rapidly. With each month, as the number of native labourers increased, the demand for electrical energy and compressed air would continue to increase also. As they were aware, there occurred a recrudescence of these disturbances in February last, but, owing to the prompt action of General Botha's Government, the consequences were greatly minimised and, in fact, beyond the month of February showing a natural decrease for the few days of the strike, the remainder of the month proved to be exceptionally profitable to them. Proceeding to deal with criticisms which had appeared in the Press regarding what were said to be the optimistic statements which he made at the last meeting as to the company's future, the Chairman said he thought the severest critic must admit that had it not been for the two causes, namely, the drought and the labour troubles, they would have been in a position to pay off five months of arrears of dividend, which would absorb £50,000, and which would have made the preference dividend then only seven months in arrear. If they were spared the troubles which had upset them in the past year, and if up to 1916 the business of the company should continue as it appeared, then, so far as the repayment of back dividends was concerned, he thought they could go away with confidence that these would be earned and paid, and that they would continue to receive the full dividend of 6 per cent. Many of them would say, "Why not 10 per cent.?" When he made his forecast last year he was not in possession of the mind and intentions of the Union Government. Although he believed that at the present time it was not a law of the land, still there was little doubt that the Finance Bill of 1914 would place upon the company a very heavy burden. The burden was not one which would deprive them of their prosperity, but, so far as they could see, it was probable that it would be represented by a sum in the neighbourhood of £30,000 a year. Under the provisions of the Bill as submitted for second reading, companies earning profits in South Africa were liable to income tax on their net profits after payment of debenture interest. In addition the companies would have to pay over to the South African Government the income tax on the debenture interest with permission, however, to recover the amount so paid, from the debenture holders. Having referred at length to the question of the probable life of the mines on the Rand, the Chairman said he could only assume that statements made by the leaders of the industry, supported by figures given by the Government mining engineer, must be taken as evidence that for a long time to come the supply of payable ore on the Rand would provide suitable employment for the plant which they had provided. Personally, from calculations which he had had got out, he was not anxious regarding the future. Unless renewed prosperity occurred in the mining industry, he thought they were safe in saying that they had sufficient plant installed, or coming into active operation, by the end of this year, to meet all notified demands for some considerable time to come, as well as provide for the amount of spare plant which it was necessary under their contracts that they should provide, and which was an insurance against failure.

Mr. A. BRAKHAN seconded the motion, which was adopted without discussion.

Marconi's Wireless Telegraph Co., Ltd.

THE directors' report for the year 1913 states that the gross profit amounted to £245,584, and the net profit to £122,323. Attention was drawn in the last report to the fact that substantial profit had been realised for the year 1912 under exceptional circumstances, and that the directors therefore deemed it prudent to avail themselves of the opportunity to establish a reserve account, and had appropriated £100,000 from these profits for that purpose. An effective comparison of the results of the two years cannot therefore be made. The directors regret that the business of the past year should not have shown more immediate profits. The company has nevertheless carried out a considerable amount of work, which should contribute large annual revenues in future years. The financial conditions which have prevailed throughout the world for some time past have been responsible for many foreign governments deferring to place orders which the company expected to receive. In other cases the company has been unable to complete contracts within the year owing to delay on that portion of the work which had to be carried out by the governments. The directors recommend the payment of a final dividend for the year 1913, of 10 per cent. on both classes of shares. Summarised, the proposed appropriation of the available balance is as follows:—preference shares: dividend of 17 per cent. for year ended 31st December, 1913, of which 7 per cent. was paid on 1st October, 1913, £42,500; ordinary shares, dividend of 20 per cent. for year ended 31st December, 1913, of which 10 per cent. was paid on 31st January, 1914, £150,000; balance carried forward to next account, £76,550; total, £269,050.

In the balance sheet "Shares in Associated Companies and Patents" are taken into account as usual at their cost price, viz., £1,298,744, an increase over last year of £442,624, the par value of the shares being £2,421,220, showing an increase over last year of £826,637. The amount shown in the balance sheet, and the par value of the shares, show substantial increases over the figures of last year, the company having acquired additional interests which are calculated at cost.

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After careful consideration the directors have resolved to discontinue publishing particulars of the shares held by the company, it being in their opinion prejudical to the interests of the company that such information should be made public. Taking the prices quoted on 30th June last for such shares as are quoted on the London Stock Exchange, and placing a moderate valuation on those unquoted (taking into consideration the different elements which they now possess for such valuation), the total value so arrived at represents a sum in excess of the £1,298,744 appearing in the balance sheet. This latter figure also includes the cost to the company of the whole of its patents and patent rights. The cost of patent renewals have been entirely written off from profit and loss account, and no other figure appears in the balance sheet representing either establishment costs or goodwill.

In October, 1913, the capital of the company was increased to £1,500,000 by the creation of 500,000 new ordinary shares of £1 each, ranking for dividends declared in respect of the period commencing the 1st January, 1914, and in all other respects *pari passu* with the existing 750,000 ordinary shares of £1 each. 250,000 shares were forthwith offered to the shareholders *pro rata* at £3 5s. per share and the whole of the issue was subscribed and duly allotted. Of the remaining 250,000 shares, 222,688 were issued for cash in December, 1913, in connection with the arangements made with respect to the shares acquired by the Compagnie Universelle de Télégraphie et Téléphonie sans Fils.

The share premium account has increased during the year by 511,958, and now stands at £767,665. Of this amount £397,058 fell due in the early part of this year and has been received.

The Goldschmidt high-frequency alternator (continuous wave machine), in which the company is interested through its share-holding in the Cie Universelle de Télégraphie et de Téléphonie sans Fil, has been erected at a station in Germany and at another near New York. This latter station has been only recently completed and experimental work is being conducted between the two stations. It is yet too early to speak definitely as to the results. A demonstration has been given of the transmission of 3,000 words from America to Germany, when conditions were favourable, but tests from Germany to America on a similar scale have not yet been made. Given that they prove sufficiently promising, work will be proceeded with immediately with a view to making necessary changes and additions to equip both stations on a commercial basis. Some months, however, must be allowed for this work to be completed.

The contract entered into with H.M. Government for the erection of six high-power stations was ratified by Parliament on 8th August last, when the directors contemplated proceeding immediately with the erection of all the stations simultaneously. Additional staff had been engaged and trained in anticipation at considerable expense, but nearly a year has passed, and the board realises that the slow progress which the company has been permitted to make seriously prejudices the company's interests. Much work has been done by the company and a substantial sum of money has been expended, for which no return has been received during the past year. The directors are giving this matter their serious consideration.

The company has continued to do a substantial and remunerative business in Italy, and enjoys the confidence and support of the Italian Government. The erection of the high-power station for the Norwegian Government is well advanced and should be completed by the autumn. A commercial telegraph service between Northern Europe and the United States of America is to be inaugurated, in which this company will be interested to the extent of 10 per cent. of the gross receipts. In December last the Trans-Oceanic Wireless Telegraph Co., Ltd., was incorporated, with a capital of £200,000, for the purpose of conducting a wireless telegraph service between this country and the United States. That company has acquired the new stations which have been erected in Wales for this purpose. These stations will be opened in the near future when for the first time a direct wireless service between London and New York will be established. By this service messages will be automatically transmitted and received at the rate of one hundred words per minute, a speed considerably in excess of the fastest cable. This new service will be conducted by the Trans-Oceanic and American Marconi Companies without the intervention of landlines controlled by any other company. The issued capital of the Trans-Oceanic Co. is held by this company. Telegraph offices will be opened in the City at No. 1, Fenchurch Street, which will be in direct communication by private line with the stations in Wales. Licences have been obtained from the British and Spanish Governments for a direct wireless service between the two countries. For this purpose the company's station at Poldhu has been enlarged, and a service to Spain and the Canary Islands will be inaugurated within a few weeks.

The report gives the following information respecting subsidiary and associated companies:—

The American Company.—Exceptional weather causing considerable difficulty and delay in transport of plant has caused the high-power stations to be longer in course of erection than was contemplated. Those, however, of San Francisco, Hawaii and Belmar (New York), are now practically complete, and will be opened for service in the near future. Difficulty was experienced in securing the services of a man with the knowledge and ability needed for the direction of the American company, and the business of last year was therefore less profitable it is believed than it otherwise would have been. We are glad to be able to report that Mr. E. J. Nally, Ex-Vice-President of the Postal Union Telegraph Co. of America, has become the Vice-President and Manager of the American company. Your directors have had the advantage of receiving two visits from him, and are very hopeful that his business ability and experience in all matters concerning the cable and telegraph business, together with his energetic methods and organising powers, will soon make themselves markedly felt in the development of the American business. The patent actions in the American courts, to which the Chairman referred last year, have now been decided in the company's favour and substantial results should be derived therefrom.

The Canadian Company has made progress during the year and steps which are in contemplation should markedly improve its position in the near future.

The Argentine Company is proceeding with the construction of the high-power station for communication with Europe, which, so soon as the new transatlantic service is opened, will be pushed on with all speed.

The Belgian Company has continued to earn satisfactory profits and is making substantial progress. For the year ending the 31st December, 1913, a dividend at the rate of 7½ per cent. has been declared. This company now owns and operates nearly 200 ship telegraph stations.

The French Company has declared a dividend for the year 1913 at the rate of 10 per cent. on the Ordinary shares, and 31.25 francs per share upon the Founders' shares. This company now owns and operates nearly 100 ship telegraph stations.

The Marconi International Marine Communication Co., Ltd. has shown an increase during the year 1913 of nearly 50 per cent. in its receipts. A final dividend of 5 per cent. has just been declared, making a total of 10 per cent. for the year. This company now owns and operates some 873 ship telegraph stations as compared with 580 at the end of 1912. Our interest in the German Mercantile Marine continues to show excellent progress, and the company receives satisfactory and improving returns therefrom.

The Russian Company is making steady and satisfactory progress. It has declared a dividend for the year 1913 at the rate of 6 per cent. The contracts in hand show an increase over those of the preceding year, and the prospects of future business are highly encouraging.

The Spanish Company in which the Spanish and General Wireless Trust, Ltd., have large interests, has not made the progress expected. The receipts from their stations, although increasing, are not satisfactory. The terms of their concessions have been impaired by recent legislation, which it is considered entitles the company to substantial compensation. Our managing director has recently paid a visit to Madrid, where he conferred with the Prime Minister and other members of the Government, and informs us that he is encouraged in the belief that the proposals which he has caused to be submitted to the Government will be accepted. In that event the company's position will be distinctly improved, and a reasonable return upon its capital may be expected to follow.

The Betulander Automatic Telephone Co., Ltd., in which this company holds a controlling interest, was incorporated on the 29th August, 1913, to acquire from this company the rights and patents in connection with the automatic telephone system invented by Mr. G. A. Betulander, of Stockholm. The business is being rapidly developed and the directors are confident that it will show substantial and remunerative results.

During the past year this company and its affiliated agents have entered into contracts and executed work for the Governments of the following countries: Great Britain, Dominion of Canada, Indian Empire, Union of South Africa, Bolivia, Brazil, Bulgaria, Chili, Greece, Italy, Norway, Portugal, Rumania, Russia, Servia, Spain, Turkey, and United States of America.

Improvements have been made in some of the types of field station aparatus, notably the lightest form of military apparatus, known as the Knapsack station, which has been entirely re-designed. The sales for 1914 are more than double those of the previous year, and during the early part of 1914 important orders have been received from foreign Governments.

Numerous additional patents, which are believed to be of great value, were taken out during the year.

Rapid progress has been made in the development of wireless telephone apparatus, and the company has recently introduced a practical and commercial set for moderate distances. Further important developments are proceeding and it is contemplated that apparatus will shortly be available for the transmission of speech over considerable distances. The development of this new means of communication should add considerably to the earning powers of the company.

Marked progress has been made during the past year in the development of the Wireless Compass or Direction-finder, and Fog and Submarine Signalling apparatus. These instruments should add materially to the safety of life at sea, and it is hoped they will be universally adopted by the mercantile marine. An apparatus for use in lifeboats has also been recently introduced on the market, and is much appreciated by shipping companies.

An International Convention for Safety of Life at Sea was signed in London on the 20th January, 1914, and a Bill to give effect thereto is now before Parliament. Under this Bill wireless telegraphy is rendered compulsory upon ships carrying 50 or more persons including crew. As similar provisions are to be enforced in all the principal countries of the world, increased business should result for all the subsidiary companies which are operating wireless telegraphy on board ships.

The directors have entered into a provisional agreement with the North British and Mercantile Insurance Co. for the establishment of a Staff Superannuation Fund.

The action brought by Mr. O. Locker Lampson, M.P., and Mr. P. E. Wright, referred to in the last annual report, is still pending. The Chairman will make a statement at the meeting. M. Maurice Travailleur retired from the Board in May, 1914, owing to ill-health. The directors retiring at this meeting, although they would not in the ordinary course retire by rotation, are Commendatore G. Marconi and Mr. Godfrey C. Isaacs, who, being eligible, offer themselves for re-election.

The meeting is to be held on Tuesday next, July 21st.

Edmundson's Electricity Corporation, Ltd.

The annual meeting was held on July 9th at Salisbury House, E.C., under the presidency of Mr. P. D. Tuckett.

In proposing the adoption of the report (Elec Rev., p. 66), the Chairman said that during the past year the progress of the company had been well maintained, both in the growth of the business and in the profits earned. The connections had increased by the equivalent of 169,699 33-watt lamps, the largest annual increase they had ever secured, and practically double that of five or six years ago. Whether they would be able to maintain that rapid rate of increase he very much doubted with trade tending to become less active and with the smaller capital expenditure they were now making, but he saw no reason to suppose that the business would not con-

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tinue to show a healthy and satisfactory growth from year to year and, indeed, so far this year their connections were somewhat in excess of those for the corresponding period, the lighting connections in particular being substantially up. An equally satisfactory increase of over 6½ million units was shown in the output, the lighting units having increased 5 per cent. and the power units 33 per cent. The profits of the various undertakings had increased by £11,460, which, though not quite so large an increase as in the previous year, when they were up £12,414, was largely in excess of the increases for 1910 and 1911, and was by no means unsatisfactory when they took into consideration the phenomenally fine summer last year as compared with one of the vilest summers on record the previous year. Indeed, so marked was the contrast that for the summer quarter of 1913 they actually earned less profit than in the previous summer quarter. Moreover, coal cost them over £3,500 more owing to higher prices. In this respect, however, he was glad to say that they were at last likely to find some relief since most of their coal contracts were now being renewed at somewhat reduced prices, the benefit of which they would feel this year and next. Of this increased profit of £11,460, £2,561 had been received in the form of extra dividends and interest, but owing to the redemption of the prior lien debenture stock in 1912 they had lost the interest which appeared in last year's accounts on the temporary investments and cash loans. Consequently, the net increase in the item of dividends and interest was only £1,640, but, as he had previously explained, they could not expect to receive more than a comparatively small proportion of the additional profits earned by the subsidiary companies until the Urban Co., with far the largest capital of any of them, was in a position to resume payment of dividends on its ordinary shares, of which they held more than half. The yield on their investments was, however, steadily progressive, being at the rate of 3.24 per cent. last year as compared with 3.06 per cent. for 1912, 2.71 per cent. for 1911, 2.38 per cent. for 1910, and 2.19 per cent. for 1909. This clearly indicated the steady improvement which was taking place in the position of the company, although the yield was admittedly still far from adequate, thanks largely to the fact that something like £400,000 of their investments was still bringing in no return at all. The figure of £45,297 representing dividends and interest compared with the figure of only £24,087 six years ago, and during the same period the annual reserve provisions made by the subsidiary companies had been increased by over £26,000. It would be seen therefore that not only was the position of this company being steadily improved, but the position of the subsidiary companies was at the same time being correspondingly strengthened. There was an increase of £911 in the gross trading profit and an increase of £4,226 in the net profit of £23,125. They proposed to place £9,000 to reserve, £12,000 to the payment of the dividend for the year on the cumulative preference shares, carrying forward the balance of £2,125. For reasons which he had often explained, their trading profits could not safely be regarded as being to anything but a small extent available for distribution. They were perfectly legitimate profits, and ultimately they would reap the benefit of them, but until that time arrived they were not going to repeat the mistake, which contributed to bring about the disastrous position in which the company found itself some seven years ago, by treating them as immediately distributable. Turning to the balance sheet, the Cromer undertaking now appeared along with the Frome undertaking under the heading of undertakings owned by the Corporation. Although the Cromer undertaking shared with Frome the unenviable distinction of being amongst their least profitable undertakings, there was no question as to the advantage of their owning it in preference to the previous arrangement. The item of work in progress, which stood at £10,098 as compared with £6,420 a year ago, indicated that they had made a favourable start for the current year in their trading business. The shrinkage of nearly £13,000 in their cash resources was not so satisfactory, but it was entirely attributable to the unprecedented financial conditions which had rendered it inexpedient to replenish their resources. Consequently, until times improved, which he thought would certainly be the case if only the Ulster question was once disposed of, they were restricting capital expenditure within as narrow limits as they reasonably could. On the liabilities side the reserve had been increased by about £16,000, a most satisfactory feature of the accounts. With regard to the gross profits of the subsidiary companies, most of them showed some improvement, and in the few instances where this was not the case, the apparent want of improvement was accounted for by some specially heavy repair or other equally definite explanation. It might interest them to know that in the all-important feature of return on capital the aggregate yield shown was steadily progressive, being at the rate of 5.2 per cent. as compared with 4.9 per cent. for 1912 and 4.7 per cent. for 1910. The Lancashire Power Co. continued to make steady progress, its profits having increased during the year from about £15,000 to nearly £23,000, whilst the directors reported that the outlook for the present year was distinctly encouraging. In conclusion, he had only to say that with the one exception of the difficulty experienced in raising fresh capital without undue sacrifice under the adverse conditions which had recently prevailed, and which had equally affected other similarly situated industrial concerns, and from every other standpoint except that of immediate dividends, the position of the company was increasingly satisfactory and its prospects were steadily improving.

Mr. A. A. Campbell Swinton seconded the motion, which was carried unanimously.

In proposing the re-election of the Chairman as a director, Mr. Swinton said that the improvement which had taken place in the position of the company was due in a very large degree to the work of Mr. Tuckett.

The motion was carried, and the Chairman, in thanking the meeting for his re-election, remarked that he had received the loyal support of his colleagues and Mr. Highfield (their Advisory Engineer) in carrying out his duties. It was not possible for any one man to get the company out of the difficulties into which it got some years ago, but as he had said on previous occasions, he believed it only needed continued patience for the shareholders to ultimately receive an adequate return on their holdings.

Crompton & Co., Ltd.

Mr. C. F. Tufnell presided at the annual meeting held on Monday at Salisbury House, E.C. In moving the adoption of the report (Elec. Rev. p. 67) he congratulated shareholders upon the very decided improvement in the business, an improvement which they predicted as the inevitable result of putting their house in order. The new capital had been a great help, but as they only received the last instalment three months before the close of the accounts, they had not yet reaped the full benefit. Not only had the capital been reorganised, but they had also made considerable changes in the organisation of the business, and with satisfactory results. This had involved a large amount of work which had been done without dislocation of business. The question of debentures had given the directors certain anxiety since the last meeting. Acting on the advice of eminent counsel, they proposed to keep the debentures of the old company in force, but certain debenture holders in February considered that the company was wrong in that respect, and applied to the Court, resulting in a decision in the debenture holders' favour. The difficulty was overcome by a scheme of arrangement continuing the debentures in force, but the directors thought it expedient to increase the interest from 5 to 5½ per cent. The necessary majority was obtained at the meeting of the debenture holders called to approve the scheme, and in due course the sanction of the Court was obtained and the scheme made binding. The profit made during the year, after deducting various charges, including interest on debentures, etc., was £13,551. Shareholders might suggest that that would warrant a more liberal distribution than they proposed, but the directors felt strongly that a conservative policy must be adopted from the commencement and every effort made to strengthen their position. The present balance sheet could not be compared with that of the old company as a good many changes had taken place. The whole 136,000 preference shares had been issued, and the 7s. 6d. liability thereon at the time of issue had been paid up. The first mortgage debentures remained, as in the case of the old company, at £100,000. On the other side of the account the first item was the balance of the purchase price of the business, after deducting assets separately valued. They had had to leave in this first item the shares in the Auxiliary Electrical Co., which might one day be worth something appreciable, but their present value could not be ascertained. The face value of the shares was some £42,000, and this sum represented amounts paid under a guarantee of the earnings of the Electric Supply Corporation, and the Auxiliary Electrical Co., which was entirely owned by this company, was entitled to be repaid the amount so advanced out of the surplus profits of the Electric Supply Corporation. The Corporation was at present paying a small dividend, but was yet some distance from earning sufficient to entitle the Auxiliary Co. to any return. The directors had not separately valued a claim arising out of a contract with the P.W.D., Madras, which had been the subject of litigation. The decision of the Court of first instance in Madras was largely against the company, but the decision of the Madras Appeal Court was entirely in the company's favour. It would take some time to ascertain the amount due to the company, which included damages and interest, and there was always the possibility of an appeal to the Privy Council. The stock-in-trade and work in progress had been carefully valued. With regard to sundry debtors, provision had been made for the possibility of bad debts. The investments in other companies were of small amount, and were valued on a conservative basis. The preliminary expenses represented the cost of the registration of the company, underwriting and other expenses, and their idea was to write these off in three years. There was a note on the balance sheet with regard to liability in respect of cost of liquidation. This was not an important matter, but as the liquidation accounts were not finally closed they were obliged to refer to it. The note on the other side of the balance sheet in regard to liability of shares referred to the Auxiliary Electrical shares, but there was no possibility of any further monies being called on those shares. Turning now to the profit and loss account, they had spent considerable sums in maintenance, repairs and renewal of plant, tools and premises, all of which had been charged against revenue. They had charged depreciation at the usual rates, and provided for the possibility of bad debts. As to the future, he could not forecast the course of trade, but the prospects for the current year were good. Further, not only was this business on a much sounder footing than formerly but, in his

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opinion, this remark would also apply to the electrical trade as a whole, and he thought they were not likely to see a return of the insensate price-cutting which prevailed in former years. One of the directors, Mr. Hale, had recently returned from a visit to Australia, and he spoke well of the prospects of the business in the company's manufactures in that Colony, and of the energy and ability of the company's Australian manager, Mr. E. J. Erskine. The Chairman finally referred to the excellent work done, both during the reconstruction and subsequently, by Mr. Edwin Reeves, the managing director, and he was to be congratulated upon the condition in which the new company found itself. He also bore witness to the improved work at Chelmsford, where their new works manager, Mr. Britten, had done and was still doing yeoman service. The whole staff at London and Chelmsford, and the branches, had been most loyal to the board, and were deserving of the thanks of the shareholders.

The report was adopted.

Prospectus.—*Southern Brazil Electric Co., Ltd.*—The list was to close on Wednesday in an issue of £570,000 6 per cent. mortgage debentures at 98 per cent. in this company, which was formed in March last year to acquire the control of and to develop certain electric supply and other public utilities in Brazil. It is acquiring over 99 per cent. of the issued share capital of a company which has the power, lighting and traction exclusive concession until 1946 for the City of Campinas and the villages of Vallinhos Souzas and Laranjal; also 70 per cent. of the capital of a company which has a 30 years' exclusive concession for electric supply in the town of Amparo; a 14 years' (remaining) concession for the lighting in the City of Piracicaba (an extension of 30 years, including a tramway, is being applied for); over 99 per cent. of the capital of the Paranagua company which has a 30 years' electric light and water concession for Paranagua; and a one-half interest in the firm of Byington & Co., of Sao Paulo, Santos and Rio Grande do Sul, who carry on business as electrical engineers and contractors. The populations and the estimated profits of the four undertakings and the firm, for the year ended December, 1913, are given as follows:—Campinas, 45,000, profit £45,165; Amparo, 12,000, profit £3,610; Piracicaba, 18,000, profit £12,026; Paranagua, 10,000, profit £3,484; Byington & Co., profit (50 per cent.) £9,448. The valuation of the properties as going concerns is put down at £1,056,500, the profit for 1913 at £73,733, and the estimated capital outlay for the next three years at £190,500. It is estimated that the various properties will receive remarkable benefit by consolidation, and the income for the three years, 1914, 1915 and 1916, is estimated at £96,860, £114,700 and £142,800 respectively.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—The directors have declared an interim dividend of 2½ per cent. on the ordinary shares.

Direct United States Cable Co., Ltd.—Interim dividend, 2s. per share, being at the rate of 4 per cent. per annum, for the quarter ended June 30th, 1914.

Anglo-American Telegraph Co., Ltd.—Interim dividends for the quarter ended June 30th, 1914, of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock.

British Columbia Electric Railway Co., Ltd.—Dividend at the rate of 5 per cent. per annum on the preferred ordinary stock for the June half-year, together with an additional 1 per cent. per annum for the same period.

STOCKS AND SHARES.

Tuesday Evening.

The immediate factor in Stock Exchange markets, at the beginning of this week, was the renewed recrudescence of the Ulster crisis. This dominated everything else, and the strenuous efforts of the newspapers in the direction of calming popular passions and sternly refusing to print a single line of inflammatory flummery, were the subject of general comment. In spite of this remarkable restraint on the part of the ink-slingers, some people went evidently frightened at the outlook, and Consols fell with a sharp drop, to recover later on. Minor sensations include the issue of the Marconi report, a slump in Brazil Tractions, and a notable rally in confidence as regards Mexican Railway matters.

Marconi shares experienced a formidable fall on the issue of the report. The dividend is made up to 20 per cent., as before, but the figures show so heavy a reduction, in net profits, as to cause grave disappointment. At one time, the parent shares were offered at 39s. 9d., but the usual reaction occurred. On the week the loss shown overleaf is 10s., and it has to be remembered that the present price of 2 1/8 compares with 3¼ touched only three weeks ago. With the slump in the Ordinary shares there has also come, of course, severe shrinkage in the Preference, while Americans and Canadians gave way to 10s. 9d. and 5s. 6d. respectively.

It must be admitted that the company's figures make a very poor display against those of a year ago, and are worse than most people expected them to be. The 1912 profits were admittedly swollen by special circumstances, but normal expansion of the business should have made up partially for the extra money brought in by sales of shares in last year's accounts. Next week's meeting promises to be a lively affair, for both the Commendatore himself and Mr. Godfrey Isaacs have voluntarily offered to retire from the board, seeking re-election, as to the result of which there is not much doubt.

The critic may be excused for venturing the opinion that the board would have been better advised had they declared less dividend and retained the money for the building up of the reserve funds. Such a course would, at least, have had the effect of lessening the chance of rumour-mongers toying with guesses at possible new issues—a chance which, to the Stock Exchange mind, will be present for some time to come.

Lively discussion, too, is raging round the proposals of the British Electric Traction Company. The main part of the opposition springs from holders of the 7 per cent. non-cumulative Preferred stockholders, some of whom consider themselves badly-used in the suggested reorganisation. The directors, we understand, are anxious to deal with all the classes of proprietors as strictly equitably as possible, but their task was obviously difficult, and any scheme must have aroused resentment where sacrifice was inevitable. The terms, of course, are not settled yet, and it may be taken for granted that alternatives will receive fair, and impartial, consideration. Market quotations for the three junior stocks are 1 to 2 higher on the week.

Underground Railway issues have given way, and so have steam stocks, the declines in the latter being associated with Ulster apprehensions. More intimate causes affected Districts and the shares of the Underground Electric Railways Company, because the House of Lords Committee has passed the Bill of the Middlesex Council for putting a tax of ⅜ths of a penny per car-mile on the motor-'buses, using certain highways, by way of contribution to the new Bath Road. That other bodies will follow suit is more than likely, and this will cut into the profits of the group's most prosperous unit, the London General Omnibus Company. That something of this kind was bound to happen, it has been frequently urged here, and especially a year or two back when 'Bus "A" shares were being "tipped" with such vigour at 13s. Their present price is about 8s. The company's £10 shares are 5s. down. No doubt the next step will be a revision of fares in the upward direction.

Excited rises in Mexican Railway stocks followed an order from the Mexican Government that the company should repair a gap in the line made previously, under the same authority, to check intercommunication by train between the rebels. This was read as an inference that the Mexican Government considered the insurrection to be ending, but Utility issues failed to share the strength of the Railway Market. Mexico Trams and Mexican Lights are both easier. Both of these command large Continental followings, and the Brazilian slump has so upset Paris and Brussels that lines of other stock came on offer from those centres. Brazilian Tractions felt the chief force of the Belgian selling. The price is down 5½. Rio Tramway bonds, too, are lower.

Montreal Light and Power Common has gained 6 points in spite of severe spasms of flatness in Canadian Railway descriptions. Canadian Generals rose 2, but lost the gain afterwards.

The Indian shares are good. Rises of 7s. 6d. in Calcutta Trams, 2s. 6d. in Calcutta Electric Supply and in Rangoon Preference have come about as a consequence of continual investment in the shares by Anglo-Indian banks on behalf of their Indian customers. Bombay Second Debenture is a point lower, though the Firsts gained 1. Lisbon Tramways Preference rose to 1⅛, but Barcelona Tractions have been very flat, dropping to 18. In view of recent lavish advertising, the slump in these shares may appear perplexing. The recent issue of bonds is called normally 78. It was offered, of course, at 82½.

Home Electricity Supply securities are very quiet. Kensingtons slipped back, and Metropolitans rose ½. Otherwise there is not a quotable change worth mentioning. Nobody expects this market to become illuminated in the summer time, and in many cases there is not so much as a solitary transaction per diem. When public interest revives, there are several fresh names to be added to our price-list; as market conditions are at present, the catalogue might be reduced by one-half and still contain twice as many issues as the investor is paying heed to just now.

Telegraphs are steadily mounting in price. On top of gains last week have come others in the Anglo-American, Eastern and Trust Companies' groups. Eastern Ordinary and Preference have recovered dividend deductions: China shares did better still. Indo-Europeans are 20s. up. Western Union bonds advanced 2. The whole market is somewhat short of stock, while the investor is keen on having what there is. West India and Panama Ordinary are an exception, shedding another ⅛, so that on the basis of the last dividend, the present return is 9 per cent, on the money.

The strength of cable shares has spread to those of the manufacturing companies. Telegraph Constructions regained their 12s. dividend. British Insulated Ordinary put on 12s. 6d.; the Preference, with India-Rubber Preference, rose 2s. 6d. Other shares are very firm. Rubber issues improved a little on the hardening of the produce.

Six per cent. debentures have been offered this week, at 98, by the Southern Brazil Electric Company, a bonus of 10 per cent. in shares accompanying the bonds, which look a speculative security. The Manila Electric Railroad publishes a report showing good progress, and earnings of about 12 per cent. on the Common shares, which receive 7 per cent. Less satisfactory is the report of the Alabama Traction, Light and Power Company, wherein the opinion is expressed that by the end of this year the concern will be making enough net revenue to cover fixed charges and operating expenses. The 5 per cent. bonds stand at 67. Manila capital stock is quoted at 102, and the 5 per cent. bonds at par.

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SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Name.	Stock or Share.*	Dividends for 1912.	1913.	Closing Quotations July 14th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	[illegible]	..	Nil
Do. 5% Pref.	1	5	5	[illegible] xd	..	6 19 0
Do. 4½% Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6% Pref. ..	100	..	..	17 — 19	+1½	..
Do. Do. Deferred ..	100	..	..	10 — 12	+2	..
Do. Do. 6% Cum. Pr'f.	100	6	6	85 — 89	..	6 11 2
Do. 7% Non-Cum. Pr'f.	100	8	8½	54 — 57 xd	+1	6 2 10
Do. 5% Perp. Deb. ..	100	5	5	91 — 93	..	5 7 5
Do. 4½% 2nd Deb. ..	100	4½	4½	77 — 79	..	5 14 0
Central London Railway, Ord. ..	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented ..	100	..	4	82 — 84	..	4 15 8
Do. Pref.	100	4	4	68 — 78	..	5 9 7
Do. Gtd. Assented	100	..	4	84 — 86	..	4 18 0
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	80 — 82	..	4 17 7
Do. 4% Deb.	100	4	4	95 — 97 xd	..	4 2 6
City & S. London, 5% Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	91 — 94	..	5 6 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1903	100	5	5	89 — 92	..	5 8 8
Do. 4% Deb.	100	4	4	86 — 88	..	4 11 0
Hastings Trams, 6% Pref. ..	1	6	6†	[illegible]	..	8 6 8
Do. 4½% Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5% Pref.	5	2½	3	[illegible] — 2½	..	6 0 0
Do. 4% Deb.	100	4	4	71 — 76	..	5 2 7
Lancashire United, 5% Deb. ..	100	5	5	84½ — 86½	..	5 15 4
London and Suburban, Ord. ..	1	..	..	[illegible]	..	..
Do. Do. 5% Cum. Pref.	1	..	5†	[illegible]	+1/32	8 0 0
Do. Do. 4½% 1st Deb. ..	100	4½	4½	74 — 79	..	5 14 0

Name.	Stock or Share.*	Dividends for 1912.	1913.	Closing Quotations July 14th.	Rise + or Fall —	Present Yield p.c. £ s. d.
London Elec. Railways, 4% Deb.	100	4	4	88 — 90	..	4 9 0
London United Trams, 4% Deb.	100	4	4	54 — 58	..	6 18 0
Metropolitan Railway Consol. ..	100	1½	1½	40½ — 41	—¾	3 19 3
Do. Surplus Lands	100	2½	2½	62 — 64	+1	4 6 0
Do. 3½% Deb.	100	3½	3½	86 — 88 xd	..	3 18 7
Do. 3½% Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½% Con. Pref.	100	3½	3½	79 — 81	..	4 6 4
Metropolitan District Ord. ..	100	Nil	..	25½ — 25¾	..	Nil
Do. 6% Deb.	100	6	6	136 — 139	..	4 6 0
Do. 4% Deb.	100	4	4	91 — 93	..	4 6 0
Do. 4% Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½% First Pref.	100	4½	4½	83 — 86	..	5 4 8
Do. 3½% Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½% Deb.	100	4½	4½	84 — 87	..	5 3 6
Do. 5% Deb.	100	5	5	85¼ — 88¼	..	5 18 0
Potteries, Ord.	1	3½	3½	[illegible]	..	8 12 10
Do. 5% Pref.	1	5	5	[illegible]	..	7 12 8
Do. 4½% Deb.	100	4½	4½	81½ — 84½	..	5 6 2
South Metro. Trams, 4% Deb.	100	4	4	64 — 68	..	5 17 8
Underground Elec. Railways ..	10	..	..	[illegible]	—½	Nil
Do. "A"	1/-	..	..	[illegible]	—1/16	Nil
Do. 6% First Cum. Inc. Deb.	100	6	6	116 — 118	..	5 1 7
Do. 4½% Bonds	100	4½	4½	99 — 101	+1	4 9 0
Do. 6% Income	100	6	6	90½ — 91½	..	6 11 2
Yorkshire (West Riding), Ord. ..	5	Nil	Nil	[illegible]	..	Nil
Do. 6% Pref.	5	3	4	[illegible]	+⅛	4 6 6
Do. 4½% Deb.	100	4½	4½	84 — 87	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Name.	Stock or Share.*	Dividends for 1912.	1913.	Closing Quotations July 14th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅞ — 5	..	5 10 0
Do. 2nd Pref.	5	5¾	5¾	4⅝ — 4⅞	..	6 5 9
Do. 4% Deb.	100	4	4	90 — 92	—1	4 7 0
Do. 4½% Deb.	100	4½	4½	96 — 98 xd	..	4 11 0
Do. 5% Deb.	100	5	5	95 — 97	..	5 8 0
Auckland Trams, 5% Deb. ..	100	5	5	101 — 104 xd	..	4 16 8
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11½	..	5 2 2
Do. 4½% Deb.	100	4½	4½	95 — 97	+1	4 12 9
Do. 5% 2nd Deb.	100	5	5	99 — 101	—1	4 19 0
Brazilian Traction, Light and Power	$100	6	6†	72 — 74	—5½	8 2 2
Brisbane Trams Invt., Ord. ..	5	8	8	7½ — 7¾	+½	5 8 8
Do. 5% Pref.	5	5	5	4¾ — 5¼	..	4 15 8
Do. 4½% Deb.	100	4½	4½	99 — 101	+1	4 9 0
B. Columbia Elec. Rly., Def. ..	100	8	8†	106 — 110	—½	7 5 6
Do. Pref. Ord.	100	6	6	103 — 107	..	5 12 1
Do. 5% Pref.	100	5	5	102½ — 105½ xd	..	4 14 7
Do. 4½% 1st Mort. Deb. ..	40	4½	4½	98 — 101	..	4 9 0
Do. 4½% Vancouver Deb. ..	100	4½	4½	94 — 96	..	4 12 0
Do. 4½% Con. Deb.	100	4½	4½	95½ — 97½	..	4 7 2
Calcutta Trams, Ord.	5	7½	9½	6⅞ — 7⅛	+⅜	6 8 9
Do. 5% Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. 4½% Deb.	100	4½	4½	97 — 100	..	4 10 0
Cape Electric Trams	1	5	5	[illegible]	..	6 18 4
City Buenos Aires Trams (1904)	5	5	5	5¾ — 5⅞	+⅛	4 9 0
Do. 4% Deb.	100	4	4	95 — 100	..	4 0 0
Colombo Elec. Tr. & Lt., 5% Deb.	100	5	5	91 — 95	..	5 5 8
Havana Elec. Rly., 5% Bonds ..	$1000	5	5	91 — 95 xd	..	5 5 8
Kalgoorlie El. Trams 5% A Deb.	100	5	5	82 — 87	..	5 15 0
Do. 5% B Deb.	100	8	..	10 — 20	..	Nil

Name.	Stock or Share.*	Dividends for 1912.	1913.	Closing Quotations July 14th.	Rise + or Fall —	Present Yield p.c. £ s. d.
La Plata Elec. Trams, Ord. ..	1	..	..	[illegible]	..	..
Do. Pref.	1	4½d.	6	[illegible]	..	6 5 0
Lisbon Elec. Trams, Ord. ..	1	6	6	1⅛ — 1⅜	..	4 9 8
Do. 6% Pref.	1	6	6	1 — 1¼	+3/32	4 16 0
Do. 5% Deb.	100	5	5	92½ — 94½ xd	..	5 2 6
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 14 8
" Elec. Tr. (1904), Deb. ..	100	5	5	99 — 101	..	4 19 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	75½ — 78½	..	6 7 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ — 100½	..	4 19 6
Mexico Trams Com	$100	7	7	71 — 75	—1	..
Do. Gen. Con. 5% Bonds ..	..	5	5	80 — 84	..	5 19 1
Do. 6% Bonds	100	6	6	73 — 77	—1	7 15 10
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	4 — 4½	..	11 2 2
Do. 6% Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5% 1st Deb.	100	5	5	88 — 91	+½	5 10 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	+⅛	5 9 1
Do. 4½% 1st Deb.	100	4½	4½	94 — 96	..	4 18 9
Rio de Janeiro Trams, 1st Mort. 5% Bonds	..	5	5	96½ — 98½	—1	5 1 6
Do. 5% Mort. Bonds	100	5	5	88½ — 90½	—1½	5 10 8
Sao Paulo Tram., Lt. and P. 5% 1st Deb.	$500	5	5	97 — 101	..	4 19 0
Singapore Trams, 5% Deb. ..	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5% Deb.	100	5	5	95 — 97	..	5 8 0
Un. Elec. Trams Monte Video ..	5	7	7	4½ — 4¾	..	7 7 4
Do. 6% Pref.	5	6	6	4⅞ — 5⅛	..	5 17 8
Do. 5% 1st Deb.	100	5	5	95 — 97	..	5 8 0
Winnipeg Elec. Rly., 4½% Deb.	100	4½	4½	93½ — 95½	..	4 14 8

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Name.	Stock or Share.*	Dividends for 1912.	1913.	Closing Quotations July 14th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	6	7	10 — 11	..	6 7 4
Do. 4½% Pref.	10	4½	4½	9½ — 10½	..	4 5 9
Do. Second 6% Pref.	10	6	6	10½ — 11	..	5 9 1
Do. 4½% Deb. Stock	Stock	4½	4½	93 — 96	..	4 18 9
Brompton & Kensington, Ord. ..	5	10	10	8⅞ — 9¼	..	5 8 1
Do. 7% Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4% Guar. Deb.	100	4	4	91 — 94	..	4 5 1
Charing Cross, West End & City	5	5	6	4⅞ — 5⅜	..	5 11 7
Do. 4½% Cum. Pref.	5	4½	4½	4½ — 4⅞	..	4 12 4
Do. City Undertaking 4½% Cum. Pref.	5	4½	4½	4 1/16 — 4 9/16	..	4 18 8
Do. Do. 4% Deb.	100	4	4	90½ — 92½	..	4 6 6
Chelsea, Ord.	5	5	5	4½ — 5	..	5 0 0
Do. [illegible] Deb.	Stock	4½	4½	95 — 98 xd	..	4 11 0
City of London, Ord.	10	9	10	16 — 17	..	5 17 8
Do. [illegible] Pref.	10	6	6	13 — 14	..	4 5 9
Do. [illegible]	Stock	5	5	115 — 118	..	4 4 9
Do. [illegible] Deb.	100	4½	4½	98 — 101	..	4 9 1
County of London, Ord.	10	6	7	11⅞ — 12¼	..	5 14 8
Do. [illegible]	10	6	6	11⅞ — 12⅜	..	4 17 0
Do. [illegible]	Stock	4½	4½	101 — 104	..	4 6 7
[illegible] Deb.	Stock	4½	4½	99 — 102	..	4 8 1
[illegible]	£8	..	..	[illegible]	..	Nil
[illegible]	5	6	6	8½ — 9 xd	..	7 10 0
[illegible]	5	..	..	1⅞ — 2	..	..
[illegible]	100	4½	4½	81 — 84 xd	..	5 7 2
[illegible]	5	6	6	5 — 5½	..	5 9 1
[illegible]	100	4½	4½	93 — 95	..	4 14 9

Name.	Stock or Share.*	Dividends for 1912.	1913.	Closing Quotations July 14th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Hove	5	8	9	8½ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7¼ — 7¾	—⅛	5 16 8
Do. 4% Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½% Deb. ..	Stock	4½	4½	73¾ — 77¾ xd	..	5 16 9
London Electric, Ord.	8	2½	8	1¼ — 1⅜	..	5 10 7
Do. 6% Pref.	5	6	6	4⅞ — 5¼	..	5 14 8
Do. 4% First Mort. Deb. ..	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	4½	4½	8¼ — 8¾	+⅛	6 0 0
Do. 4½% Cum. Pref.	5	4½	4½	4¼ — 4½	..	4 10 0
Do. 4½% First Mort. Deb. ..	Stock	4½	4½	96 — 99	..	4 11 0
Do. 3½% Mort. Deb.	Stock	3½	3½	82 — 84	..	4 8 4
North Metropolitan Power Supply, 5% Mortgages (Red.)	100	5	5	99 — 102	..	4 18 1
Notting Hill, 6% Non-Cum. Pref.	10	6	6	9½ — 10½	..	5 17 8
Oxford..	5	7	7	5⅞ — 6⅜	..	5 10 0
St. James' and Pall Mall, Ord. ..	5	10	12	9⅛ — 9⅝	..	6 4 8
Do. 7% Pref	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½% Deb.	100	3½	3½	82 — 85	..	4 2 4
South London, Ord.	4	5½	5½	2¾ — 3⅛	..	6 10 4
Do. 5% First Mort. Deb. ..	100	5	5	9¾ — 101	+1	4 19 0
South Metropolitan, 7% Pref. ..	1	7	7	1 3/16 — 1 5/16	..	5 6 8
Do. 4½% First Deb. Stock ..	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£8	Nil	..	[illegible]	..	
Do. 5% Cum Pref.	5	8½	4	[illegible] — 3	..	6 18 4
Do. 4½% First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 8 8
Westminster, Ord...	5	10	10	8⅜ — 8⅞	..	5 12
Do. 4½% Cum Pref.	5	4½	4½	4 15/16 — 5 3/16	..	4 6 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 14th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	£	6	6	5⅛ — 5⅜	..	5 11 7
Calcutta, Ord.	£	8½	9	7¼ — 7⅜	+ ⅛	5 16 2
Do. 5 % Pref.	£	5	5	5 7/16 — 5 9/16	..	4 14 1
Calgary Power, 1st Mort. Bds.	100	5	5	87 — 89	..	5 12 3
Canadian Gen. El. Com.	$100	7	8	98 —103	..	7 15 6
Do. 7 % Pref.	$100	7	7	116 —121	..	5 15 10
Cordoba Lt., Power and T., Ord.	1	5	..	7/16 — ⅜	..	7 12 0
Do. 5 % Deb.	100	5	5	80 — 85	..	5 17 8
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	82 — 83	+1	6 19 6
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	94 — 97	..	5 8 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93 — 95	..	5 5 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/16 — 5/16	..	Nil
Do. 6 % Pref.	1	6	4	¼ — ⅜	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	99 —102	..	4 18 0
Madras, Ord.	£	Nil	..	1½ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 —106	..	4 14 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	58 — 63	..	7 18 8
Mexican Lt. & Power, Common	$100	4	4†	45 — 48	—1	..
Do. 7 % Cum. Pref.	$100	7	7	71 — 75	—2	9 6 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	76 — 81	..	6 3 5
Do. 5 % 2nd Mort. Bonds	100	5	5	59 — 64	..	7 13 3
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	* 100	1912. 5	1913. 5	48 — 53	..	£ s. d. .. ..
Montreal, Lt., H. and Power	$100	9	10†	236 — 241	+6	4 3 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	10	235 —245	..	4 1 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	97 —103	..	5 16 6
Do. 5 % Deb. Stock	Do.	5	5	99 —101	..	4 19 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5½	6	132 —137 xd	—3	4 7 7
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	103 —106	..	4 14 4
Do. 4½ % Per. Deb.	Stock	4½	4½	100 —102	..	4 8 3
Toronto Power, 4½ % 1st Deb.	Do.	4½	4½	98 — 100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	82½ - 84½	..	5 18 4
Victoria Falls Power, Pref.	1	6	6	11/16 — ¾	..	8 0 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 3

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 14th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	£	7	7	1¼ — 1 5/16 xd	..	8 12 4
Do. 6 % Pref.	£	6	6	3/32 — 3/16 xd	..	7 2 3
Babcock & Wilcox	£	16	16	7/16 — ½	+ 1/32	5 6 8
Do. Pref.	£	6	6	1 3/16 — 1 5/16	..	4 8 6
British Aluminium, Ord.	£	..	5	1 3/16 — 1 5/16	..	4 14 1
Do. 6 % Cum. Pref.	£	6	6	5/8 — 11/16	..	6 9 0
Do. 5 % Prior Liens Debs.	100	5	5	95 — 98	..	5 2 0
Do. Deb. Stk.	100	5	5	90 — 95	..	5 5 3
B.I. & Helsby Cables	£	10	18	10 — 10½	+ ⅛	6 13 8
Do. Pref.	£	6	6	6 — 6¼	+ ⅛	4 12 4
Do. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref.	£	Nil	5	1⅝ — 1⅞	..	5 6 8
Do. Deb.	100	4	4	73 — 76	..	5 5 3
Do. 6 % Prior Lien	100	6	6	101 —104	..	5 16 6
Browett, Lindley, Ord.	£	..	..	2/- —8/-	..	Nil
Do. Pref.	£	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	£	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 — 85	..	5 17 8
Lo 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb.	100	4½	4½	33 — 38	..	18 12 8
Callender's Cable	£	15	15	11¾ — 12¼	..	6 2 5
Do. Pref.	£	5	5	5 — 6¼	..	4 15 3
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	£	20	22½	2 7/16 — 2 9/16	..	8 15 5
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Dick, Kerr	£	Nil	..	3/16 — ¼	..	..
Do. Pref.	£	6	6	⅛ — ⅜	..	6 17 2
Edison & Swan, A, £2 paid	£	Nil	..	3/32 — 5/32	..	Nil
Do. fully paid	£	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	67 — 61	..	6 11 1
Do. 5 % Second Deb.	100	5	5	61 — 66	..	7 11 6
Electric Construction	£	5	6	7/16 — 11/16	..	8 14 6
Do. Pref.	£	7	7	1 — 1⅛	..	6 4 5
Greenwood & Batley, Pref.	£	10	7	6¾ — 7¼	..	9 18 3
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	£	10	6	10⅜ — 10⅝	..	5 10 4
Do. Deb.	100	4	4	88 — 92	..	4 7 0
Henley's, Ord.	£	15	20	14½ — 15½	..	6 9 0
Do. Pref.	£	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	99½ —101½	..	4 8 6
India-Rubber, G. & T.	£	10	7½	9½ — 10¼	..	7 2 10
Do. Pref.	£	10	5	9 — 9⅝	+ ⅛	5 2 7
Telegraph Construction	£	12	20	87½ — 89½ xd	+ ⅝	6 1 7
Do. Deb.	100	4	4	97 — 99	..	4 0 10
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	..	68 — 67	..	5 19 8
Do. B 4 % Cum. Pref.	100	..	£4	38 — 42	..	9 10 6

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 14th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	£	4½	4½	5⅝ — 6⅛	..	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 98	..	5 2 0
American Telep. & Teleg., Cap.	$100	8	8	121 —125	..	6 8 0
Do. Collat. Trust	$1000	4	4	91 — 94	..	4 5 0
Anglo-American Telegraph	Stock	8	8	64 — 67 xd	+ ½	4 9 7
Do. 6 % Pref.	Do.	6	6	101½ —103½ xd	+1	5 10 11
Do. Def.	Do.	80/-	80/-	25⅛ — 28⅜	+ ½	6 7 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	£	8	6†	7½ — 7¾	..	5 6 8
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80½ — 82½	..	4 17 0
Cuba Telegraph	£	10	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	£	10	10	16 — 17	..	6 17 8
Direct Spanish Telegraph, Ord.	£	4	4	3½ — 4	..	5 0 0
Do. 10 % Cum. Pref.	£	10	10	7½ — 7¾	..	6 9 0
Direct United States Cable	£	4	4	6⅜ — 7⅛	+ ⅛	5 12 3
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	130 —133 xd	+1½	5 5 3
Do. 8½ % Pref. Stock	Do.	8½	8½	76 — 78 xd	+ ⅝	4 9 9
Do. 4 % Mort. Deb.	Do.	4	4	95½ — 97½	..	4 2 1
Eastern Extension	£	10	7	12⅝ — 13⅛ xd	+ ⅛	5 6 9
Do. 4 % Deb.	Stock	4	4	96 — 98	+ ½	4 1 8
Globe Telegraph and Trust	£	10	6†	11 — 11½	+ ⅛	5 4 4
Do. 6 % Pref.	£	10	6	12½ — 13	+ ⅛	4 12 4
Great Northern Telegraph	£	20	20	81½ — 83½	..	5 19 5
Indo-European Telegraph	£	18	18	58 — 60	+1	5 8 4
Mackay Companies Common	$100	5	5	80 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 72	..	5 10 1
Marconi's Wireless Telegraph	£	20	20	2 — 2⅛	— ⅛	9 8 2
Do. 7 % Cum. Partic. Pref.	£	17	17	1 7/16 — 1 11/16	— ⅛	10 1 8
Monte Video Telephone, Ord.	£	6	6	⅝ — ¾	..	6 8 0
Do. 5 % Pref.	£	5	5	⅞ — ⅞	..	5 18 6
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100⅜ — 101⅛	..	4 9 0
Oriental Telep. and Elec.	£	10	10	2 1/16 — 2 3/32	..	4 7 6
Do. 6 % Cum. Pref.	£	6	6	1 5/16 — 1 7/16	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 11 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	95 — 97	—1	4 2 8
Reuter's	£	10	7	7¼ — 8¼	..	8 9 8
Submarine Cables Trust	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	97 — 99	..	4 11 0
United River Plate Telephone	£	8	6†	6⅛ — 6⅝	..	6 0 9
Do. 5 % Cum. Pref.	£	5	5	5 — 5¼ xd	..	4 11 0
West Coast of America	2½	2½	N	7/16 — 1⅛	..	Nil
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1½	1½	1⅛ — 1⅜	— 1/16	9 1 10
Do. 6 % Cum. 1st Pref.	10	6	6	6⅛ — 9½	..	6 9 9
Do. 6 % Cum. 2nd Pref	10	6	6	8¼ — 8⅝	..	6 16 9
Do. 5 % Debs.	100	5	5	98 —101	..	4 19 0
Western Telegraph, Ltd.	10	7	7	13⅜ - 13⅝	..	5 0 11
Do. 4 % Debs.	Stock	4	4	97 9/16 — 97 11/16	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	95 — 100	+2	4 10 0

* Unless otherwise stated all shares are fully paid. † Interim dividend. a Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Jacks on Tramcars.—At an inquest held at Manchester into the death of a two-year old child, whose body was found beneath the lifeguard of one of the Corporation tramcars, it was stated that the jack would not lift the car, and the public got round and lifted it bodily so that the dead child might be removed. The Coroner said that he had had case after case where these jacks had been called into question. They never seemed to be of any use. He did not know why they were carried. The jury, in returning an open verdict, expressed the opinion that the Corporation should take the jacks into consideration, especially after the number of cases which had occurred reflecting on their efficiency. Mr. Derbyshire, who appeared for the Tramways Committee, said that the jacks were quite strong enough to lift the cars, and they ought to do so. It was suggested that on such occasions drivers got excited. The Coroner replied that that might be so, but drivers should be so drilled in the use of the jacks that their operation would become automatic.

E.H.T. Testing Transformers for Japan.—Two testing transformers, having a normal rating of 360,000 volts continuously, and 500,000 volts for short periods, have recently been installed by the Inawashiro Hydro-Electric Power Co., one being located at the generating station on the Nipashi River, at the outlet of Lake Inashiro, about 145 miles from Tokio, and the other in the receiving sub-station in Tokio. The machines, which were built by the Westinghouse Co., of Pittsburg, U.S.A., are intended to be used for testing the transmission lines and apparatus in the stations. Among the features of interest in the transformers are the arrangement of the windings to give distributed static fields, the use of condenser terminals to give distributed stresses from terminals to earth, and the terminal "hat" to distribute stresses from terminal tip to earth. The machines are 19 ft. high from the base to the top of the terminals, and the tanks are 9 ft. high and 9 ft. in diameter. One high-tension terminal of each transformer is earthed to the core and case, the other being brought out.

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THE EXAMINATIONS OF THE I.E.E.

THE first examination for candidates for the Associate Membership of the Institution of Electrical Engineers was held in May last, and the June issue of the *Journal* of the Institution contained a list of the successful candidates, together with the names of the examiners and the subjects for which they were severally responsible.

We do not propose to consider in detail the papers which were set at this examination, or to discuss the results; there are, however, certain broad aspects of the scheme of examinations which we think may be considered with advantage at the present time.

We feel that the action of the Council in instituting these examinations as a test of the general education and of the scientific and technical training of candidates for entry to the rank of Associate Membership is a wise one, and that it is in consonance with the object for which the Institution was founded in 1871, namely:—"To promote the general advancement of electrical and telegraphic science and its applications." There can be little doubt that the ultimate result of the action of the Council in this matter will be to raise the professional status of the Institution, and enable it to influence beneficially the courses provided by the schools and colleges in the country for the training of electrical engineers.

With a view to ascertaining whether the influence of the examination in its present form is altogether in the direction of advancement, we shall proceed to consider the scheme in some detail in the following connections:—

(*a*) The relation of the examination to existing curricula in electrical engineering in day and evening schools.

(*b*) The qualifications for exemption from the examination.

(*c*) The suitability of the examination as a test of training and attainment.

As a preliminary, it may be well to state briefly the subjects of the examination.

The examination is in two parts; the first part consists of an English essay, or translation into English of passages in one of the following languages, to be selected by the candidate:—French, German, Italian or Spanish. In addition to this, a composite paper in Science must be taken, in which the section on Applied Mechanics is obligatory, while the sections on Physics and Chemistry are alternative.

The second part of the examination consists of two papers on one of the following subjects, to be selected by the candidate:—(*a*) Electricity Supply (generation, transmission and distribution); (*b*) Electric Lighting and Power; (*c*) Electric Traction; (*d*) Telegraphy; (*e*) Telephony; (*f*) Application of Electricity in Mines; (*g*) Electro-Chemistry and Electro-Metallurgy; (*h*) Manufacture of Electric Machinery (including works management); (*i*) Design of Electric Machinery and Apparatus.

The papers in Part II include optional questions in administrative and economic matters. No detailed syllabus of the subjects of examination is published.

(*a*) *The Relation of the Examination to Existing Curricula in Day and Evening Schools.*

The examinations will not affect the courses for engineering degrees in any University in the United Kingdom or in the British Dominions, or for the certificates and diplomas in electrical engineering issued by six schools and colleges in London, three colleges in the North of England, two colleges in Scotland and one Colonial college. The certificates of these colleges are accepted by the I.E.E. as exempting candidates from the whole of the examination.

The number of approved colleges might be extended with advantage, since the geographical distribution of the colleges approved at the present time leaves considerable sections of England (*e.g.*, the Midlands and the South of England) without adequate provision.

So far as day courses are concerned, candidates for the examination will be drawn from students who have not been successful in obtaining degrees or diplomas which exempt from the examination, or who have taken taken day courses at schools or colleges which are not recognised by the I.E.E. as exempting from the examination.

A typical day course in electrical engineering would extend over three years, and would consist in the first year of instruction in mathematics, mechanics, physics, chemistry, and engineering drawing. The second and third year courses would comprise instruction in mathematics, engineering drawing and designing, strength of materials, heat engines, hydraulics, electrotechnics, electricity supply, electric traction, and electrical design.

Part I of the I.E.E. examination would be covered by the work done by a student for the entrance examination to the college, and in the first year of his college course.

Part II of the examination is concerned entirely with the technical applications of electricity; only one branch of the subject may be selected by a candidate, and since two papers are set in each branch, it is evident that a considerable degree of specialised knowledge is called for.

It is eminently desirable that schools and colleges should not attempt to specialise to the extent called for by Part II of the examination. Their function should be to give a broad training in the principles of mechanical and electrical engineering. Students who are not attending courses recognised for exemption will desire to sit for the I.E.E. examination at the end of their school course. If the schools yield to this desire on the part of the students, it will necessitate a large amount of informational training being given at the expense of educational training, and it will result also in the elimination of most of the teaching in mechanical engineering subjects in the second and third year courses, and in a premature and unreal specialisation in electrical subjects.

It may be urged that these students should pursue the curriculum at present laid down for them in their day courses, and that on the completion of their day training they should continue their studies in evening classes with a view to specialising before sitting for the I.E.E. examination.

In the circumstances, this probably would be the best course to pursue, but it would lead undoubtedly to "cramming" in the evening classes, and it is open to the further objections that the work done for Part I of the examination would be separated from the date of the examination by an interval of four or five years, while the work for Part II of the examination would have to be carried on under the adverse conditions which are inseparable from evening instruction.

Candidates for the examination will also be forthcoming from the ranks of those whose technical education has been obtained wholly or in large part in evening classes, and it will be well to see to what extent the I.E.E. examinations may influence the curricula of such students.

In this connection we shall have to reckon with a strong educational movement which aims (in all except the final years of the courses) at breadth of training rather than specialisation and at instruction in principles rather than in details of current practice. This movement, which had its inception in the North of England about 10 years ago, has now spread over the whole country. Its characteristic feature is that a technical subject, such as electrical engineering, is not taught as a single subject, but that concurrent instruction is given in branches of science and technology which are akin to it. For this reason it is known commonly as the "grouped-course system." As a rule, the instruction extends over 2-2½ hours on each of three evenings a week for four years, with a further year which is devoted to specialisation. A typical group-course of training in electrical engineering would be somewhat as follows:—

First Year.—Mathematics, mechanics and physics, engineering drawing.

Second Year.—Mathematics, technical electricity, engineering drawing.

Third Year.—Mathematics, elementary C.C. and A.C. work.

Fourth Year.—Mathematics, intermediate C.C. and A.C. work.

Fifth Year.—Advanced courses in specialised branches of mechanical and electrical engineering.

The time which an evening student can give to study is extremely limited, and the conditions under which he obtains

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instruction are unfavourable. The solution of the difficult problem of evening instruction lies in the supersedence of evening classes by part-time day courses. Under present conditions, however, the specialisation called for in Part II of the examination will tend to foster study in single subjects, and to discourage the broader training which the grouped-course system involves.

The grouped-course system has only recently been established in the South of England, and its scheme of internal examinations with external assessors has not yet been developed fully. It is suggested that the Council should watch carefully the development of this system with a view to recognising the grouped-course certificates of approved institutions as exempting from the examination. This action on the part of the Council would tend to conserve in evening courses in electrical engineering, that breadth of curriculum and attention to principles which is so essential to a sound engineering training.

(*b*) *The Qualifications for Exemption from the Examination.*—In addition to the degrees in engineering of any British University, and to the diplomas and certificates of certain approved Institutions, the following qualifications are accepted as exempting from the whole of the examination:—Whitworth Scholarships, Commissions in the Royal Engineers, Royal Artillery and Royal Navy (Engineering branch), and the Final Grade Certificate of the Department of Technology of the City and Guilds of London Institute.

The presentation of a thesis, paper, or other approved contribution, on acceptance by the examiners, will exempt from the examination, but the candidate is liable to be examined upon his thesis, either orally or in writing, at the discretion of the examiners.

A science degree from any University in the United Kingdom or the British Dominions will exempt from Part I of the examination.

The Council will consider on its merits, with reference to exemption from the examination, any other engineering degree, diploma, or certificate of equivalent standing to those enumerated above, which may have been obtained by a candidate from any University or College in the United Kingdom or abroad.

It is not to be expected, or even to be desired, that precise identity of standard should obtain in these various qualifications for exemption, but it will be seen that the chief characteristic of nearly all of them is the fact that the candidate must have been *trained* specifically as an engineer. The exception to the above is the final certificate in Electrical Engineering, issued by the Department of Technology of the City and Guilds of London Institute. For this certificate there is no examination in General Education, in Mechanics, Physics, Chemistry, or in Mechanical Engineering subjects, but the certificate is obtained as the result of passing three examinations in electrical subjects only.

The presentation of a thesis or paper is an admirable alternative to the examination, and the Council is to be congratulated upon the stimulus that this provision is likely to give to research. There is no direct qualification in general education or scientific training involved other than is necessitated by the writing of the thesis, but if additional evidence of these qualifications should be necessary, it may be obtained by means of the oral or written examination to which the candidate may be required to submit himself at the discretion of the examiners.

(*c*) *The Suitability of the Examination as a Test of Training and Attainment.*—We have seen in connection with the qualifications for exemption from the examination that adequate training in engineering is necessary; we have seen also that the majority of students sitting for the examination will be composed of those whose training in day courses has been incomplete or unsuccessful, or whose technical training has been obtained under adverse conditions in evening classes.

In order, therefore, that the character of the examination should be comparable with that of the qualifications for exemption, it is necessary that the examination should furnish a reliable test of the engineering training of the candidates. It is at this point that the I.E.E. examination, in common with all other examinations which are purely external in character, breaks down.

Of all students, the engineering student lends himself least to a true appraisement of his training by means of external examinations, for it is quite impossible to test satisfactorily by this means the laboratory work and practical work upon which his training is based.

From the extremely short list of successes in the recent examination, it would appear that the Council is fully alive to the defects and limitations of a purely external examination.

It seems probable that the Council intends to make as little use as possible of the examinations, and to rely mainly upon its carefully selected set of exemptions as a means of entrance to the professional ranks of the Institution. In this we feel that the Council is acting wisely and in agreement with the best educational opinion of the day.

It is, however, desirable that some steps should be taken in connection with the examination to place emphasis upon the element of training. This could be effected by requiring from candidates, as a condition precedent to sitting for the examination, that they should produce a certificate showing that they had attended and worked satisfactorily either in a day course in electrical engineering or in grouped courses of approved character in the evening. Candidates who are not able to produce a certificate of this nature should be obliged to submit themselves to an oral examination in addition to the written test.

THE LATEST TYPE OF RENNERFELT FURNACE.

The original type of Rennerfelt furnace, developed in 1912, has already made itself prominent in the steel industries, particularly in Sweden, Norway and Russia. This furnace consisted essentially of a chamber lined with fire brick and an inner covering of basic or acid bricks in which three Acheson graphite electrodes, one vertical and two horizontal, converged to a point some six or twelve inches above the top surface of the material to be treated. The arc was sprayed downwards on to the surface by electromagnetic repulsion, and hence a very uniform operation was secured, materially assisted by heat reflected from the roof above the electrodes. The smooth running properties and efficient performance, together with high power factor and low cost per ton of material treated, place the furnace in a very favourable position.

Within recent times, however, the range of operation of the furnace has been extended. The furnaces with three electrodes only ranging from 100 kilogrammes up to, say, three tons capacity were particularly adapted for small crucible work, together with steel foundry, copper, alloy and chemical processes requiring high temperatures, but the restriction in size can be removed by adopting a multiple arc furnace based on the same principle, and we are indebted to the Aktiebolaget Elektriska Ugnar, of Stockholm, Sweden, for particulars of the latest advance in this direction, providing a really large electric furnace capable of receiving the entire charge of steel from the Bessemer converter or open-hearth furnace up to 50 or 75 tons in size. The refining furnace of 75 tons requires about 7,500 kilowatts, and to properly change this large amount of energy into heat in an effective manner is an engineering operation involving many important problems.

Obviously, it is imperative to sub-divide the energy of such a furnace into a number of smaller units by employing several sets of electrodes. Thus the size of each electrode can be kept within such dimensions as are practicable to manufacture, and furthermore, the generation of heat will not be concentrated in a few points where the temperature would be so excessive that no brickwork, either acid or basic, would be capable of enduring it, but is much more uni-

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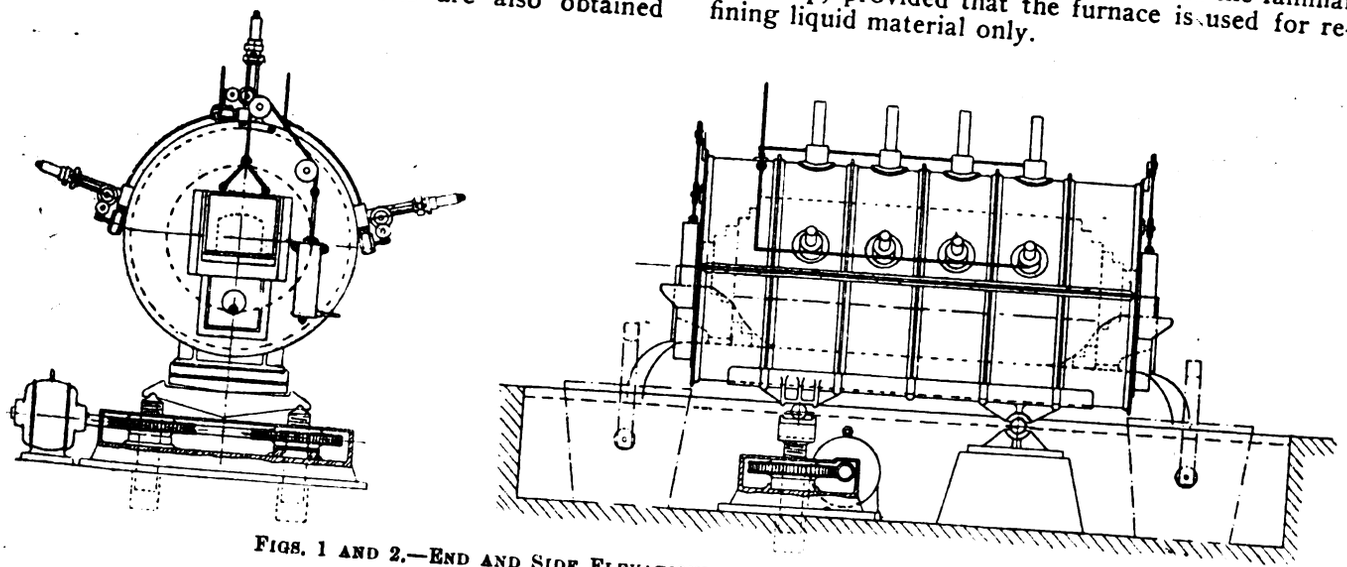
formly spread over the working area of the furnace. The Rennerfelt multiple arc furnace is illustrated in Figs. 1 and 2. It will be seen that the furnace is built as an elongated crucible preferably of cylindrical cross section, made up of a number of similar sections bolted to one another, and each fitted with one set of electrodes arranged according to the diagram Fig. 3. The small heat-generating sets of electrodes are thus distributed over the entire surface of the bath, which therefore is uniformly heated all over. The heat radiated from the arcs has only a short distance to pass to the steel, whereas the distance from the arcs to the roof and walls is considerably greater. In this way the furnace can be worked at a very much higher average temperature than can be carried in such a large furnace with only a few electrodes.

The wear and tear on the brickwork is correspondingly reduced and the output of the furnace is largely increased, and in this way there is a saving effected both in upkeep and renewals. More rapid and certain chemical reactions are also obtained through the better distribution of heat and the higher mean temperature existing in the active zones. The cylindrical elongated form of the furnace gives the advantage of a strong casing which is not subject to distortion by the heat. The furnace is constructed in rings utilising bricks of only a few simple patterns, and these can be set with a minimum of labour and without the necessity of injurious and expensive cutting.

The furnace can be lengthened by simply adding cylindrical sections to the shell; the cost of increasing the capacity of an existing furnace is therefore small. The control of the furnace is very simple, as the current is distributed between several sets of electrodes connected in parallel, but otherwise independent of each other. One may consider the entire plant as made up of several small furnaces each kept under separate and easy control. The electrodes, cooling boxes, switches and circuit-protecting apparatus are thus simplified and cheapened. Irregularities in the consumption of energy become less troublesome and disturbing, and occur in arcs of comparatively small size, and hence the power curve of a furnace thus heated approaches a straight line with only a few relatively unimportant deviations.

The 15-ton multiple arc furnace uses about 1,800 kilowatts, and has eight arcs of 225 kilowatts each. The current in each electrode is 2,500 amperes. The problem of automatic control of the electrodes has been solved in a very simple manner. Only the horizontal electrodes need control, and as these are of small size only a small force is required to adjust them so that each receives its normal current. Once the multiple arc furnace has been started and adjusted to normal conditions, the regulating machinery for the horizontal electrodes works in the same way as the corresponding device in the familiar arc lamp, provided that the furnace is used for refining liquid material only.



Figs. 1 and 2.—End and Side Elevations of the Rennerfelt Furnace.

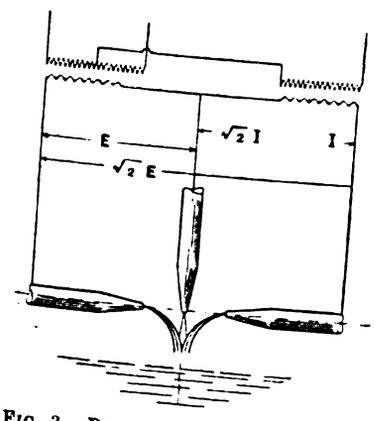


Fig. 3.—Diagram of Connections.

Any kind of electric current, alternating or direct, can be used, and the frequency of alternating current is of little importance. The construction of the brickwork is simple, strong and durable, with a minimum loss of heat from radiation. The roof of the furnace is not weakened by more than one small electrode in each section. On account of its form, the roof may be made of brick, permitting working with a very high average temperature. Those portions of the brickwork most exposed to destruction can be quickly repaired without dismantling the furnace. The fettling of the melting chamber may be thoroughly and rapidly sintered without introducing coke or other fuel under the electrodes; hence the maintenance is simple, giving a long life to the lining. The thermal efficiency is high, because of the peculiar method of generating the heat, the interior being sealed to prevent the outside air from entering. The heat emitted by the arcs spreads uniformly over the whole surface of the charge, the shape and position of the arcs relative to the slag increasing the chemical activity between steel and slag. The electrodes are placed rather high above the surface of the slag, and are thus well protected from the strongly oxidising slag during the period of dephosphorisation. Owing to the position of the electrodes above the charge, the furnaces can be tilted without shutting off the power or withdrawing the electrodes. The regulation of the power is simple, only two of the three electrodes belonging to a three-phase furnace having to be attended to. The operation of the furnace is quiet and smooth, even if the bath is boiling violently. The consumption of the electrodes is small. The phase displacement is also small, cos ϕ varying between 0.9 and unity, and non-ferrous alloys can be melted without

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being evaporated by too high a temperature, as the arcs are not in contact with the charge. On all these counts, therefore, the furnace is of an interesting and useful description.

IMPORT TRADE STATISTICS OF SWITZERLAND.

THE following figures of the imports of electrical and similar goods into Switzerland in the year 1912 are taken from the recently issued official trade statistics; the figures for 1911 are added for purposes of comparison, and notes of increases or decreases are given. Attention should be called particularly to the predominant position of German trade as contrasted with the practically insignificant British share in most lines:—

	1911. Francs.	1912. Francs.	Inc. or dec. Francs.
Electric cable not insulated.—			
From Germany	28,000	37,000	+ 9,000
,, France	19,000	3,000	− 16,000
,, Other countries ...	—	1,000	+ 1,000
Total ...	47,000	41,000	− 6,000
Electric cable insulated with rubber or paper.—			
From Germany	90,000	145,000	+ 55,000
,, Great Britain ...	5,000	5,000	—
,, Other countries ...	14,000	19,000	+ 5,000
Total ...	109,000	169,000	+ 60,000
Cable ditto covered with lead.—			
From Austria	43,000	68,000	+ 25,000
,, Germany	2,000	2,000	—
Total ...	45,000	70,000	+ 25,000
Cable insulated with rubber or paper and covered with textiles.—			
From Germany	192,000	314,000	+ 122,000
,, Other countries ...	18,000	15,000	− 3,000
Total ...	210,000	329,000	+ 119,000
Cable ditto covered with lead.—			
From Germany	95,000	32,000	− 63,000
,, Austria	—	57,000	+ 57,000
,, Other countries ...	5,000	2,000	− 3,000
Total ...	100,000	91,000	− 9,000
Steam boilers of iron or steel.—			
From Germany	1,995,000	2,624,000	+ 629,000
,, France	177,000	226,000	+ 49,000
,, Belgium	24,000	10,000	− 14,000
,, Great Britain ...	31,000	25,000	− 6,000
,, Other countries ...	22,000	45,000	+ 23,000
Total ...	2,249,000	2,930,000	+ 681,000
Dynamo-electric machines and electric transformers.—			
From Germany	921,000	1,361,000	+ 440,000
,, France	38,000	45,000	+ 7,000
,, Italy	23,000	38,000	+ 15,000
,, Great Britain ...	3,000	16,000	+ 13,000
,, Other countries ...	32,000	19,000	− 13,000
Total ...	1,017,000	1,479,000	+ 462,000
Hydraulic and wind motors and pumps.—			
From Germany	679,000	727,000	+ 48,000
,, Austria	40,000	13,000	− 27,000
,, France	32,000	43,000	+ 11,000
,, Italy	35,000	28,000	− 7,000
,, Great Britain ...	4,000	14,000	+ 10,000
,, United States ...	20,000	16,000	− 4,000
,, Other countries ...	10,000	7,000	− 3,000
Total ...	820,000	848,000	+ 28,000
Steam engines, locomobiles, steam turbines, etc.—			
From Germany	228,000	437,000	+ 209,000
,, France	10,000	41,000	+ 31,000
,, Great Britain ...	55,000	71,000	+ 16,000
,, Other countries ...	7,000	6,000	− 1,000
Total ...	300,000	555,000	+ 255,000
Gas, petrol, benzine, etc., motors.—			
From Germany	192,000	306,000	+ 114,000
,, France	180,000	123,000	− 57,000
,, Italy	13,000	36,000	+ 23,000
,, Great Britain ...	17,000	11,000	− 6,000
,, United States ...	50,000	35,000	− 15,000
,, Other countries ...	15,000	20,000	+ 5,000
Total ...	467,000	531,000	+ 64,000
Accumulators, batteries, electrodes.—			
From Germany	196,000	244,000	+ 48,000
,, Austria	48,000	77,000	+ 29,000
,, France	37,000	31,000	− 6,000
,, Other countries ...	16,000	8,000	− 8,000
Total ...	297,000	360,000	+ 63,000
Insulators, mounted.—			
From Germany	60,000	93,000	+ 33,000
,, France	3,000	2,000	− 1,000
,, Other countries ...	2,000	3,000	+ 1,000
Total ...	65,000	98,000	+ 33,000
Electric meters.—			
From Germany	1,108,000	970,000	− 138,000
,, France	67,000	104,000	+ 37,000
,, Italy	21,000	10,000	− 11,000
,, Great Britain ...	10,000	3,000	− 7,000
,, United States ...	14,000	5,000	− 9,000
,, Other countries ...	20,000	17,000	− 3,000
Total ...	1,240,000	1,109,000	− 131,000
Telegraph and telephone apparatus.—			
From Germany	300,000	348,000	+ 48,000
,, Belgium	165,000	297,000	+ 132,000
,, Great Britain ...	68,000	19,000	− 49,000
,, Sweden	20,000	44,000	+ 24,000
,, Other countries ...	36,000	16,000	− 20,000
Total ...	589,000	724,000	+ 135,000

NOTE.—25 francs = £1.

GERMAN RULES FOR ELECTRICAL INSTALLATIONS.

THE outstanding feature of the revised rules proposed by the V.D.E. for application to the erection and operation of light and power installations lies in the inclusion of clauses minimising the danger to which operators are exposed, by requiring liberal clearances between and insulation of accessible live parts; discouraging the use of inaccessible connections; and requiring the provision of indicating plates and devices (specifying the nature of current carried by apparatus and showing whether the latter is live) and improved permanent or emergency earthing arrangements. Space limitations forbid a complete review of the new rules, but in the following paragraphs are summarised a few of the more important and particular new clauses; those of more general application, which are covered by the above indication of scope, are perforce omitted from further mention.*

Throughout, the rules are intended to secure that live parts in general and high-tension parts in particular may be inaccessible when possible to workers and others, and that when such parts are necessarily accessible they may be adequately insulated or screened. Great emphasis is laid upon the desirability of admitting only thoroughly reliable and competent men to high-tension enclosures and test rooms, etc., of instructing these men in the risks to which they are exposed and the precautions which they should observe, and of providing adequate inter-locking devices, pilot lamps and other safeguards, including warning tablets and distinctive markings, in and on high-tension enclosures, apparatus and the switchgear controlling supply thereto. Stress is laid upon the importance of earthing thoroughly all metal parts which cannot be insulated but which may become live.

Lacquering or enamelling is not to be taken as sufficient insulation to protect against shock. High-tension insulating materials must be damp-proof if solid, and suitably impregnated if of fibrous or porous material. In low-voltage networks, the leakage current between any two fuses or behind the last fuse must not exceed one milliampere under working pressure, *i.e.*, the insulation resistance of each line section and distribution board must be at least 1,000 ohms per 1-volt working pressure.

Bare H.T. lines must be separated from other lines, walls or

* A complete draft of the new rules is to be found in the *E.T.Z.*, pp. 46-50; 71-76: 1914.

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protective coverings by the following minimum distances:—Up to 1,000 v., 2in.; 3,000 v., 3in.; 6,000 v., 4 in.; 12,000 v., 5 in.; 24,000 v., 7 in.; 35,000 v., 9½ in. The voltage refers to that between lines in the circuit concerned. Outside buildings, H.T. lines must clear walls by at least 1 CM. (.4 in.) per 1,000 v. with a minimum of 4 in. Insulated conductors for pressures exceeding 1,000 v. must be spaced at the distances stipulated for bare wires if they are laid on bells, rollers, etc., without protection of their insulation against weathering; below 1,000 v., 2 CM. spacing is sufficient.

Overhead high-tension lines must be bare except for suitable painting where corrosion is to be prevented. In buildings, bare H.T. wires are admissible only at contact lines (outside electric power houses and battery rooms) and must be fitted with isolating switches. Iron or reinforced concrete masts and anchor wires must be earthed and earthed line-guard rings or nets must be provided under specified conditions.

New rules applying to accumulator batteries prescribe that cells be insulated from their stands and the latter from earth by non-hygroscopic supports. It must be impossible to touch live parts at more than 250 v. P.D. during attendance on the cells. Insulated footplates must be provided round high-tension batteries, and it is recommended that batteries working at 1,000 v. or higher pressure above earth be divided by section switches into 500 v. groups. Celluloid may not be used for battery cases or outside the electrolyte in cells for higher pressures than 16 v.

The minimum distance between walls and bare live parts on switchboards, etc., is fixed at 3½ ft. in low-voltage and 5 ft. in high-tension installations. If such parts are at a normally accessible height on both sides of a gangway, they should be at least 6½ ft. apart horizontally. High-tension parts in gangways should be specially protected if within 8½ ft. from the ground. Special rules apply to the making and safeguarding of connections on boards to which there is no back access.

Pressures exceeding 250 v. are not permissible in hand apparatus of 0.5 KW. or smaller capacity. Handles should be of insulating material where possible, and if controlling higher pressure than 1,000 volts, a permanently earthed link should be provided between handle and apparatus. Leakage currents over insulators must be earthed.

High-tension oil switches in circuits liable to 5,000 amps. or heavier short-circuit currents must be placed behind a wall protecting attendants from possible flame and burning oil. Current-carrying parts in starters and rheostats must be protected by fireproof material, mounted on fireproof supports and located away from inflammable material; this rule does not apply absolutely to electric power houses and sub-stations, etc. Plugs must be designed so that they cannot be inserted in circuits carrying higher current and voltage than those for which the plugs are designed; in high-tension circuits, it must be impossible to make or break plug or other temporary connections while either part is live.

Conductors must be of adequate mechanical strength and insulated copper wires and cords are rated as follows (abstract):—

Section. Sq. mm.	Current. Amps.	Corresponding nominal rating for fuses. Amps.
0.5	7.5	6
1.0	11	6
10	43	35
50	160	125
500	760	600
1,000	1,250	1,000

Bare copper wires up to 50 sq. mm. are subject to the same rating; larger wires and all overhead wires are subject merely to the stipulation of reasonable temperature rise. The smallest permissible copper conductor sections are:—Wires to and in lighting fittings, 0.5 sq. mm.; pendant cords, 0.75 sq. mm.; insulated wires laid in pipes or on insulators not more than 3½ft. apart or for portable use, 1.0 sq. mm.; insulated or bare wires in buildings or open for which points of suspension are more than 3½ ft. apart, 4 sq. mm.; overhead lines, 10 sq. mm. Fuses of soft, plastic metals and alloys must be provided with contact lugs of copper or other suitable metal. Multiple fuses and repaired plug fuses are not sanctioned.

In high-tension circuits, accessible glow lamps and fittings are permissible only for direct current and for pressures up to 1,000 volts. High-tension leads may not be used to suspend arc lamps and in such cases the lamp must be insulated from the insulating wire or chain and the latter from its support (if of metal) or both rope and carrier may be earthed; if the circuit pressure exceeds 1,000 v., both safeguards must be provided. Further, such arc lamps must be inaccessible during working and their circuits must include isolating switches. The clear diameter of tubes or cavities through which two leads are to pass in lamp fittings must be at least ¼ in. in low-voltage and ½ in. in high-voltage apparatus. Pipes laid under plaster must have at least 0.45 in. internal diameter (0.65 in. in H.T. circuits) if intended to accommodate more than one wire. Pendant fittings and hand lamps are inadmissible in high-tension circuits.

Others of the new rules apply to special provisions and exemptions to be made and precautions to be observed in special situations and installations, among which are electric power houses, accumulator rooms, damp situations, chemical works, places where explosion risks are present, shop windows, warehouses, testing laboratories, theatres and other public buildings.

The rules for the operation of heavy current installations are similarly arranged and demand little more than those provisions and precautions which ordinary experience and practice show to be desirable and which, in the absence of definite regulations, are so apt to be neglected from time to time. Finally, there is presented a most convenient and useful collection of signs and symbols to be used in denoting various circuits, instruments and apparatus. Nothing less than complete reproduction of this scheme would be of service, but the latter certainly deserves to be better known. A fundamental convention greatly simplifying complex wiring diagrams is the use of single lines to represent two or three-wire circuits, the actual number of conductors being indicated by double or treble dots on the apparatus diagrams and double or treble cross lines on the single conductor-lines, regulating switch handles and so forth. The German original is well worth the careful study of all interested.

ELECTRICAL WORK AT THE NATIONAL PHYSICAL LABORATORY DURING 1913.

A LARGE number of absolute measurements of resistance were made during 1913 with the Lorenz apparatus in the Physics Department of the National Physical Laboratory. The following table summarises the results obtained from resistances nominally of 0.001, 0.002 and 0.01 ohms:—

Lorenz coils used.	Nominal value.	Resistance. Absolute measure cm./sec.	International ohms.	Difference. Parts in 100,000 (Abs.-Int. × 10^9).
1, 2, 3, 4	0·001 ohm.	100091_6	$100039_3 \times 10^9$	$52·_3$
,,	0·01 ,,	$10009\,0_{10}$	$100038_3 \times 10_8$	$51·_8$
,,	0·002 ,,	Standard varied slightly		$53·_1$
1, 2	0·001 ,,	100090_4	$100039_3 \times 10_9$	$51·_1$
3, 4	0·001 ,,	100091_6	$100039_3 \times 10_9$	$52·_5$
				Mean = $52·_2$

A resistance of one International ohm is therefore 1.00052 ohms (10^9 cm./sec.); the probable error in the value 1.00052 is about four parts in 100,000. The length of the mercury column at 0°C. which has a resistance of one ohm is 106.245 ± 0.004 cm., the cross section being the same as that of a mercury column 106.3 long having a resistance of one International ohm. The whole Lorenz apparatus is in a very satisfactory condition.

In some of the absolute measurements of current made during the year the current was maintained constant and its value calculated from the weights used to maintain equilibrium in the current-weigher. In other measurements the current was allowed to vary, its mean value being calculated from the change in period of the balance. Current circulated in the coils so as to produce large increase or decrease in the restoring force but no change in the equilibrium position. This way of using a current weigher adds to the value of the instrument since direct determination of the electro-chemical equivalent of a substance may be made without maintaining a constant current.

Eight hermetically-sealed 1 ohm manganin coils were dispatched in July, 1913, to the Laboratoire Central d'Electricité, the Physikalisch-Technische Reichsanstalt, the Bureau of Weights and Measures (St. Petersburg) and the Bureau of Standards (Washington) for comparison with the resistance standards of these institutions. P.-T.R. values were 19 and 16 parts in 1,000,000 less than the N.P.L. values; the Bureau of Standards values were 7 parts in 1,000,000 greater; and the St. Petersburg values were 3 and 7 parts in 1,000,000 greater than the N.P.L. values. French mercury standards are not yet complete, but the standards maintained at the L.C.d'E. are known to agree with N.P.L. standards within 1 part in 100,000. Resistance measurements may therefore be regarded as being on the same basis the world over.

In 1911 Dr. Schuster suggested a new type of magnetometer by which any horizontal component of the earth's field could be compared with the field produced at a certain point by current flowing through coils of known dimensions. Preliminary experiments indicate that values of H can be measured with a probable error not exceeding 1 part in 100,000 of the C.G.S. unit, the time necessary for a measurement being about four minutes. A precision instrument will be built in the Laboratory workshops.

Present magnetic disturbances due to electric tramcars can be coped with, but any additional disturbance may greatly increase the difficulty of making precise electrical and magnetic measurements. Two recording instruments have been erected in a non-magnetic hut to measure changes in the horizontal component of the earth's field and in the declination. Records show that the present sudden variations in H are of the order of 5 γ; very sudden changes in declination (exceeding 2′ of arc) have not been observed.

The equilibrium of the Weston normal cell has been studied to obtain a satisfactory explanation of the hysteresis phenomena first mentioned in the 1911 B.A. Report. Investigation of the hydrolysis of mercury sulphate has confirmed the work of

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Gouy and shows that hydrolysis can be prevented by adding 1 part of sulphuric acid to 10,000 of water. A new method has been used to determine the solubility of mercurous sulphate solution in water and in cadmium sulphate solutions. Mercurous sulphate solution is contained in one limb of a cell, the E.M.F. of which is measured as titration proceeds. When mercury ions practically vanish from the solution there is a sudden change in the E.M.F. of the cell. By plotting E.M.F. against volume of titrating liquid, the amount required for complete precipitation of mercury is obtained.

Experiments on dielectric losses in condensers have now been extended to frequencies (at least 1,000,000 cycles) covering the range which has so much practical importance in wireless telegraphy. With well-dried castor oil as dielectric, the power factor is 0.0005 at 800 cycles but 0.038 at 1,000,000 cycles per second, and this increase in the power losses at high frequencies makes castor oil unsuitable for condensers to be used in wireless telegraphy, particularly as the oil has a high temperature coefficient (about − 0.3 per cent. per 1°C.). Well-dried petroleum behaves well as regards temperature coefficient and high-frequency dielectric loss. Mica condensers are also very good, but their temperature coefficient, though small, is much greater at 25°C. than at 10°C.

Three mutual inductometers have been constructed, the range of inductance measurement now running from 10^{-9} henry up to over 1,000 henries. Moving coil vibration galvanometers have been constructed with unifilar torsional control and coils of low effective resistance. Combination of the latter with high sensitivity gives increased accuracy in measuring small inductances such as occur in small coils and single loops used in radiotelegraphy. The constants of more than 350 wavemeter coils were evaluated at a number of different frequencies; in a few cases, instruments were tested up to 6,000 metres wave length.

Much work was done in decrement and high-frequency resistance measurements. The determination of radiotelegraphic efficiency depends largely on decrement measurements. The high-frequency effective resistances of coils with solid and stranded wire were determined by direct power measurements; the results corroborated Lindemann's discovery that, at certain frequencies, solid are better than stranded conductors. Further experiments are in progress.

Commercial frequency meters have been calibrated from 300 up to 800 cycles per second by aid of a Duddell singing arc and standard tuning forks.

Photometric investigations indicate that new values for the laboratory electric sub-standard lamps (in terms of the pentane lamp) will agree very closely with the determination made ten years ago. The reliability of the later sub-standards (1.5 watts per mean horizontal candle) has been fairly well demonstrated. An accuracy of 0.25 per cent. can be ascribed to the international intercomparison of high-efficiency light standards, the final value ratios being :—Reichsanstalt/.(N.P.L. × 0.9) = 1.00 ; Bureau of Standards/N.P.L. = 0.99 ; Laboratoire Central/N.P.L. = 0.99 .

At the request of the Local Government Board, an investigation has been undertaken to see if anything can be done to mitigate the nuisance of dazzle produced by motor car headlights. It being impracticable to reduce the general intensity of the beam, experiments have been made with acetylene and electric headlamps adapted to produce beams in which the upper right hand portion (as seen from behind the lamp) is blotted out. This leaves the driver with light to the full height on his left hand side and below the horizontal for the full width of the road. Provided such lamps are mounted correctly, they are satisfactory to the driver and of marked advantage to on-coming traffic. Unless fitted with louvres, parabolic lamps are not so easy to deal with as those constructed on the lens-mirror principle.

An account of work undertaken for the Departmental Committee on Industrial Lighting will be embodied in the Committee's Report. The bureau of the International Illumination Commission is at the Laboratory, Mr. Paterson being Hon. Secretary. An investigation which promises to lead to interesting and useful results is one on the constants of diffusing surfaces and media and methods of measuring them. Knowing these constants, it is possible to determine the coefficient of reflection of materials by direct measurement of surface brightness using illumination photometers.

An apparatus has been built and used successfully to spin large sources of light and facilitate the measurement of their curves of mean candle-power distribution. Arc lamps must be rotated slowly, but 3,000 C.P. nitrogen lamps may be rotated as rapidly as desired.

The testing of A.C. wattmeters and watt-hour meters has been an important and growing part of the work of the Electrotechnics Department. Many of the instruments being for use in official tests, the disposal of bonus and penalty sums depended on the results of such calibrations. The apparatus described by Paterson, Rayner and Kinnes (I.E.E., May, 1913) has been used practically to its full capacity and improvements in detail have been made to expedite testing.

A special switch designed for use in 20,000-volt circuits has been completed to permit watt and watt-hour meters to be tested with current and potential transformers complete (as used in practice). New 500-ampere and other 2,000-ampere water-tube resistances are being built to permit three-phase meter testing at higher currents than heretofore.

Heating tests on field coils have shown that impregnating coils of cotton-covered wire after winding, generally produces appreciable reduction of the internal temperature gradient. The use of a protective covering of tape or other material may be expected to increase the internal temperature by 15°C.

The capacity of the large battery used for heavy-current D.C. testing has fallen to about 70 per cent. of the original capacity, due to deterioration of the negative plates. The positive plates are expected to last for some years longer.

The insulation resistance of the ebonite tops of the large resistance bridge and standard coils (used for commercial tests) has deteriorated badly. The coils have therefore been remounted in oil-filled hermetically-sealed brass cases; connection is made to mercury cups as well as to terminals. The present plug contacts in the bridge are to be replaced by dial switches mounted on ebonite and protected by a metal cover.

The resistance of steel conductor rails is usually specified in terms of copper, comparison being made sometimes between rails of equal length and weight, sometimes between rails of equal length and section. Steel rails are invariably bought by their weight per yard and it is hoped, in co-operation with the Engineering Standards Committee, to arrive at a specification permitting ready comparisons of conductivity of rails of different weight, resistance being measured and quoted in ohms or microhms. Tables of conversion and correction factors have been prepared connecting values obtained by the old and new methods. Resistance measurements and chemical analyses show that (in the samples tested) the resistance of steel rails varies in the same direction as, and the temperature coefficient in the opposite direction to, the total amount of impurities present.

The work in hand for the Wiring Rules Committee of the I.E.E. has made good progress during the year. A report has been presented concerning the heating of flex used with heating apparatus. Experiments relating to high temperature deterioration of standard cables show that slight difference in quality of the insulating material may lead to widely different results, hence the search will have to be extended to include all qualities of rubber, paper and oil used for insulating cables.

Arrangements have been made for investigations on the heating of buried cables to be carried out in eleven different towns, selected to include different sizes of cable and to cover practically all the systems of laying mains at present in use. Winter tests are to be made under normal load and summer tests with a special testing load. The scheme of tests to be made at these towns and the laying and testing of experimental mains at the Laboratory have been approved by the I.E.E., and it is hoped that experimental work will soon be commenced.

Last year's work on the emission of electricity from metals has been continued with a view to ascertaining to what extent the phenomena observed on a somewhat large scale with carbon can be reproduced with other substances. The metals employed were mostly in the form of strips 5 mm. wide × 50 mm. between clamps, the hot emitting area being about 4 sq. cm. Currents used to heat the strips varied from 50 to 250 amps, and the voltage from 0.5 to 5 volts. Iridium, platinum, iron, tantalum, nickel, copper and brass were tested, the strip being generally surrounded by nitrogen at reduced pressure. From the preliminary experiments conducted it appears that emission of positive electricity occurs at temperatures from 1,000° to 1,400°C. A sudden marked increase occurs at the liquefying points of metals melting within this range, probably due to sudden release of occluded gas. The positive emission is apparently augmented by presence of oxygen. At higher temperature, negative electricity predominates and increases rapidly with the temperature. The negative current attained with iridium at the melting point was 0.08 amp.; with tantalum at 1,670°C., 220 micro-amps.; and with iron at the melting point, 90 micro-amps. Probably these negative currents are a consequence of some reaction between the metal and surrounding gas. These results, in which currents were obtained without the usual applied potential, have a bearing on the question of electron emission from metals at high temperature. During experiments on the electrical emissivity of alkaline earths and other materials, when raised suddenly to the high temperature (2,000-2,500°C.) possible in a carbon resistance furnace, very large ionisation currents were obtained.

At the request of the Geodetic Survey of India, an apparatus has been designed to measure air temperatures within 0.1°C. at intervals of 15 ft. up to 150 ft. above ground (thus making possible approximate correction for air refraction in geodetic survey work). Ten appropriately spaced platinum resistance thermometers are connected by manganin wires in series with each other and with a standard manganin resistance. Potential leads are taken from the ends of each thermometer to a selector key and portable potentiometer. The potential drop over the constant resistance and the drop over each thermometer make possible easy determination of the temperature of the latter. Arrangements are made for screening the thermometers from solar and terrestrial radiation by double screens of aluminium painted balloon fabric which permit free air circulation to the wires.

It is expected that the revised specification for bayonet lamp holders will soon be issued. A series of "Not-go" cylindrical gauges (not included in the provisional draft specification) is considered necessary for the screwed part of the holder.

Measurements on 13 sparking plugs and four sets of taps show diametral dimensions about 0.2 mm. smaller than those given in E.S.C. Report No. 45. Measurements on the hexagons, barrel, etc., of the plugs have been tabulated.

The Laboratory Report includes a list of papers published by members of the staff and a summary of work proposed for the current year.

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THE "POINT FIVE" ASSOCIATION.

AT the meeting of this association at Birmingham, on June 18th, the chairman, Mr. ALLEN, of Wolverhampton, briefly reviewed the work accomplished by the members.

He asked were they aiding the manufacturers to decide upon what particular type of any piece of domestic apparatus was most suitable to the general body of users, and in what manner could they further the standardisation of apparatus, which must ultimately benefit them and the industry generally by cheapening the apparatus under consideration. It had been suggested that a central bureau might be established to test and report upon cooking, heating and other domestic apparatus. In his opinion the strongest bureau which could possibly be established was already in existence, and had for its working committee the members of the Point Five Association, because they were themselves handling such a large proportion of such apparatus. A central testing laboratory was far from satisfactory, and its staff was bound to get prejudiced opinions sooner or later. One of the most important things tending to set back progress in the general use of cooking and heating apparatus was the lack of the necessary power to hire out apparatus. Those undertakings which possessed powers had been able with a suitable tariff to increase their business enormously, with considerable advantage both to the consumer and to the electrical contractor. In Wolverhampton they had full powers. The tariff came into operation last autumn, and during the first six months the number of private house installations connected was three times as many as the number during the same period of the year previously, and they had supplied on hire just 500 KW. of heating and cooking apparatus. From other members he found that since the "point five" tariffs have been in vogue, connections for about 10,000 KW. had been made, and that about 7,000 KW. of cooking and heating apparatus had been connected up in private houses. The greater part of the cooking and heating apparatus comprising the 7,000 KW. was hired by the consumers, and were it not for the hiring facilities, the thousands of householders would never have been connected at all, much to the loss of the manufacturers, the supply undertakings, and to the wiring contractors who carried out more than three quarters of the necessary wiring work. There was a tariff question which would probably have to be considered by several members before long, and that was—How should electric car battery supply be charged to those domestic consumers now enjoying the "point five" tariff? He saw no reason why such a demand could not be treated separately on the differential system of charging with the units used charged at a halfpenny per unit. The fixed amount per annum would not be so easily determined as that due to a lighting supply.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Type Current Transformers.

Messrs. Vedovelli, Priestley & Co., Paris, whose agents are MESSRS. LAING, WHARTON, LTD., 7, Great Newport Street, W.C., have recently brought out a type of current transformer, which is claimed to overcome all the troubles usually met with in this apparatus, and to combine with these properties high accuracy and

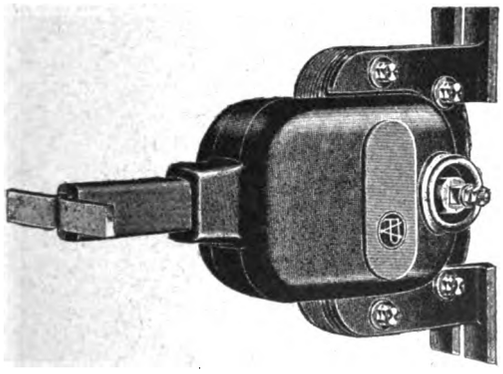

FIG. 1.—COIL TYPE CURRENT TRANSFORMER.

low first cost. This type of transformer is shown in figs. 1 and 2, illustrating the coil type and straight-through bar type, suitable for slipping over bus-bars or cables where large currents are involved.

A feature of this transformer is that a special insulating material, with high insulation properties, is moulded under pressure round the windings and core of the transformer, thus forming both an electrical and mechanical clothing.

It is due to the high qualities of this material that such success has been obtained, these qualities being enumerated as follows:—

1 cm. thickness will withstand a pressure of 60,000 volts; it is extremely hard, and mechanically very strong, and begins to slightly soften internally at a temperature of 120° C. at the end of one hour.

It is non-hygroscopic, and the transformer can be immersed in water without damage to same.

It is impossible for the transformer windings to become displaced due to electro-magnetic forces caused by short-circuit, as the windings are embedded in the material moulded round them, and due to the thorough exclusion of air, no ozonisation and decay of the windings takes place.

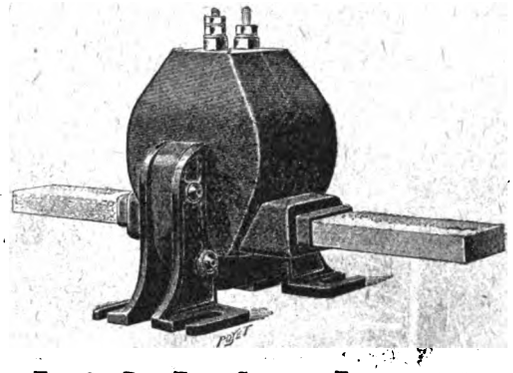

FIG. 2.—BAR TYPE CURRENT TRANSFORMER.

The accuracy of the transformers is extremely high.

The transformers are made in four sizes, having capacities at 50 cycles of 20, 50 and 250 volt-amperes respectively.

Up to the present they have been constructed up to 5,000 volts pressure, and are now in the course of manufacture for a working pressure of 110,000 volts between phases and a test pressure of 250,000 volts.

In no single instance has a breakdown been experienced, although some transformers have now been in service for a period extending over four years.

Ironclad Switches and Adapters.

MESSRS. G. F. NEWNHAM & CO., of 7A, Shirley Road, Acock's Green, Birmingham, have just placed on the market a type of ironclad switch for conduit work, the design of which, we understand, is based on certain suggestions contained in our own columns.

The switch (shown in fig. 3) is constructed with a separate English china base to each pole, and a fire-proof division between them.

The case is of cast iron, stove enammelled black, fitted with an

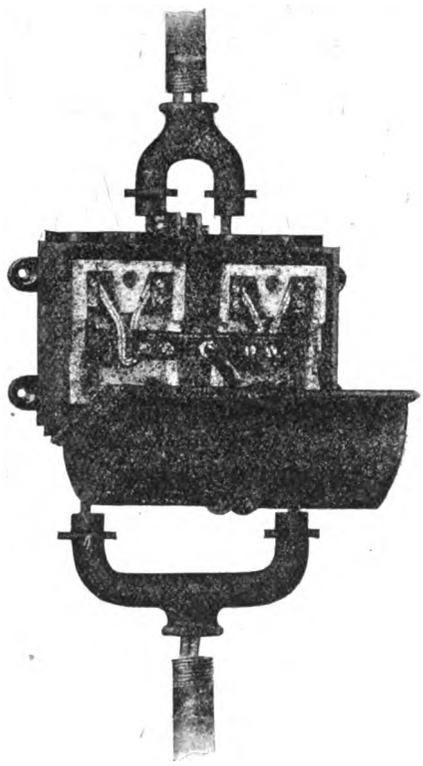

FIG. 3.—IRONCLAD SWITCH WITH ADAPTERS.

earthing screw and provided with bosses, which can be tapped for conduit, either four holes at top or two each at top and bottom.

The switch cover is lined with insulating non-hygroscopic compound. Malleable iron black enamelled adapters are supplied to suit the switches, tapped and screwed for ¾ in. conduit.

The nipples are arranged to slip into clear holes drilled in the switch case and are held by screws, thus providing perfect continuity. The switches can be adapted for wooden bushes if desired, and are rated at up to 12 amperes and 600 volts.

The "Marvel" Cooker.

THE FIRELESS COOKER CO., of Horton Street, Lyng, West Bromwich, send us particulars of their Marvel cooking outfit, which we illustrate in fig. 4. This includes an oven measuring 15 in.

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× 9½ in. × 10½ in., an 8½ in. hot plate and a steamer with copper bottom to fit over it.

The oven is of sheet steel, well lagged, and provided with a movable rack and lined at the sides and back with aluminium. The heating elements are bolted to cast-iron detachable plates at

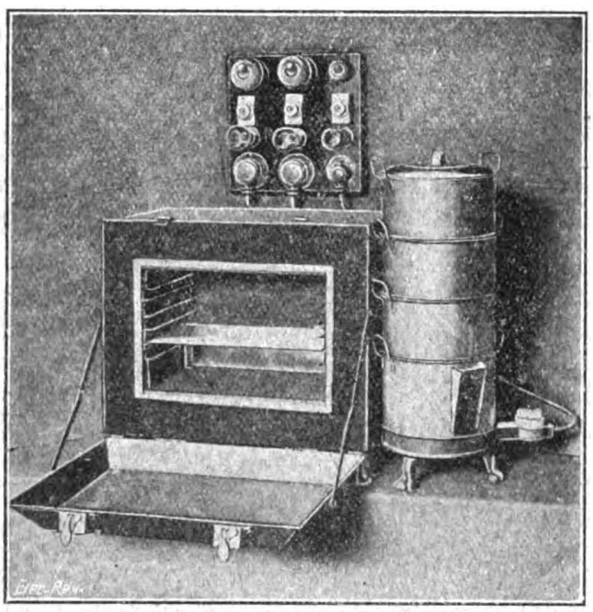

FIG. 4.—"MARVEL" COOKING OUTFIT.

top and bottom. The hot plate has two heat regulations and a small hot cupboard can be supplied to fit under it. A switchboard of polished teak with china switches, Zed fuses, and pilot lights is provided, with cable connections run in flexible metallic tubing to the heaters.

Provision for earthing either by plugs, as shown in our view, or otherwise, is made. The outfit is claimed to be exceedingly economical in use, and is supplied in various sizes to suit usual requirements.

Ozone Generators.

Several new types of ozone generators have recently been designed by MR. C. W. DENNY, of 39, Oakley Crescent, Chelsea, S.W., and include apparatus for the purification of air and the sterilisation of water. Fig. 5 shows a portable fan oxoniser for the purification of air, and fig. 7 a small domestic type water steriliser, in section.

A novel feature in the design of this class of apparatus is the concentric tubular electrodes, which are shown mounted on a triangular spider in fig. 5. The inner tube has a specially prepared surface to facilitate the high-tension brush discharge; the air to be ozonised passes through an annular space between the two metal electrodes or tubes, which are in turn firmly mounted in conjunction with a micanite insulating tube.

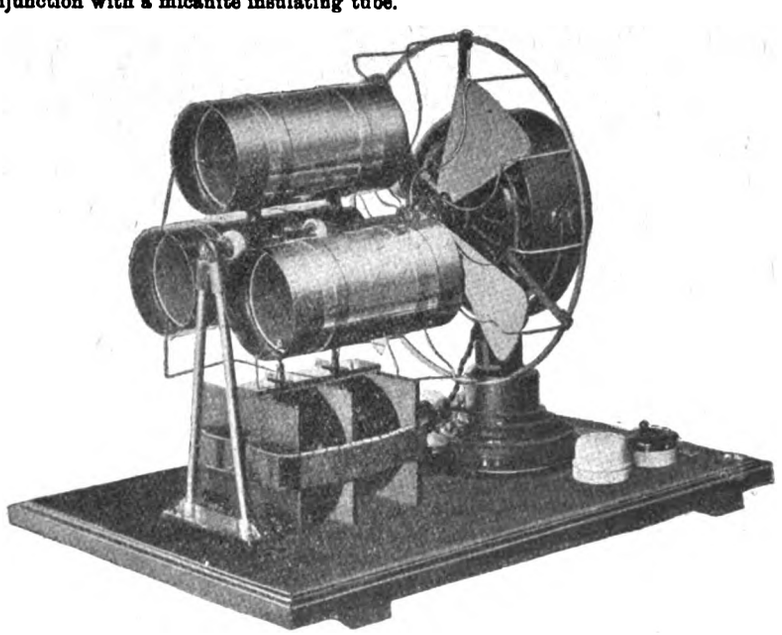

FIG. 5.—SMALL PORTABLE OZONISER.

The water sterilising apparatus in fig. 7 is fitted with similar electrodes to those in fig. 5, but in this case they are all mounted concentrically. The highly ozonised air is drawn into the water pipe on the injector principle and thoroughly mixed with the water in the mixing ball or chamber below. The water is then ready for consumption.

We understand that exhaustive tests on this class of ozoniser have been carried out by the Faraday House laboratories, which give very promising results, the concentration of ozone from one of the ozonising cylinders being as high as 71 parts per million; moreover, no nitrous oxides are produced.

Electric Candlestick.

We illustrate in fig. 6 a new and handy electric candlestick which is fitted with its own battery placed in the base. Access to the battery is provided by removing a metal footplate which is turned for opening by a key. The lamp is lighted by raising the

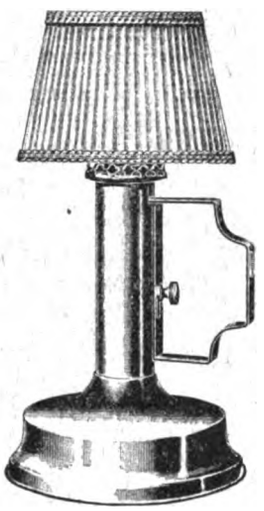

FIG. 6.—SELF-CONTAINED ELECTRIC CANDLESTICK.

handle and tightening the screw shown in the illustration. There is a hole in the handle so that the lamp may be fitted on a wall-hook. This candlestick fitting is a useful and inexpensive little novelty, and can be obtained from MESSRS. LIGHTING SUPPLIES, LTD., of 36, Commercial Road, London, E.

B.T.H. Aluminium Lightning Arresters.

We have received from the BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, particulars of their latest aluminium lightning arresters, one of which is shown in cross-section in fig. 8. The

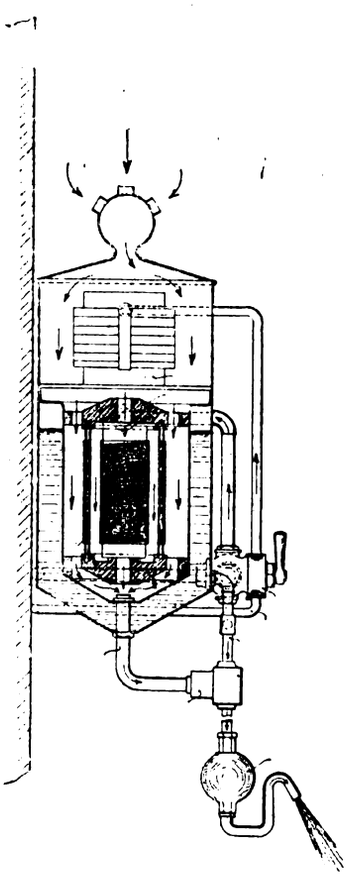

FIG. 7.—SECTION OF DENNY WATER STERILISER.

arrester consists of a series of concentric inverted cones placed one above another, with the electrolyte between them, the whole being immersed in a tank of oil. The tank is of steel, with welded seams, and has a metal cover. An insulating cylinder surrounds the upper part of the stack of cones, and improves the circulation of the oil, while preventing failure of insulation between the cones

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and the case. For a three-phase system four stacks are provided, connected together at the base; three are connected at the top to the lines through horn gap arresters, while the fourth is connected to earth, so that there are always two stacks in series between lines, and two between any line and earth. As the cells have to be "charged" for a few seconds daily, to renew the film of hydroxide

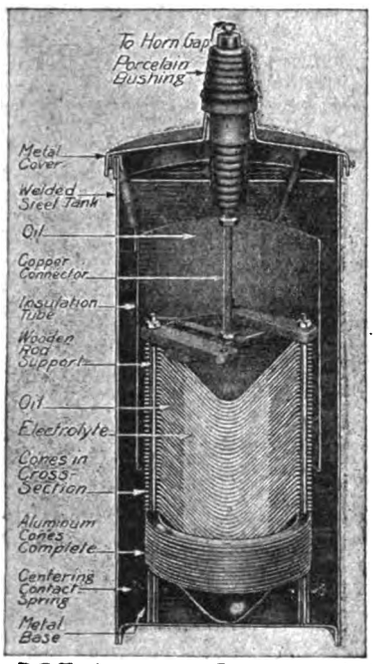


FIG. 8.—B.T.H. ALUMINIUM LIGHTNING ARRESTER.

on which their action depends, the horn gaps are modified to enable this to be done from the line with ease. Fig. 9 shows a standard horn gap for a 6,600-volt arrester, fitted with a charging resistance to limit the current, and a short-circuiting contact which can be actuated with safety. For higher voltages a rather more elaborate device is employed, having an auxiliary horn. Provision is also made for interchanging the earth stack with one of the line stacks during the charging operation, so that the films of all the

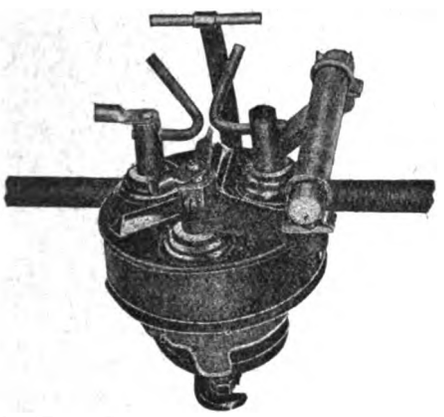


FIG. 9.—HORN GAP, WITH CHARGING RESISTANCE, &c.

cells can be formed up to the same value. No alteration is made in the setting of the horns during the charging operation, the present designs being an improvement on their forerunners in this respect. A special electrolyte is supplied for arresters that are used in climates where freezing has to be provided against.

Other devices used in conjunction with the arresters are charging-current indicators, which show the condition of the cells, and choke coils. These and other features of the B.T.H. arresters are described in List No. 4,505, recently issued.

Two New Vacuum Cleaners.

MESSRS. DUNCAN WATSON & CO., of 62, Berners Street, W., have recently introduced two new vacuum cleaners to the English market, known as the "Apex" and "Cleveland" respectively, and illustrated in figs. 10 and 11. The striking feature of these machines, which are excellently finished in every detail, is their low price—roughly two-thirds the cost of similar machines in use here.

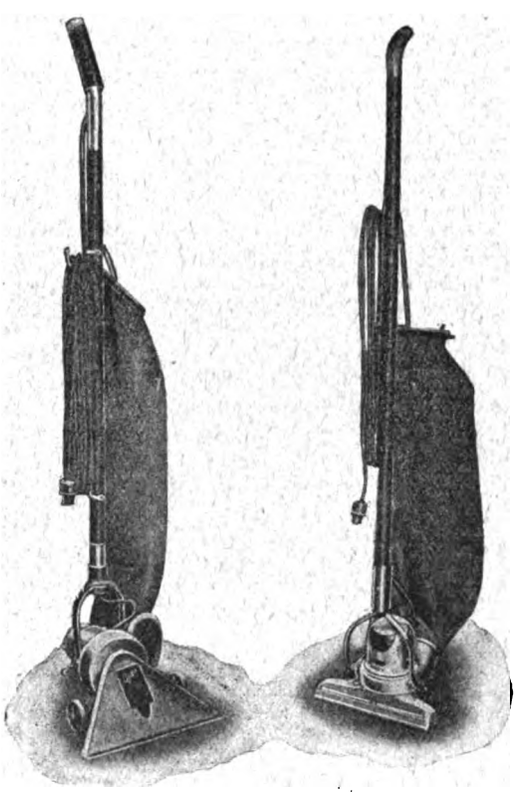
The Cleveland weighs about 9 lb. and is fitted with a small vertical motor, of universal type, suited for either A.C. or D.C., and fitted with bearings having oil reservoirs, containing felt pads for holding the oil. A special Hart turn switch is contained in the handle.

A small rotary brush is fitted in the suction orifice to pick up fluff and cotton, and to use the various accessories, a special hose attachment can be plugged in either above or below the fan casing, providing either air blast or suction.

The Apex machine weighs about 1 lb. extra and costs rather more; it is fitted with a horizontal motor for either A.C. or D.C. and a divided splayed suction orifice, to which a small rotary brush attachment can be fixed.

Both machines run on small wheels, the Apex, however, has an adjustment to the back wheel which regulates the nearness of the suction nozzle to the floor.

In both machines the dust bag is provided with an inner tube to prevent the dust from falling back into the machine.



FIGS. 10 AND 11.—THE APEX AND CLEVELAND VACUUM CLEANERS.

Amongst the accessories, the length of suction hose has strong rubber connecting pieces at either end, and included are a solid steel handle, renovator, wall brush, &c. Either machine is rated at 100 watts and supplied with 18 ft. of flex.

The machines have been tested by Messrs. Duncan Watson against the numerous other standard types which they stock and certainly appear to lack nothing either in finish or performance by comparison with more expensive models.

"Universal" Electric Grill.

The accompanying illustration, fig. 12, shows the B. & T.K. "Universal" electric grill, introduced by the BROMPTON AND KENSINGTON ACCESSORIES CO., LTD., of 254, Earl's Court Road, S.W. It is adapted to a remarkably wide range of uses; it has a heating surface of 7⅛ in. × 4½ in., and it will boil, make toast

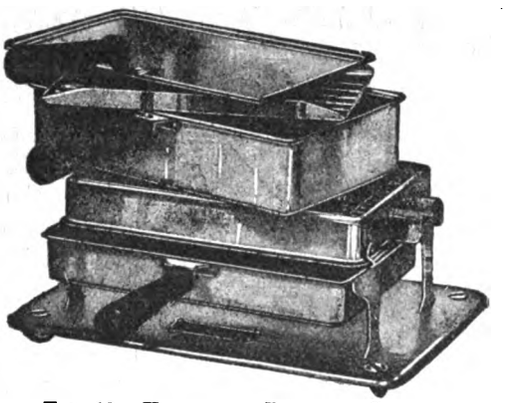


FIG. 12.—UNIVERSAL ELECTRIC GRILL.

grill bacon, chops, or a small steak, cook small portions of cereal, creamed chicken, beef, or potatoes, at the table. The heating element is close to the frame, thus securing the spread of heat over the entire surface. One pan has a depth of 2 in. and can be used above or below the heating element at the same time that some other dish is being prepared in one of the other pans. The base pans and frame are nickel-plated and highly polished, and the price is moderate.

Accident.—On Saturday, while testing a new electrical apparatus at the Goole Docks in a shed, a Manchester workman named O. Mosley was severely burned about the face and arms He got into contact with a "live" wire, and was taken to hospital in a precarious condition.

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NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this Journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

15,506. "Recording mariners' compasses." R. Kennedy. June 29th.

15,539. "Method of energy supply and control for wagons or trains of electric railways or similar contrivances by means of variable resistances." Right Hon. C. E. H. Hobhouse, W. Slingo, H. C. Gunton, W. H. Powell, and J. R. Kingston. June 29th.

15,546. "Selecting-devices for telephone or other circuits." Siemens Bros. and Co., Ltd. June 29th. (Partly communicated by Siemens & Halske Akt. Ges., Germany). (Addition to 818/13). (Complete).

15,549. "Printing-telegraph apparatus." A. E. Alexander. June 29th. (Union Switch & Signal Co., United States). (Complete).

15,550. "Printing-telegraph apparatus." A. E. Alexander. June 29th. (Union Switch & Signal Co., United States). (Complete).

15,552. "Automatic fire-alarms." H. Marsden. June 29th. (Complete).

15,553. "Car switch-operating mechanisms." G. A. Errington. June 29th. (Complete).

15,560. "Systems or apparatus for the production and utilisation of electric currents." F. Juan. June 29th.

15,576. "Magnetos." J. F. J. Bethenod. June 29th. (Addition to 15,353/14. Convention date, October 4th, 1913, Belgium). (Complete).

15,580. "Connections for electric condensers." Allgemeine Elektricitats Ges., and H. Aland. June 29th. (Convention date, June 28th, 1913, Germany). (Complete).

15,585. "Dynamo-electric machinery." Hon. Sir C. A. Parsons. June 29th. (Complete).

15,598. "Antiseptic protectors for telephones." T. Lamb. June 29th. (Complete).

15,602. "Electrolysis of metals." A. E. Battle. June 30th.

15,615. "Electric meters." British Insulated & Helsby Cables. Ltd., and L. B. Wilson. June 30th.

15,617. "Wire filaments for electric incandescent lamps and other electric resistances." W. H. Sabine. June 30th.

15,642. "Apparatus for the control or operation of railway and like points or switches." Siemens Bros. & Co., Ltd. June 30th. (Siemens & Halske Akt. Ges., Germany). (Complete).

15,644. "Electric meters." H. Aron Elektricitatszahlerfabrik G.m.b.H. June 30th. (Convention date, December 22nd, 1913, Germany). (Complete).

15,676. "Electric ignition in internal-combustion engines." B. Dory, and E. Bajtay. June 30th. (Complete).

15,681. "Apparatus for receiving or relaying electric signals." G. W. Pierce. June 30th. (Convention date, August 5th, 1913, United States). (Complete).

15,690. "Electric couplings." J. Bing. June 30th.

15,719. "Electric snuffer with protection against lightning and stray currents." A. G. Davies. July 1st.

15,727. "Intercommunication telephones." H. G. White, and I. H. Parsons. July 1st.

15,758. "High-tension electric ignition for internal-combustion engines." A. R. Bellamy. July 1st.

15,767. "Means for elucidating electrical systems or circuits." A. A. Crofts, and F. J. R. Mackenzie. July 1st.

15,788. "Electrical vacuum discharge devices and methods of utilizing the same." British Thomson-Houston Co., Ltd. July 1st. (General Electric Co., United States).

15,804. "Arc lamps." A. Trafford, and C. E. Haskler. July 2nd.

15,843. "Electro-magnetic means for operating a movable member in a mechanism by a passing body." H. A. Cox, G. E. Lloyd, and H. E. Osborne. July 2nd.

15,857. "Wireless telegraphy." P. C. Bird. July 2nd.

15,868. "Electric meters." British Thomson-Houston Co., Ltd. July 2nd. (General Electric Co., United States).

15,870. "Pulsating-devices." A. G Bloxam. July 2nd. (W. R. Neiman, and H. Sorenson, United States). (Complete).

15,871. "Interrupting-devices for high-tension electric currents." Siemens Bros. & Co., Ltd. July 2nd. (Siemens & Halske Akt. Ges., Germany). (Complete).

15,881. "Detector for electro-magnetic waves." Deutsche Telephonwerke G.m.b.H. July 2nd. (Convention date, January 24th, 1914, Germany). (Complete).

15,939. "Starting devices for electric motors." W. G. Wilson, and P. L. Harlow. July 3rd.

15,946. "Junctions for overhead trolley wires." Cedes Electric Traction, Ltd., and K. D. Bowen. July 3rd.

15,958. "Windings of dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd., and E. O. Kieffer. July 3rd. (Complete).

15,967. "Electric lighting equipment of motor-car and like vehicles." G. A Jelly. July 3rd.

15,981. "Alarm Marconi-bell for ships in fog at sea and for railway train, air-craft, and the like." R. B. Gupte. July 4th.

15,988. "Railway safe-running devices." A. R. Angus. July 4th.

16,007. "Incandescent electric lamps." W. W. D. Knight, and H. E. Clerk. July 4th.

16,027. "Insulation of dynamo-electric machinery." Micanite & Insulators Co., Ltd., and J. Allan. July 4th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

9,090. Railway Safe-running Devices. A. R. Angus. April 17th. (April 17th, 1912).

9,109. Apparatus for Minimising the Destructive Action of Electric Arcs, Especially Applicable to Electric Cut-outs and Fuses. V. Hope. April 18th.

11,214. Dynamo-electric Machines. V. A. Fynn. May 13th. (May 13th, 1912).

11,539. Electric Transformers. R. Arno. May 17th.

13,418. Reverse Power Electric Relays. E. G. Waters. June 10th.

13,644. Reflectors. E. Weiner. June 12th. (December 28th, 1912).

13,715. Electric Clock (Independent or Master). J. G. Scott. June 13th. (Convention date not granted).

13,755. Production of High-tension Discharges. W. H. Wilson. June 13th. (Cognate Application, 20,937/13).

13,983. Dynamo-electric Generators for Igniting in Internal-combustion Engines. A. Schubert. June 17th.

14,043. Operating Gear for Electric Controllers. Sandycroft, Ltd., and T. M. Dutton. June 17th.

14,521. Naval Fire Control. A. H. Pollen, and H. Isherwood. June 23rd.

14,614. Number-dial for Automatic and Semi-automatic Telephone Systems. Siemens Bros. & Co., and E. A. Petithory. June 24th.

15,074. Electric Couplings or Connectors for Lighting Fixtures. British Thomson-Houston Co. (General Electric Co.). June 30th.

15,607. Adjustable Telephone Arms. M. J. D. Carter. July 7th.

17,761. Water-tight Electric Switch-controlled Wall-sockets. R. G. Tyler, E. H. Freeman, and F. G. Shrewsbury. August 2nd.

18,178. Electric Motors. H. A. Whiteside. August 9th. (August 10th, 1912).

19,706. Alarm and Indicator Arrangements for Laundry Washing-machines and the like. W. A. Lees. September 1st.

19,756. Device for Facilitating the Mounting of Stereo, Electro, and other Printing Plates. E. W. J. Barnett. September 1st.

22,850. Circuit Arrangements for Automatic Telephone Systems. Siemens and Halske Akt. Ges. October 9th. (October 11th, 1912, Addition to 18,498/12).

13,478. Electrical Signalling Apparatus. G. Dearle. October 16th.

26,713. Metal Filament Electric Lamps. B. Gnann. November 20th. (September 1st, 1913).

29,447. Apparatus Suitable for Use in Wireless Telegraphy and Telephony. J. Schiessler. December 20th. (October 16th, 1913).

29,799. Means for Warning an Engine-driver of his Approach to a Signal which is at Danger. J. Forrester. December 27th.

29,839. Insulators for use on Electrical Circuits. T. V. Frankum. December 27th.

1914.

198. Apparatus for the Control from a Distance of a Number of Guns from a Single Transmitter. R. Girardelli. January 3rd. (January 16th, 1913).

743. Electro-plating Devices. L. Schulte. January 10th.

1,982. Remote Controlled Electric Switches. G. W. Hart. January 26th.

2,025. Holder for the Filament of Electric Incandescent Lamps. S. Bloch. January 26th.

3,171. Method of Periodically Modifying High-frequency Electric Currents. E. Von Lepel. February 6th. (February 11th, 1913).

5,024. Portable Electric Lamps for Illuminating Heating Chambers such as Bakers' Ovens and the like to Facilitate Inspection thereof. C. R. Ellinger. February 26th.

6,093. Electric Baths. H. Aub. March 10th.

7,165. Fittings for Electric Lamps. J. Lutley. March 21st.

8,185. Construction and Method of Arranging Induction Coils for Loading Duplexed Double Overhead Telephone Lines Worked on the Pupin System. H B. M. Pleijel, and A. H. Olsson. March 31st. (May 9th, 1913).

9,960. Electric Arc Lamps. Siemens Schuckertwerke Ges. April 22nd. (April 22nd, 1913).

10,683. Interrupter for the Electric Ignition of Internal-combustion Engines. Robert Bosch (Firm of). April 30th. (August 1st, 1913).

British Trade with Morocco.—A Commercial Agency has been established in London named the British Commercial Agency for Morocco, Ltd. (139, Cannon Street, E.C.), with the object of promoting the sale of British manufactures in the rapidly increasing markets of Morocco. It is shown by official returns that British trade with Moroco has been declining for some time past, while that of other foreign nations, notably France and Germany, has been increasing by rapid strides. It has been thought that this keen competition cannot be met better than by establishing on the spot an efficient organisation which will devote itself to pushing forward, in every possible channel, the sale of British manufactures.

Cotton Post Bags.—We have received from Messrs. Cooper & Roberts, 3, Paul's Bakehouse Court, Godliman Street, E.C., a set of the standard sizes of Aman's patent sample cotton post bags with linen address labels attached. These are manufactured by Messrs. Rockliff Bros., Ltd., of Liverpool, for whom Messrs. Cooper & Roberts are sole London agents, and we believe that they will commend themselves to electrical and engineering firms who have small samples of an unbreakable nature to send through the post. Goods enclosed in the bags are less likely to get damaged by the Post Office stamping as the address label is clear of the bag; the labels are most securely fastened to the bags by Aman's patent process.

Electromagnetic Piano.—The *Times* correspondent in Paris reports that at a conversazione given by the French Society of Civil Engineers to visiting British engineers, a demonstration was given of a new invention of two Frenchmen, M. Maitre and M. Martin, a piano in which the notes are produced by the wires being set in vibration by an electromagnet instead of being struck by hammers. The mechanism is operated in the usual way by a keyboard, but instead of dying gradually away as they do with ordinary pianos, the notes maintain their volume as long as the key is pressed. The effect produced is similar to that of an organ, and makes of the piano an entirely new and different instrument.

Wire Lamp Patents.—According to the *Neue Freie Presse*, the Austrian Patent Office has declared the two patents of the Deutsche Gasgluhlicht A.G. (the Auer-Osram Co.) for spring holders and molybdenum holders, Nos. 84,107 and 44,438, to be invalid. This is the result of the proceedings which the Gasgluhlicht-Gesellschaft originally initiated against the Vienna firms of Job Kremenezky, makers of the Metallum lamp, and the Westinghouse Metallfaden Gluhlampenfabrik, which produces the Vertex lamp.

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THE

ELECTRICAL REVIEW.

VOL. LXXV. JULY 24, 1914. No. 1,913.

ELECTRICAL REVIEW.

Vol. LXXV.] CONTENTS: July 24, 1914. [No. 1,913.

	Page
Electricity from Gas	121
Road Maintenance	122
The Future of Electricity Supply in Berlin	122
The Rubber Market	122
The Poor Man's Lawyer	123
Reviews	123
Correspondence—	
Proposed Central Testing Institution	124
The Training of the Instrument Maker	125
Difficulties in Canada	126
The Policy of the A.E.S.E.	126
New Electrical Devices, Fittings and Plant (*illus.*)	126
Parliamentary	128
Legal	129
Business Notes	129
Notes	137
The New Cable Ship "Edouard Jéramec" (*illus.*)	139
Power and Light at Messrs. Elliott Brothers' Works (*illus.*)	141
Edison 'Buses for South Shields (*illus.*)	142
City Notes	144
Stocks and Shares	149
Market Quotations	150
Share List of Electrical Companies	151
Exports and Imports of Electrical Goods during June, 1914	153
Electrical Accidents in 1913 (*concluded*)	154
British Trade in Canada	155
The Tramway Congress	157
Newcastle Corporation Tramways	157
Tramways in Brazil	158
Standard Tramway Rails (*illus.*)	158
Foreign and Colonial Tariffs on Electrical Goods	159
New Patents Applied For, 1914	160
Abstracts of Published Specifications	160
Contractors' Column	Advertisement pages xxiv and xxvi

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(J. A. Berly's).

1914 EDITION

M. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

ELECTRICITY FROM GAS.

SOME five years ago, when Messrs. Andrews and Porter read their paper on large gas engines before the I.E.E., the growing use of the internal-combustion engine was "the question of the day"; but the answer was apparently in the negative, for little has been done in this country in the direction of adopting large gas engines in central-station practice since that date. There is, however, one striking exception—namely, the Accrington Corporation—which, on the advice of its engineer, Mr. Harold Gray, put down producer gas plant with by-product recovery, and two 1,000-H.P. gas-engines and generators, in addition to its existing steam plant; and Mr. Gray's report for the past year—in his opinion the most important period in the existence of the undertaking—is now before us. The plant was fully described in our issues of August 15th and 22nd last year.

It may be remembered that the authors of the paper mentioned above regarded 2,000 H.P. as the limit below which by-product recovery could not be carried on profitably—and not even at that figure unless the load factor was exceptionally good; they suggested that where the gas plant was added to an existing steam plant, the former should be run continuously, and the latter should be employed for the peak loads, thus taking advantage to the utmost of the fuel economy of the gas engine, and the elasticity of the steam plant. Mr. Gray has run his plant somewhat on these lines; the producers have never been shut down, and both engines have been running daily and one all night—a fact which reflects great credit upon the engine builders, and not less upon Mr. Gray and his staff, for who expects a large gas engine to run continuously throughout the year? The result has been a sale of over four million units generated by the gas plant, and $1\frac{3}{4}$ millions by steam; using ordinary coal, for the most part, in the producers, the cost of fuel has worked out at 0·220d. per unit for gas, and 0·483d. for steam, the average price per ton of coal being in both cases 13s. 10d. The wages are high, because the gas plant is small, but it is being doubled in size, without requiring a larger staff. They work out at 0·126d. for gas, 0·200d. for steam.

Mr. Gray regards tar with little favour; it is troublesome to deal with, and brings in little profit, but it has to be got rid of; the sulphate of ammonia, on the other hand, pays for more than half the cost of the fuel, and although the recovery plant was in operation for only 38 weeks, having been started at the end of June, 1913, it returned a profit of 0·077d. per "gas unit." This can evidently be materially increased. The cost of oil, stores and repairs on the gas plant was 0·069d. per unit, compared with 0·079d. for steam; and the net result for works cost was 0·338d. per gas unit, and 0·762d. per steam unit, or for both plants combined 0·466d. per unit.

In considering these figures, it must be borne in mind that the gas plant was comparatively small, and was only in full operation for nine months; that the steam and gas stations were practically independent, so that the wages were higher than they would otherwise have been; and that the steam plant was not run for economy but for convenience. Making allowance for these facts, we think Mr. Gray is to

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be congratulated on the large measure of success that he has attained in the past year, and there is every reason to anticipate that when he has the extended plant in full operation, with the experience that he has gained, he will be able to show results still better than those recorded above.

Unfortunately, the report does not include any statement of accounts, so that we are unable to ascertain the financial charges and the total cost of production; but seeing that the gas plant was run on a high load factor, we should expect to find that the result was not unsatisfactory.

The progress of the installation will be watched with keen interest by central-station engineers; the movement towards the more economical utilisation of coal is growing in strength and vitality, and in spite of the instinctive repugnance felt by the electrical engineer towards making his plant a chemical works, the pressure of events compels him to take into consideration every opening for economy, while the benefit to the community resulting from the manufacture of a fertiliser and the elimination of smoke needs no demonstration.

Road Maintenance.

At the Tramway Congress, held at Newcastle last week, the chairman, Mr. Stephen Sellon, took the opportunity of defining the attitude of the Tramways and Light Railways Association towards the question of maintenance of roads. Naturally, the Association feels that the burdens imposed upon electric tramways, which are forced to maintain the pavement which they cannot possibly use, are harsh and unreasonable, whereas their competitors, the motor-omnibuses, contribute nothing towards the upkeep of the roads, but, nevertheless, do an immense amount of damage to them. Moreover, the latter are not required to carry workmen at a loss. The Association, therefore, has approached the Local Government Board, with a view to securing an opportunity of stating the case for the tramways before the Departmental Committee which is inquiring into the subject.

The matter has also been raised in the House of Lords, in connection with the Bill of the Middlesex County Council for the construction of a new highway in the West End. Clause 24 authorised the Council to impose a charge of $\frac{3}{8}$d. per 'bus-mile on 'buses using the new road, and this was objected to on the ground that if motor-omnibuses, then other heavy vehicles ought to be taxed; but this is not necessarily a sound proposition. All members of the community are entitled to a reasonable user of the public roads, but in the case of public carriers of passengers or goods, the roads become actually part of their working plant, at present a free gift to them from the community. A shopkeeper's use of the road is merely incidental to his trade; customers may come to his shop and carry their purchases away, or he may send the goods to their houses, using the roads only for the transport of his own wares. The same thing applies to a manufacturer, the essential feature being that in either case the business would not be hindered, but rather aided, if the customers lived on his premises and roads were superfluous. But in that event the carrier's business would be gone—the road is his means of livelihood. That the 'buses quickly destroy ordinary roads is notorious — none know this better than cyclists, to their sorrow; delivery vans may traverse a certain road only once or twice a day, but the 'buses are hammering away at it all the time. We are glad to record, therefore, that the House of Lords approved the clause, which had been incorporated in other private Bills and had also passed the House of Commons, so that we may now regard the principle as having become a settled policy of Parliament. It still remains, however, to secure universal application of the principle by making an alteration in the general law, and to relieve the tramways of the onerous burdens under which they groan, and these tasks will, we hope, be energetically handled by the Departmental Committee. That action is urgently necessary is clearly shown by the unfortunate predicament of the various metropolitan tramway systems, due to the unfair competition to which they are subjected.

The Future of Electricity Supply in Berlin.

During the past two years informal conversations, which have been followed by actual negotiations more recently, have proceeded between representatives of the Berlin Electricity Works Co. and of the Municipal Council with respect to the future position of the supply business in that city as affected by the right of the latter to expropriate the former's undertaking on October 1st, 1915. Notice of intention to exercise the right has already been given, and of the two alternatives—purchase at the book value or at a valuation—the former has been selected provisionally. The service of notice to this effect is largely a formal proceeding, as the future of the supply undertaking is uncertain in consequence of the divided opinions which prevail in municipal circles, one section being in favour of entire expropriation, whilst another group expresses confidence in the establishment of a joint private and municipal enterprise as from October 1st, 1915. As will be remembered, the Electricity Works Co. has a monopoly of supply in Berlin and various suburbs, and in association with it stands the A.E.G., which, we believe, originally created the undertaking, and has a preferential right of delivery of all the machinery and plant required by it. The A.E.G., in fact, may be considered to be a constituent part of the enterprise, and it is, therefore, comprehensible that the company should also be associated with the supply company in the negotiations which are in progress, and which have now resulted in the preparation of a scheme for the reorganisation of the supply undertaking as a joint economical enterprise. The scheme provides in the first place for the handing over by the supply company of £1,000,000 in preference shares, free of charge, to the Municipal Council, and the concession agreement is to be prolonged from 1915 to the end of 1939. At present the concession applies to a sphere of interest amounting to 18·6 miles around Berlin. It is, however, suggested by the scheme that an additional superficial area of 9,300 sq. miles should be permitted to be added by the formation of a connection with the Berlin Suburban Electricity Works and the Mark Electricity Works, both of which are already associated directly or indirectly with the Berlin Electricity Works Co. and the A.E.G. The project also provides for a reduction in the supply charges and for the reversion to the city, free of charge, at the expiration of the agreement of all the plant existing at the beginning of the agreement, the plant representing £5,000,000 exclusive of sites and buildings. It would, however, be possible for the city to take over the undertaking during the currency of the agreement at certain periods and according to values to be determined by the remunerativeness of the undertaking. The city is to receive a fixed annual payment as well as a share in the profits; the preferential right of delivery enjoyed by the A.E.G. is to be curtailed to one half, and the A.E.G. is also to renounce its preferential right of subscription to new issues of shares by the Berlin Electricity Works Co. It remains to be seen whether the proposal for a joint enterprise will be accepted by the Municipal Council or whether the undertaking will be taken over entirely next year. In either case the future of the supply company is declared to be assured, as early precautions were adopted in the direction of securing a financial interest in other supply works, whilst at the same time profitable investment in other undertakings is held in prospect for the capital which would be rendered available if the supply company should be expropriated in 1915.

The Rubber Market.

The price of rubber has not altered much on balance, though there are a few fluctuations met with. There is, however, rather a disposition in some directions to take a slightly more cheerful view of the position, based upon the strong belief that we are getting near to the time when there must be an improvement in the United States. The whole tenor of American advices for months past has been one of gloom and depression, and it is impossible that rubber can have escaped from the temporary blight which seems to have

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attacked trans-Atlantic trade. With some faint indications that things are on the turn for the better in America, a little new hope has been born in European circles, and there is a bare chance of things improving as regards the rubber market. The price of the commodity is certainly very moderate, and many people think that at to-day's rates the deficiencies in the situation, whatever they may be, have been about discounted. It would almost appear that all the bad points had already had their full play, and that any alteration must now be for the better. Even admitting this, however, there can be no suggestion of anything very dramatic in price developments favouring holders of rubber, or rubber shares, for the days of the memorable boom have gone, never to return. At the same time the prospect from a strictly producing and commercial standpoint is not at all discouraging, for while outputs of the plantations are being increased there is a steady and very material improvement proceeding in respect to the costs of yield, and this, in conjunction with the exercise of economical methods of estate management and development generally, is going to be of the utmost benefit to plantation companies in the long run. Of late there has been nothing more heard of the proposals for bringing about a combined selling organisation and probably it is just as well, for attempts to regulate trade currents are by no means an unmixed boon, and it is, on the whole, preferable to allow the rubber trade to find its own level in the matter of prices, free from adventitious aids, the more so as the aids proposed in this case might conceivably have worked damage ultimately to the cause they were intended to serve. A fair number of the growers whose assent had been given provisionally to the proposals put forward were really not much in sympathy with them, though they had joined, and if a practicable scheme had been evolved, would have stood by it.

At the auctions this week about 970 tons were submitted, the sales opening with a pretty steady demand, prices being much about the same as they were at the termination of the previous series, and up to 2s. 3¾d. was paid for smoked sheets, though this was exceptional, most of the parcels going at about 2s. 3½d. a lb. The tendency became rather irregular as the sales proceeded.

The exports of plantation rubber from the Straits Settlements for June totalled 1,480 tons, compared with 1,309 tons in May, and 812 tons in June of last year, details being appended :—

	1912.	1913.	1914.
January	258	784	1,181 tons
February	274	743	1,703 ,,
March	427	898	1,285 ,,
April	387	762	1,548 ,,
May	431	814	1,309 ,,
June	398	812	1,480 ,,
Total... ...	2,170	4,813	8,506 ,,

The Poor Man's Lawyer.

A County Court Judge recently took occasion to deplore the fact that while elaborate arrangements have been made to give legal aid to the poor in High Court cases, nothing has been done to facilitate their access to the County Court. Speaking for ourselves, we do not often find that the poor man with a good case has very much difficulty in obtaining all the legal assistance he requires.

Many years ago the late Lord Russell of Killowen expressed the opinion that it would be a misfortune if there were no lawyers who were willing to take up cases on the "no cure, no pay, principle." To judge from the enormous number of claims which are made annually under the Workmen's Compensation and other similar Acts, it is obvious that certain members of the legal profession have not been slow to take this judicial hint. In the electrical industry claims for compensation are frequently made by persons of very limited means, and we have never yet heard of an instance where there was a denial of justice because no lawyer could be found to take up a *bonâ fide* case. If a man has a bad claim, it is as well that the time of the Courts should not be taken up in considering it. There is a well-known legal maxim—*Interest reipublicæ ut sit finis litium.*

REVIEWS.

Incandescent Electric Lamps. By D. H. Ogley. London: Longmans, Green & Co., Ltd. Price 2/6 net.

It is a difficult task to condense information, in such a manner that all who read may understand, without omitting many important items; but Mr. Ogley has carried out his work in an admirable manner, and the omissions are few. They could have been reduced, however, by a careful revision of the work, and at the same time redundancy would have been avoided; we do not understand why certain curves and calculations should have been included a second time in other portions of the book.

In the first chapter the production and propagation of light are touched upon, and the matter contained under this heading should be of great use to those unfamiliar with the subject, for various terms are here explained in a manner which is exceptionally clear. Terms somewhat more technical are treated in the next chapter, and again we must commend their presentation. The second paragraph under the Law of Inverse Squares contains an obvious mistake which we trust will be remedied in future editions. Standard Light Sources occupy a considerable amount of space for such a work as this, and we think that the blue pencil might here have been used to advantage; on the other hand photometry and photometers are but briefly dealt with, but their principles are well set forth, so that it should be easy for one to understand the working of any instrument handled.

Chapter V is devoted to light distribution from incandescent sources and is very short, the matter only being treated in a general way. The next chapter, however, is unique, and one is enabled to learn much regarding the manufacture of carbon, tantalum and tungsten filament lamps. The characteristics of these lamps are then fully discussed, and many interesting points, which at first sight are not perfectly obvious, are set forth. A number of the tests are new, and betoken much patient care on the part of the author, who is able to write with first-hand knowledge. The effects of light sources upon one's optic nerves are then touched upon in a brief manner, but there is sufficient detail to enable one to comprehend the various arguments put forward in the following chapter, which deals with lighting systems. The illustrations consist largely of reproductions which have from time to time appeared in the technical Press, but they form an interesting collection which serves to contrast the good and bad points of lighting installations; various reflectors are depicted and described, as well as one or two fittings.

The next few pages deal exclusively with indirect lighting; a few illumination calculations, and a table of cosines cubed complete the book, which should commend itself to all those whose desire it is to obtain a knowledge of recent information regarding incandescent electric lamps and their application.

Problems in Alternating-Current Machinery. By Waldo V. Lyon. London: Hill Publishing Co. Price 6/3 net.

This book consists of a series of numerical examples intended to serve as problems for practice by honours students in their final year at college. No introductory matter is given, so that the student is expected to make use of his text-book or lecture notes for all the information he may need as to the methods of solution to be employed.

As is aptly stated in an introductory note by Prof. Clifford, of Harvard University, it requires a special gift to originate and develop problems which shall give sound training in the fundamentals of engineering, and whose solution shall not only interest the

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student but shall train his intellectual power as well. Mr. Lyon evidently possesses this gift, but he also possesses the means of collecting varied and up-to-date data of actual machinery and the patience and industry necessary to make use of such valuable opportunities in framing an excellent collection of problems. The problems are arranged in a definite sequence in each chapter, corresponding as far as possible with the natural line of development of the principles underlying each particular type of machine in a college course.

The first chapter contains 98 problems dealing with the transformer. Taken in order, the subjects of the exercises include iron losses, flux densities, no-load current, copper losses, regulation and efficiency under load, auto-transformers, and the operation of transformers in parallel.

Chapter II contains 99 problems on synchronous generators which bear on the following matters:—Form-factor of generated E.M.F., virtual voltage generated, armature reactions, leakage reactance, synchronous reactance, regulation to be calculated from various data and employing various methods of solution, efficiency, operation in parallel, operation under test.

There follow separate chapters on synchronous motors (50 problems), induction motors (80 problems), rotary converters (61 problems), polyphase circuits (75 problems), and non-sinusoidal waves (44 problems). It is unnecessary to detail the character of the ground covered in each of these chapters, since what has been said of the first two will indicate sufficiently the range to be expected.

We can cordially recommend the book to teachers of advanced classes in electrical engineering, who are often in need of good representative problems for exercise work and even for examination papers. Students will also find such a collection useful for practice and most fruitful in suggesting thought and further inquiry in many directions.

We are inclined to regret the absence of answers to the questions, as these would have been useful both to the teacher and the student. We learn from the Preface that answers will be published later, and will be available "to all but undergraduate students." What a memory of the forbidden but dog-eared "crib" of by-gone days does this recall!

The Inventors' Adviser and Manufacturers' Handbook to Patents, Designs, and Trade Marks. By Reginald Haddan. London: Harrison & Sons. Price 5s. net.

The fact that Mr. Haddan's well-known volume has reached a ninth edition shows that his efforts to provide a suitable book for the use of patentees have been well appreciated.

In his preface he draws attention to the fact that the British Patent Law was altered in 1905. Before that year any person taking out a patent in the English Patent Office had no guarantee that his invention was worth anything; but he now has the satisfaction of knowing that it is not covered by anything which is to be found in the records of the English Patent Office for the last 50 years, or, at any rate, he is warned if it is discovered in the Office that his invention has been anticipated.

As Mr. Haddan points out, other causes of invalidity besides anticipation are omitted from investigation, while the invention may also have been described in a foreign patent office, or in one or other of the technical journals published in many parts of the world. It follows from this that the recent change in British patent law has by no means rendered a book like Mr. Haddan's useless to the inventor. Indeed, it might almost be said that the value of the work has become enhanced, because it is more difficult than ever for the patentee to know exactly how he stands.

We have examined the work before us, as far as possible from the point of view of the layman, and it must be admitted that Mr. Haddan has handled a technical subject in a manner which can be well understood by the patentee who has never been inside a court of law. What we like in particular about his style of writing is that instead of crowding his text with the effects of a number of cases, he selects typical decisions and gives extracts from time to time in the language actually used by the judges. For readers who have no opportunity of consulting the reports of the Patent Office, this method of treatment is distinctly advantageous.

Not by any means the least useful part of the book is that which gives in short and concise paragraphs a description of the patent laws in various parts of the world. From Algeria to Japan, from Uganda to the State of Luxembourg, every country and kingdom appears to be dealt with in the latter half of this volume. Some of the descriptions of the patent laws of these countries are no doubt rather exiguous; but when there is no patent law in a particular country the fact is recorded. For instance, it may come as a shock to some to hear that there is no patent law in Servia.

Altogether we may commend Mr. Haddan's work to the lay patentee. Not only will it be of assistance to him, but we think it very likely that it will prove useful to those who practise as patent agents.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Proposed Central Testing Institution.

Much has been written of late about the position of British manufacturers endeavouring to sell their goods in the Canadian market, consequent on the attitude of the Fire Offices, which require compliance with the code of the Chicago Board of Underwriters. This matter actively engaged my attention a year or two ago, when the position became acute, and in May, 1913, I addressed a letter to the secretary of the Institution of Electrical Engineers putting forward my views. As this letter relates to a purely industrial matter, and the Industrial Committee has been dissolved, it is improbable that the Institution will be able to deal with it. With the permission of the President, I now send you a copy of my letter, in case you should think its contents of sufficient importance to the electrical industry to warrant publication in your columns.

C. H. Wordingham.

Redhill, Surrey,
July 16th, 1914.

[copy.]

3rd May, 1913.

P. F. Rowell, Esq.,
The Institution of Electrical Engineers,
Victoria Embankment, W.C.

Dear Mr. Rowell,—In my paper read before the Institution in 1899 the proposal for a central testing institution was, so far as I know, first made. Although I believe the time was then ripe for the establishment of such an institution, the electrical industry was not prepared to support the proposal, and even received it with a certain amount of hostility, so that the matter dropped.

The value and importance of a universally recognised testing authority has now been very poignantly brought home to the electrical manufacturers of this country by the powerful position occupied by the testing bureau of the American fire offices in the United States and in Canada, and the proposal to found a testing institution in this country has in consequence of the position which has arisen attracted a considerable amount of attention, but ideas as to what is required are extremely divergent, and the whole affair is in a very nebulous condition.

When I made my original proposal its scope was very modest, and the chief object was to set a high standard of design and manufacture for fittings to be used on installations supplied by public undertakers in this country and to afford a ready means whereby central station engineers of municipal and company concerns, as well as consulting engineers, could ascertain that the prescribed standard of excellence had been attained. At the time I proposed only to test *types* of appara-

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tus and to leave the user to take his own measures for ensuring that the individual articles supplied to him conformed to the type. The American Bureau goes very much further than this and professes to inspect, and attach labels to, every individual article that is used.

The first question to consider is whether the National Electrical Proving House should be a branch of the American or closely affiliated to it or whether it should be an entirely separate and independent concern. I am unhesitatingly of opinion that it should be the latter. The British electrical industry should set its own standards and should take its own measures for securing compliance with those standards. The aim should be to put such a hall-mark on goods manufactured in Great Britain that it will be recognised as a standard of excellence over the entire world and be recognised as securing such standard for any articles to which it is applied.

The next important question to decide is whether the National Electrical Proving House should draw up rules and regulations as well as make tests for compliance with standards set up. I am strongly of opinion that it should not. As regards articles in common use on consumers' installations I am of opinion that the Institution of Electrical Engineers should draw up rules in general terms as has been done in the wiring rules issued by that Institution. These rules (as is at present the case) should deal with the matter in general terms and should expressly avoid the indication of any particular methods whereby those general requirements are to be carried out. At this point the Engineering Standards Committee should step in and should draw up detailed specifications for the individual articles or methods to comply with the general rules issued by the Institution. The Engineering Standards Committee has no machinery for testing and therefore at this stage the work should be handed over to the British Testing Institution or, as I have proposed to call it, the "National Electrical Proving House," which body would carry out tests and make examination to ensure that the specifications were complied with both as regards design, dimensions and performance.

Lastly, in the event of investigations being necessary to determine laws affecting the design of apparatus, or to ascertain the properties of materials, or generally to obtain scientific or engineering data, the National Physical Laboratory should undertake the work and carry out the necessary experiments.

There would thus be a complete chain, with existing institutions carrying out each its proper work, and the National Electrical Proving House filling a gap which unquestionably now exists and which none of the other institutions can properly fill. There would thus be no overlapping or duplication and each body would be strengthened.

The third point to consider is whether the National Electrical Proving House should test for type only or whether it should attempt to carry out an inspection of every individual article supplied. Such a detailed inspection if it is not to be far worse than useless (as it would be if it engendered a false sense of security) must be carried out on the lines of Government overseeing. This would mean an enormous staff of well paid overseers, and, in addition to the costliness of the staff, there would be the interference with manufacturers and the inconvenience entailed on them which would unquestionably represent a very substantial augmentation of the cost of production. In my opinion, although the detailed inspection during manufacture of plant and apparatus by independent overseers unquestionably gives the best guarantee for efficient construction, it would constitute an intolerable burden on the electrical industry if enforced for all manufactured goods. Although the American Bureau professes to inspect, it does not do so in anything like the effectual manner above indicated. It relies largely upon good faith of manufacturers, upon their unwillingness to risk being struck off the list of approved manufacturers and on spasmodic and unexpected actual inspection.

As regards the general scope of the Proving House, although fire offices would unquestionably be largely interested, I do not think that it should by any means be confined to looking after apparatus from the fire hazard point of view only. It would, I am convinced, be invaluable to public supply engineers and to consultants.

Broadly, my idea of the field of operations of the Proving House is as follows:—

It should be prepared to test all electrical apparatus for compliance with certain standards. Primarily these standards should be those embodied in standard specifications of the Engineering Standards Committee, but I would not limit the tests to these standards, though the certificate or hall-mark or whatever form the stamp of approval might take would necessarily vary with the standard to which the articles had been tested. I should see no objection to the Proving House testing for compliance with the rules of any recognised authority. For example, the Electrical Manufacturers' Association might draw up rules of their own for articles not covered by institution rules or Engineering Standards Committee's specifications, so also might public supply engineers. Again, I should see no objection to the Proving House testing for compliance of British made goods with the rules of the American Bureau; this would go far to diminish the grievance under which British manufacturers now labour, *i.e.*, the goods could be tested in this country instead of having to be sent to Chicago. I am doubtful whether the Proving House should test to a specification supplied by an individual manufacturer for his own wares and consider that this point might be usefully discussed.

In addition to the main work of testing for type, which practically means the testing of newly prepared designs, I should see no objection to the Proving House undertaking the inspection of individual articles on request of purchasers or manufacturers and on the payment of suitable fees. This detailed overseeing would be work additional to its main functions and would not form an integral part of them.

I now pass on to the constitution of the governing body of the Proving House. On this will, I apprehend, depend almost entirely its utility to the industry. It is absolutely necessary that it should be thoroughly representative of every interest involved, that it should be entirely independent, and unquestionably above suspicion of bias or *mala fides*. The following interests should I think be represented in about the proportion indicated:—Board of Trade, 1; Admiralty, 1; War Office, 1; Post Office, 1; Office of Works, 1; Home Office, 1; Engineering Standards Committee, 2; National Physical Laboratory, 1; Institution of Electrical Engineers, 2; Incorporated Municipal Electrical Association, 2; Engineers of Public Supply Companies, 2; British Electrical and Allied Manufacturers' Association, 2; Cable Makers' Association, 1; Fire Offices, 2; Tramways Association, 1; Professional Staff of Technical and Engineering Colleges, 2; Representatives of large purchasers of apparatus such as railway companies, docks, etc., 2; Consulting Engineers, 2.

From the foregoing should be selected a small executive committee composed roughly as follows:—Representing Government Departments, 1; Municipal Authorities, 1; Public Supply Companies, 1; Fire Offices, 1; Manufacturers, 1; Consultants, 1; Institution of Electrical Engineers, 1.

The actual work of the Proving House should be under the direction of an electrical engineer of the highest standing and technical and scientific attainments, who should be paid a thoroughly adequate salary and devote his whole time to the work of the Proving House. Under him should be an adequate well paid staff.

All certificates should be granted on the recommendation of the technical paid director, but should not be issued unless and until approved by the executive committee, whose recommendations should be subject to the approval of the main governing body, though, for practical purposes, this latter body would probably delegate its powers largely to the executive committee.

The question of funds is a vitally important one and undoubtedly presents very considerable difficulties. In the early stages the Proving House could not hope to be self-supporting and would have to be subsidised by all the interests concerned, but later on, when it had attained the importance contemplated, the money received in fees would probably go far towards rendering it self-supporting.

The foregoing observations merely indicate the roughest and broadest possible outline of what I conceive would be the most useful and suitable form for the proposal to take. I have left untouched many questions that would have to be settled.

The question would probably arise as to whether the Proving House would examine foreign goods imported into this country.

The answer would probably be that such goods should be certified subject to a clear indication of their country of origin.

Yours very truly,

(*Signed*) C. H. WORDINGHAM.

The Training of the Instrument Maker.

My letter published on June 26th has elicited interesting replies from Mr. N. Ingleby and "Scientific Instrument" in your issues of the 3rd and 10th inst. The former questions whether the more thorough training I advocate would yield the greater benefit to the employer or to the employed—a matter hard to determine, and dependent on individual character and effort.

"Scientific Instrument" gives two reasons for the dearth of well-trained men in this branch, to which I might add emigration abroad or to other trades; his remark, however, as to the employment of incompetent bullies as foremen lacks confirmation in my own experience.

Your correspondent is undoubtedly correct in stating that a skilled instrument-maker is not paid high wages in comparison with those of unskilled workers; this is due not to huge profits made by the employers, but partly to the fact that there is no recognised standard of skill or training for the worker (the title "Scientific Instrument Maker" being adopted by many men of very poor attainments) and partly because, in many shops, piece-work rates are limited by tradition to one shilling per hour, even where a smart skilled workman could earn 25 per cent. more without undue effort and without revision of the piece-work rates. Many of our best firms have found that profits have been reduced to vanishing point by the enormous expense of

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development work, such expense being often increased by the lack of interest or knowledge on the part of the workman, who prefers to "let the foreman do the thinking."

My firm opinion is that, with wider knowledge and more systematic training, a workman in this branch should obtain a status in the community that would be the envy of other skilled workers, and that his work would become thoroughly enjoyable to him.

Since writing my previous letter, I have had several communications from trade teachers and educational authorities, and from a number of firms who have kindly placed their experience of trade teaching at my disposal. I look forward to the time when an efficient trade school for instrument makers may be established, and in the meantime am proposing to attempt, during the coming autumn, a simple but definite scheme for the education of my apprentices during working hours, in trade drawing and arithmetic, the principles of workshop operations and the higher branches of workshop practice.

Thanking you for the publicity which you have given to the matter, which I hope may result in a systematic attempt to improve the efficiency and standing of the workers in this important branch of industry—

Robt. W. Paul.

London, N., *July* 15*th*, 1914.

Difficulties in Canada.

The notes which appear in your issue of June 19th *re* the desirability of British firms trading in the Dominion establishing a central organisation seem very opportune.

In addition to the points mentioned by your correspondent, there is another feature which might very well receive attention, and that is the question of general conditions. On nearly all municipal tenders in this country it is necessary for deposits to be made as a guarantee of good faith, these deposits varying from 5 per cent. to 25 per cent. of the total tender price. Where deposits are made by marked cheque, it is customary for the municipality to reserve the right to cash the cheque, usually without paying any interest on the money so held. Frequently this will mean that a municipality will be holding in this manner deposit cheques equal to the total value of the proposition for a considerable period.

The reason for this deposit system arises from the large number of comparatively unknown firms trading in the Dominion, many of whom are financially quite incapable of carrying through large or important contracts, but at the same time the scheme imposes an unnecessary burden on the really reliable firms whose very names should be sufficient guarantee of their good faith in submitting a tender. The B.E.A.M.A. and the I.E.E. have already done very good work in England in the way of establishing general conditions, and the writer believes that if the British manufacturers were organised in the manner you suggest, the chances of similarly improving trading conditions in the Dominion would be materially increased. At the present moment the Canadian manufacturers are inclined to adopt the attitude of being too important to discuss details such as this with individual foreign firms, but this attitude would not be justified if they were negotiating with a central body representing the foreign firms who are interested in trade in the Dominion.

The writer sincerely trusts that the B.E.A.M.A. will take an opportunity to consider the points which you have raised, and that we may shortly hear something of the results of such deliberations.

W. A. Coates.

Toronto, *July* 10*th*, 1914.

The Policy of the A.E.S.E.

Mr. Ebben's letter in your issue of the 10th gives interesting point to one of the suggestions put forward in my article in the previous issue, namely, the need for economic unions organised according to function.

Such unions are necessary for the following reasons :—

There are two methods of settling disputes, force and equity.

Civilisation is as yet so little advanced, that the latter mode is seldom applied, except in cases of dispute between individuals.

We forbid duelling, or fisticuffs, in the street, and we set the Law between disputants who obviously cannot come to blows, even if they would (a fight between, say, the respective shareholders of two rival railway companies would be of hilarious interest, but scarcely practicable).

We are slowly moving towards equity as between corporate bodies and even nations, but as matters are, "the good old rule, the simple plan," still obtains for the most part in human relations with, perhaps, some change in form. (Thus, the method of starvation is usually preferred to actual bloodshed as a means of coercion.)

Until the equity plan can be extended to cover industrial disputes, Mr. Ebben and his colleagues must be prepared to fight for the objects for which they are banded together.

Here I crave permission to offer a word of warning and suggestion.

There are thousands of well-trained and capable young men as yet wholly unorganised who, with a little special coaching, would be capable of replacing the members of the A.E.S.E. Mr. Ebben and his Council must be sure of the active support of the large majority of these men before aggressive operations can be undertaken with any likelihood of success.

Either the A.E.S.E. must widen its membership clauses or promote the formation of a sister union whose membership will embrace all possible unorganised competitors.

Of course there is also the employers' point of view.

C. Ashmore Baker.

London, S.W.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

High-Frequency Current Generator.

Dr. Lee de Forest has recently developed apparatus for generating in an incandescent lamp continuous high-frequency oscillations from a direct-current source, to be used as a transmitter for wireless telephony and telegraphy, as well as for numerous laboratory applications.

The small-sized 3½-volt Amplifier bulb, when properly excited, can generate alternating currents at frequencies from 60 to 1,000,000 per second, representing as much as a few hundredths of a watt, while with larger bulbs for 110 or 250-volt current two or three watts high-frequency power can be generated with only two or three hundred volts from small dry cells. We are informed

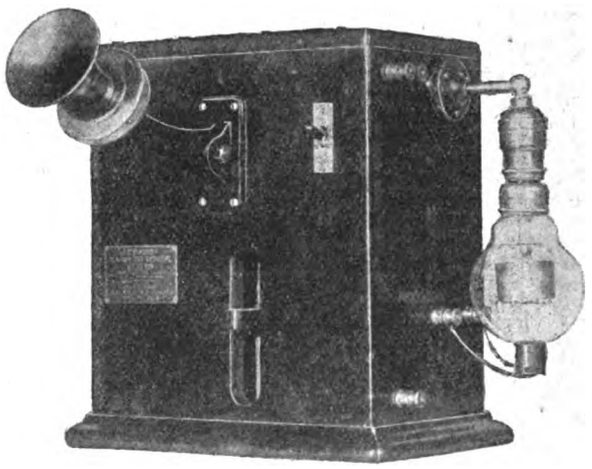

Fig. 1.—De Forest High-frequency Generator.

that with this form of transmitter and an ordinary solid-back or Berliner microphone, it is possible to telephone wirelessly for one to three miles, using an Audion as the receiving detector.

The new sytem is said to be remarkably constant and reliable in operation, and so simple, being perfectly free from adjustments, that where the operator is content to stay on one established wavelength and not to seek to switch around on various tunes, the merest tyro can operate the set.

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Where storage battery supply is available, the oscillating Audion transmitter, being perfectly quiet, can serve equally well as the receiving Audion, both functions, transmitting and receiving, being then performed by the same bulb; a telepone receiver is kept connected in the wing-filament circuit as in the ordinary receiving Audion. In this case the same tuning circuits serve for transmitter and receiver. Then if both stations are using the same wave-length, the necessity for throwing over from talking to listening is avoided, and it is possible to talk both ways as over a line.

Complete de Forest radiotelephone sets utilising the oscillating Audion are already manufactured for sale, and the larger units will be placed on the market before long.

The "Marvel" Cooker.

Our illustration last week of the FIRELESS COOKER Co.'s oven showed the lowered door in the shape of a pan; this was an error due to an optical illusion, as the door is well lagged inside and is covered with an aluminium plate, which fits close against the flat face of the oven, when closed, thus making a heat-tight joint.

New Sealing-wax Heater.

A sealing-wax heater of a new pattern has been introduced by MESSRS. SIMPLEX CONDUITS, LTD., of Garrison Lane, Birmingham, for use in post offices, banks, &c. The wax container is of cast-iron,

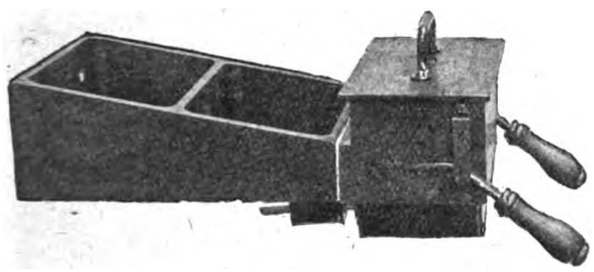

FIG. 2.—SEALING-WAX HEATER, WALL PATTERN.

and is supported from the wall by a rigid bracket arranged so that the container comes well over the table. There are two outlets for the wax, each operated independently by a lever handle. A heat insulating pad is interposed between the container and the bracket.

A Patent Automatic Furnace.

MESSRS. CLYDE EVAPORATORS, LTD., of 90, Mitchell Street, Glasgow, are introducing a new patent automatic furnace (Meikle's system) applicable to all classes of boilers. Reference to fig. 3 shows the furnace fitted to a water-tube boiler; it will be seen that fuel from the hopper is carried into the furnace by two horizontal screws, one on either side, and falls over sharply inclined firebars to a central ash trough in which an ash screw, with clinker breakers attached, revolves, for removing the ashes as made. Forced draught is conveyed in ducts to the underside of the firebars, and an auxiliary air supply is carried by means of passages in the ash trough to the back bridge and certain outlets over the coal feed screws.

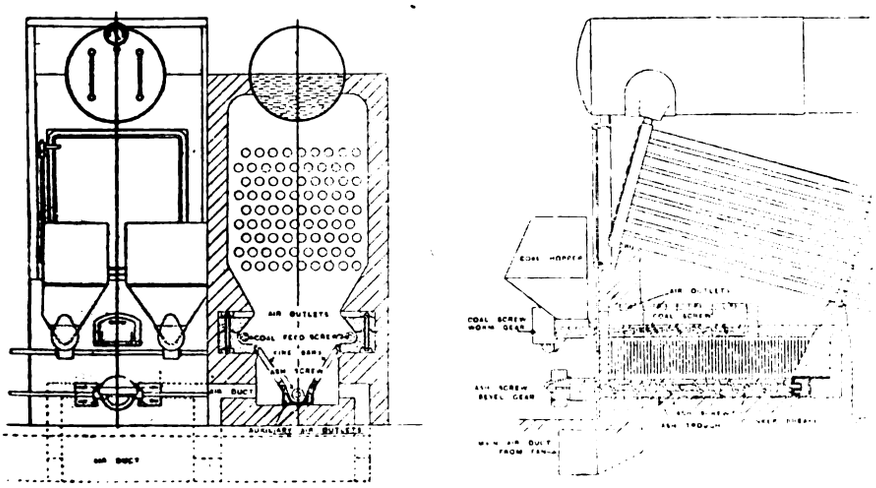

FIG. 3.—SCREW-FEED AUTOMATIC FURNACE.

Water is also supplied to the ash trough to moisten the ash and prevent dust being carried into the flues.

The coal screws are buried in the cold entering fuel, and it is claimed that coal feeding is self-adjusting, the fuel being automatically delivered to any point to compensate for rapid combustion. Some comparative combustion tests with a Babcock boiler, using hand and automatic firing, at a West of Scotland steel works are given, from which it would appear that during eight hours the results were:—Hand firing, 1,106 lb. fuel per hour; automatic firing, 756 lb.; water per hour, hand firing, 4,937 lb.; automatic firing, 4,911 lb. Evaporation from and at 212°, hand firing, 7·213 lb.; automatic firing, 10·75 lb. per lb. of fuel. The fuel used with the automatic furnace contained 15 per cent. ash, as against 11·8 per cent. ash in the other cases.

New Half-Watt Lamps.

Particulars have come to hand from the BRITISH THOMSON-HOUSTON Co., LTD., of 77, Upper Thames Street, E.C.; the GENERAL ELECTRIC Co., LTD., of 67, Queen Victoria Street, E.C.; MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., Tyssen Street, Dalston; the EDISON AND SWAN UNITED ELECTRIC LIGHT Co. LTD., of Ponder's End, Middlesex; the ELECTRICAL Co., LTD., of 122, Charing Cross Road, W.C., and MESSRS. DRAKE & GORHAM, LTD., 1, Felix Street, S.E., of reduced prices and new types of half-watt lamps. The smallest lamp, for 50-65 volts, takes 100 watts, and is rated at 200 C.P. Other new sizes are 200 watts, 400 C.P. for 50-65 and 100-130 volts; 300 watts, 600 C.P., for 100-130 volts;

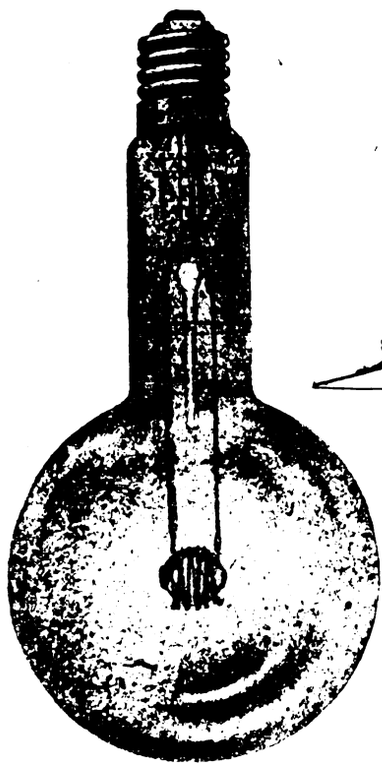

FIG. 4.—OSRAM HALF-WATT PROJECTION LAMP; 100 VOLTS 1,000 WATTS.

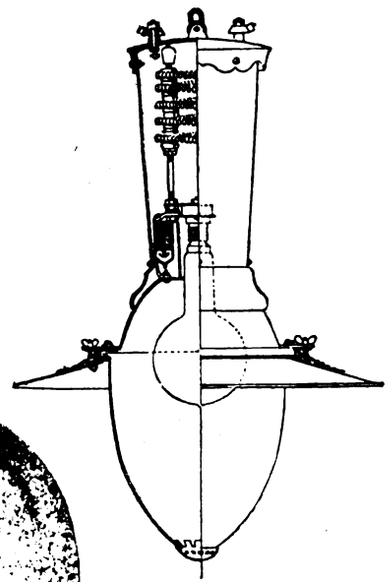

FIG. 5.—"BORO" HALF-WATT LANTERN OF THE G.E. Co.

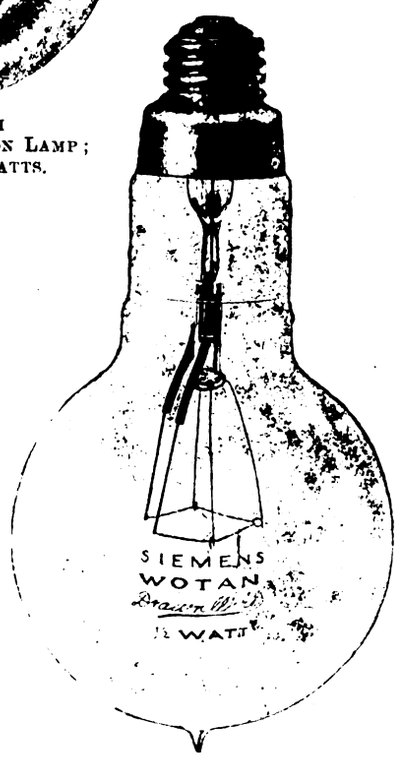

FIG. 6.—WOTAN HALF-WATT LAMP, 100 VOLTS, 200 WATTS, 400 C.P.

and 500 watts, 1,000 C.P., for 200-260 volts. These additions apply to the Mazda, Osram, Wotan, Ediswan and Nitra lamps, as illustrated in figs. 6 and 9. The price reductions came into force on July 20th. We understand that experience with the half-watt lamps shows that their average life is well over 1,000 hours.

The new types are called "projection" lamps, and are specially designed for use with parabolic or spherical reflectors and condenser lenses, as used in kinematographs, &c. The filament, therefore, is concentrated and arranged practically all in one

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plane, as shown in the accompanying illustrations, figs. 4, 7 and 8. These are made for 100-130 volts, 300-1,500 watts, and 600-3,000 c.p., in two patterns, for vertical and horizontal use respectively.

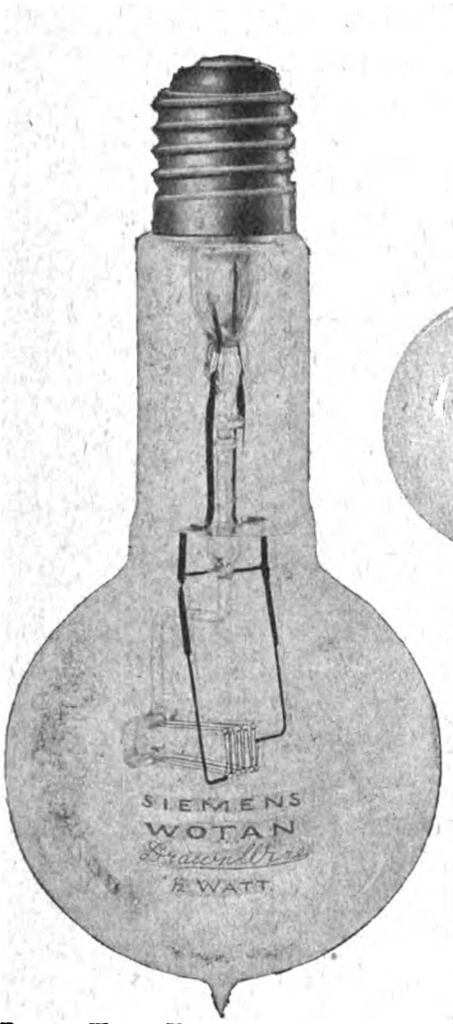

Fig. 7.—Wotan Half-Watt Projection Lamp.

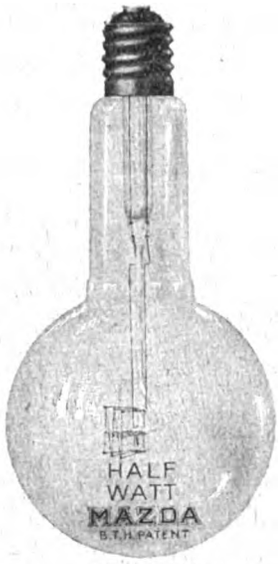

Fig. 8.—Mazda Half-Watt Projector Lamp.

Fig. 9.—Mazda Half-Watt Lamp, 200 c.p.

Fig. 5 shows the "Boro" half-watt lantern, which has been devised by the General Electric Co., Ltd., to replace arc lamps for out-door lighting, fitted with an automatic cut-out and substitutional resistance for series running.

The "Panma" Fuseboard.

A new departure is marked by the introduction of the "Panma" fuseboard, by Messrs. Siemens Brothers Dynamo Works, Ltd., of 38, Upper Thames Street, E.C., inasmuch as a slate base is dispensed with, and the fuses, of the well-known "Zed" type, are attached directly to the bus-bars, as shown in fig. 10.

The bus-bars are supported on bridge pieces of special insulating material, with a teak dividing fillet between the poles, and

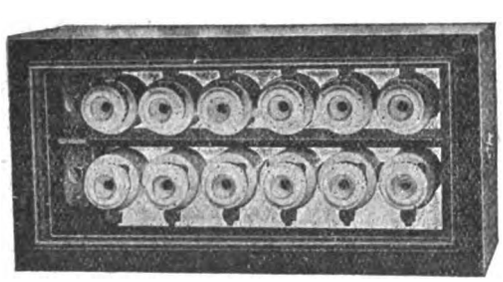

Fig. 10.—"Panma" Fuseboard.

the terminals are arranged so as to facilitate the wiring. The fuses are enclosed in a teak case fitted with a hinged glazed lid, and are made up in boards of 2 to 12 ways, at prices which compare favourably with those of ordinary boards.

To introduce these fuseboards a special bonus system is offered, to contractors only; the system is novel and ingenious, consisting in the immediate supply of free art quotation covers for estimates, inside which is a type-written letter from the contractor to the customer offering Zed fuses as an alternative to clip fuses. The bonus is granted on the number of Zed fuse fittings ordered during the six months commencing on August 1st, in the form of an open order for any goods sold by the company, at trade prices, and the conditions are simple and quite the reverse of onerous. Particulars can be had from the company, and should interest wiring contractors.

PARLIAMENTARY.

Electrification of the Brighton Line.

A Select Committee of the House of Commons, under the chairmanship of Mr. Rupert Gwynne, last week considered a Bill promoted by the London, Brighton and South Coast Railway Co., under which powers were sought further to extend their electrical supply.

Mr. Freeman, K.C., in opening the case, reminded the Committee that the promoters had for some time been electrifying their suburban lines, and they now desired to complete the scheme as far as Coulsdon on the main line and to Cheam on the Portsmouth section. So far they had been taking their supply from the London Electric Supply Corporation, and naturally, with the extension of the scheme, they would require a great deal more power. Before they decided on the extension, it was important that they should be sure of their supply, and they proposed to enter into contracts for that purpose. The Croydon Corporation, who possessed an electric lighting order, were opposing the Bill on the ground that it was not right that the company should be allowed to take power from anybody but themselves within their area. He asked the Committee to say that there were no grounds on which such opposition could be successful.

Mr. W. Forbes, general manager of the company, said that at present they were paying the Croydon Corporation between £700 and £800 a year for electricity for certain of their goods yards and sidings.

Replying to the Hon. J. D. Fitzgerald, who appeared for the Croydon Corporation, the Witness said that if the company were to make any progress with their electrification scheme, it was essential that they should take their power from one company in order that they might get it at the cheapest possible rate.

After further evidence, the Committee passed the preamble of the Bill, subject to the insertion of a clause that the company should use and not sell, and that they should use the current brought from outside the borough area solely for the purpose of the railway undertaking proper—traction, and station and goods yards lighting.

North-Eastern Railway Bill.

This Bill, which has already passed the House of Lords, came before a Committee of the House of Commons, presided over by Mr. R. Gwynne, on July 15th and 16th. Mr. Talbot, K.C., explained that originally there were 16 petitioners against the Bill, but all the opposition had been withdrawn except that of the Duke of Northumberland, who objected to the widening of the line from Killingworth and Forest Hall and Longbenton. The company had introduced a service of electrical traction in Newcastle and the neighbourhood, and the object of the widening was to give an electrical service from Benton up to Killingworth. Mr. Benton explained the position of the petitioner in regard to his wayleaves, and said that his Grace was under a complete misapprehension as to the effect of the Bill, as it could not harm him in any way.

The Chairman asked what objection there could be to giving a clause to secure to the Duke of Northumberland the same terms as he had secured in a previous Bill.

Mr. Talbot explained that the only reason was that the promoters did not want a useless enactment in the Bill.

Evidence having been given in support of the Bill, Mr. Ram, K.C., who appeared for the Duke of Northumberland, called Mr. C. G. May, solicitor, who stated that the Duke gave his land for the purpose of the railway, and the only return he got for it was in wayleaves.

The Committee found the preamble of the Bill proved, and the Chairman said they thought the chance of the Duke of Northumberland being injuriously affected was so remote that they did not think a protective clause was necessary. At the same time they did not wish their decision to be in any way prejudicial to the Duke in any further application made for the extension of that particular line.

Walsall Corporation Tramways.—This Bill, which seeks powers with regard to an extension of the tramways, trolley vehicles, and motor-omnibuses in the borough, came before a Select Committee of the House of Lords last week, the Duke of Bedford in the chair. When the Bill was before the Commons it was opposed by the County Councils of Walsall and Cannock on the question of road contribution. Mr. Fitzgerald, K.C., for the Corporation, announced that the parties had now come to terms on the point, and the Bill was ordered for report and third reading.

Third Readings.—In the House of Commons on July 14th, the Hightown Gas and Electricity Bill, and on July 16th the Shropshire, Worcestershire and Staffordshire Electric Power Bill and the Yorkshire Electric Power Bill, were read a third time.

In the House of Lords on July 20th the London United Tramways Bill was read a third time.

In the House of Commons on July 15th, the Lords' amendments to Deal and Walmer Gas and Electricity Bill were agreed to.

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LEGAL.

SENGHENYDD DISASTER.

POLICE Court proceedings taken by the Home Office against the manager and owners of Senghenydd Colliery, where 439 lives were lost in the disastrous explosion last October, concluded at Caerphilly on Saturday, when the magistrates delivered judgment. There were 17 charges against Mr. Edward Shaw, the manager, but these were reduced.

The magistrates imposed a fine of £2 for not appointing in writing a competent person to examine the safety lamps on the surface; a similar amount for not appointing in writing a competent person to unlock the safety lamps; and for not entering in the book the readings of the barometer, £5; for not providing a contrivance for the immediate reversal of the air, £10; for not causing to be made a report as to the conditions of the roads in regard to coal dust, £5. They also imposed five guineas costs on each of the convictions.

All the other summonses were dismissed, including also four summonses against the company. These dealt with alleged non-appointment in writing of an electrician and not systematically clearing road, roof, and sides of coal dust.

The evidence in this case, the magistrates said, was most conflicting, but they thought that the management had done everything practicable to prevent accumulation of coal dust. They also felt justified in dismissing the cases regarding the alleged use of safety lamps not of an approved type; also as to measurement of air on main current, as such regulations had only come into operation in the month prior to the explosion.—*Standard.*

WORKMEN'S COMPENSATION.

IN the West London County Court, on Friday last, application was made to his Honour Sir W. Lucius Selfe, for an award under the Workmen's Compensation Act, in favour of Mary Ann Sparks, 17 years of age, living at 41, Testerton Street, North Kensington, who had been employed by the Robertson Electric Lamp Co. The girl, it appeared, entered the respondents' factory at Brook Green in January, and was put to lamp cleaning. In April she was turned to cutting glass for the filaments, and while engaged in this she cut the index finger of her right hand, and this becoming bent, she was unable to work. It was proved in evidence that she earned more at "light" work than at the work she had been set to do. Witnesses deposed that cut fingers were quite common in this section of the works, and were seldom accounted serious. In May, Sparks was, with others, discharged through slackness of work, and she now claimed compensation. Asked why she was troubling about her finger, she replied that a relative told her she ought to get some recompense for the injury. His Honour awarded the girl £3 8s. compensation, with £3 3s. costs.

OSRAM LAMP WORKS, LTD., *v.* POPE'S ELECTRIC LAMP CO., LTD.

APPLICATION was made to Mr. Justice Joyce, in the Chancery Division, that a procedure summons in this action might be heard in open Court.

COUNSEL said the application was made with the consent of both parties.

His LORDSHIP acceded to the application, but said it must not be taken that the summons would be heard by him this side of the Long Vacation.

TRAMWAY ACCIDENT CLAIM.

A SETTLEMENT has been effected in the Court of Session action by a Dumbarton woman, who sued the Dumbarton Burgh and County Tramways Co., Ltd., for £1,000 damages for injuries. Fault was denied by the defenders, who have now paid the pursuer £250 in full settlement of her claim.

Copper.—The position at mid-month, to judge by the statistics tabulated by Messrs. H. R. Merton & Co., has not changed much in quantities of copper in visible and other supplies, though the price has made an appreciable advance. On the fortnight ending July 15th, 1914, English supplies had increased 1,238 tons. Total European supplies, however, owing principally to withdrawals from Rotterdam, and smaller quantities afloat, shows a decrease of 515 tons. Supplies during the fortnight have been low from North America, up to the average from Spain, slightly under from Australia and Chile. Total deliveries, at 18,678 tons, do not look very busy.

American visible supplies, as published by the American Producers' Association, had increased considerably during June, 9,718 tons being added during the month. The world's visible supplies for the end of June thus totalled 80,642 tons, the highest figure since March, 1913, and double that of last October.

The Channel Tunnel.—On June 29th an address was given by Lord Sydenham of Combe before a meeting of members of Parliament, convened by the House of Commons Channel Tunnel Committee, on the military aspect of the question. His views, and those of other speakers, were entirely opposed to the suggestion that the Tunnel would in any way weaken the defences of this country.

BUSINESS NOTES.

Consular Notes.—MANCHURIA.—The American Consul at Dairen reports that the South Manchuria Railway maintains electric lighting plants at Dairen, Mukden, Changchun, Antung and Liaoyang, and holds a controlling interest in the lighting plant at Newchang, which is operated in connection with the waterworks establishment at that port. All of the-e institutions seem to be giving fair business returns. Supplementary equipment, increasing the capacity by 1,500 KW., has recently been added to the Dairen plant. The capacity of the lighting establishments at Antung and Changchun has also been increased, and an additional generator will be installed at Liaoyang. The construction of an electric tramway, and the enlargement of the railway lighting plant at Mukden, have also been discussed. Recent statistics of lighting plants at main points along the railway give the number of households in which current has been installed as follows:—Dairen, 6,600; Mukden, 1,200; Changchun, 1,200; and Antung, 1,250. Meters are installed only where five or more lamps are in use, and the figures show that 32,000 lamps are supplied by meter in Dairen; 2,300 at Mukden; 3,400 at Changchun; and 2,600 at Antung. Lamps supplied by monthly contract number 16,000 at Dairen; 4,500 at Mukden; 3,800 at Changchun; and 3,600 at Antung.

RUSSIA.—The Russian Ministry of Communications has formulated a proposal for legislation with reference to the utilisation of water-powers, of which the following are the chief provisions:—(1) The right to utilise water-power is reserved to the State, which may either develop the power itself for the general well-being, or may grant concessions for its use in the interests of the development of certain industries; (2) this right cannot be passed to private undertakings in perpetuity as private property, but the concession must be of a terminable character, which will admit of the revision as may seem necessary, both of the terms under which the concession is let and of the purposes for which it is used; (3) should the utilisation of water-power acquire a State or public importance, the right is to be reserved to set aside all kinds of utilisation of this power of a private character in favour of public use; (4) the development of water-power must remain under Government supervision with the right to waive the concession in case of misuse or of developments of a monopolistic nature, so that the further utilisation of the water-power may pass to the Government for the remainder of the period of the concession, always provided that due compensation is made to the concessionaires concerned.

GREECE.—The British Consul for the Piræus reports that the commercial importance of the port of the Piræus has greatly increased and will continue to do so. Although the war, which cost Greece £15,179,000, has greatly affected the commercial prosperity of the country in general, the trade and industry of the Piræus has not suffered to any great extent. There is a great activity in all quarters to develop trade, and the acquisition by Greece of new territory will prove a powerful attraction for foreign and local capital to be used in the development of the agricultural and industrial resources of the country. Extension of existing railways and the construction of new lines will necessarily be undertaken, as well as irrigation works, the construction of roads, tramways and electric installations in many towns. The enlargement of the port of the Piræus, for which plans have already been made and submitted to the Government, will no doubt be carried out, as will also a large number of other important works which are under Government consideration. The agricultural districts in Macedonia, Epirus and the Islands offer openings for a good trade in machinery, flour mills, oil mills, and gas motors for working small plants, as well as in electric tramways and motor-omnibuses for carrying mails and passengers in districts where there are no railways, &c. The business that can be done in Greece is very important and of great value, and United Kingdom engineers and firms should do their utmost to secure at least part of these orders. Goods should be brought direct to the buyer's notice by advertisements, and by efficient representatives, who could explain the working of the machines and help buyers to obtain what is suited to their needs. Credit may be given against security to *bonâ-fide* agriculturists or proprietors of industrial establishments. United Kingdom machinery, implements, and all kinds of goods and articles have always received a marked preference in Greece, but the better methods adopted by foreign competitors, who have a thorough knowledge of trade conditions in Greece, tend to diminish the opportunities of United Kingdom firms. The outlook is good. Trade is already getting brisk, and when the political situation is definitely cleared up there can be little doubt that there will be better times for trade all round. The Greek market is worth much more attention than it gets from United Kingdom manufacturers, and it would be well worth their while to study the requirements and to cater for them more fully than they do at present. A boom is also expected in the building trade in the near future, and there will, consequently, be a good demand for building materials and general hardware.

The commission usually paid to agents in the Piræus districts for the sale of machinery, is from 5 to 10 per cent. The commission is due only on goods actually paid for, and applies to all orders, whether placed through the agent or direct. A local agent incurs no responsibility unless he acts contrary to instructions. The credit usually given by foreign firms through agents is from four to six months, and a discount of 2½ per cent. is usually allowed for cash payments. Prompt and punctual delivery of orders is essential; local merchants have the habit of waiting until the

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last moment before giving orders, and, should there be any delay in delivery, acceptance is often refused. Commission business is in the hands of persons who are energetic, but who in some cases do not present the necessary guarantees of solvency. For this reason the Consul is of opinion that the following measures should be taken :— (1) Agents should only be entrusted with the collection of sums of money in special instances; (2) when orders are dispatched the firm should ask that the order be signed by the merchant who orders the goods, as otherwise it is easy for disputes to arise as to quality, &c.; (3) bills of lading should be sent through a bank to ensure delivery only on payment for the goods, or in exchange for a draft. While, as a general rule, these precautions should be taken, there are several commission agents in whom full confidence can be placed. Commercial travellers are not required to go through any formalities in order to be able legally to exercise their calling in Greece, nor are they required to take out a licence provided they come and go merely as bearers and receivers of orders. Agents of British firms, resident and trading in Greece, are, however, required to take out trade licences.

SWEDEN.—In a recent report the American Consul at Gothenburg comments on the development of hydro-electric power in Sweden, and gives certain details of works either under construction at the time of writing, or recently completed.

The city of Boras (Alfsborg County) has under construction a power station of 5,000 H.P. Lindesberg, a town in Orebro County, is building at Ringaby a power plant of 800 H.P. The city of Filipstad is constructing a lighting plant of 400 H.P. within the city itself.

A number of distribution plants are also being built. Director J. Nilsson is erecting a power station of 3,000 H.P. near Odensfors. It is to co-operate with the Lindkoping power and lighting station. The Eskilstuna Iron Manufactures Co. is building a power plant of 2,400 H.P. at Tunafors, and the Huskvarna Arms Manufacturing Co., of Huskvarna, is building one of 3,650 H.P. The plant at Dejefors is being enlarged, so that it will have a capacity of about 5,000 H.P., instead of its present capacity of 3,000 H.P. Besides the power plants mentioned, there are several smaller ones under construction in the country.

At many places extensions of electric plants have been made for the use of the wood-pulp, paper and iron industries. The large power plant at Bullerfors, belonging to Stora Kopparbergs Aktiebolag, was finished in 1910. In 1913 the last machinery fixtures were installed, giving the station a capacity of 30,000 H.P., of which the largest portion is used for iron smelting at Domnarfvet.

The Uddeholms Aktiebolag has also finished its power plant of 23,000 H.P. at Forshult, on the River Klaralven. It is to be used for the same purpose as that at Bullerfors. The Uddeholm Co. has also commenced the construction work on a power plant in the Uva River, likewise intended for the electric production of pig-iron. Kookums Jarnverks Aktiebolag is extending its hydroelectric power plant in the Ronneby River, so that the stations at Kallinge and Ronneby will have increased capacity. The Jaders Iron Works are building a power plant of 600 H.P. on the Arboga River, partly for factory use and partly for distribution, and a large enterprise in this line is being planned by the Arboga machine shops (Arboga Mekaniska Verkstader).

The power plants for the mining industry were increased considerably during 1913. The Guldsmedshytte Aktiebolag is building two power stations at Blankafors and Rockesholm, on the River Svartalfven, each of 2,100 H.P., and Riddarhytte Aktiebolag is building one at Gislarbo (Wastmanland County) with a capacity of 1,500 H.P. In the neighbourhood of Ludvika two power stations of 650 and 220 H.P. are under construction for Aktiebolaget Ludvika Bruksagare. Nora Bergalags Grufvor are building dams at Rastalfakvarn to secure 550 H.P. from the waterfall there. Finally, it may be mentioned that the Norberg mines received power from the Kolback River, and Virsbo Aktiebolag from Norsbo. These stations are of 900 H.P., as is also that of Ramnas Aktiebolag at Seglingsberg.

The paper and pulp mills have been compelled to make new arrangements by reason of increased demand for power. The Klippan Paper Mills are rebuilding their power plants, so that the station at Klippan will have a capacity of 875 H.P., and that at Fermsallen 500 H.P. In the same manner the power plant at Havrestrom is enlarged by 2,000 H.P. In Norrland a new power station is under construction for this industry. The Gidea and Husum Companies built a station of 2,500 H.P. in Gide River, at Gidea, which is to furnish power to the Hornefors Pulp Mill.

Catalogues and Lists.—Messrs. A. Emanuel & Sons, Ltd., Phœnix Works, Speakingstile Walk, Birmingham.—Card showing their patent adjustable pendant which "stops where you push it."

Messrs. Taylor, Taylor & Hobson, Ltd., Stoughton Street Works, Leicester.—24-page catalogue of engraving machines describing three different types of machine for engraving letters, figures, and designs upon metals and other materials. The machines shown are (1) for general work; (2) for large plate work; (3) for automobile or cycle tire moulds, gun mountings, &c.

Messrs. John White, St. John, N.B., Canada.—Illustrated folder describing and pricing the "Magnet" electric suction cleaner.

Messrs. Edison Accumulators, Ltd., 2 and 3, Duke Street, Piccadilly, S.W.—Two small pamphlets: One, dealing with the prevention of overcharge of storage batteries, fully describes the Sangamo circuit-breaker; the other describes the Sangamo ampere-hour meters for electric vehicles—these are largely used in America for electric vehicles, also for train lighting and other service. The Edison Co. are sole agents in the British Isles for the Sangamo Electric Co.

The Edison & Swan United Electric Light Co., Ltd., Ponder's End.—Leaflet No. L 3,048 gives prices of Royal Ediswan drawn-wire traction lamps. We have also received an advance copy of a 32-page catalogue (third edition) of "Ediswan" electric heating and cooking apparatus. The contents include descriptive particulars, illustrations, and prices of boiling pots and glue pots, saucepans, stewpans, and urns, "Eadisk" cookers and hot-plates, "Hot-point" irons, Hosgood patent stoneware utensils, "Hotwynd" blowers, kettles, grills, ovens, porringers, Pygmy heaters, and so on.

Messrs. Weston & Co., 47, Minories, London, E.C.—Leaflet relating to grinding paste, its use, advantages and price.

I.T.C., Ltd., 147/149, Great Portland Street, London, W.—Priced folder concerning automatic desk and other telephones.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Illustrated lists relating to aluminium castings and tread plate; also a 32-page pocket pamphlet illustrating a number of applications of aluminium in the motor-car, electrical, gas and other industries.

Messrs. Feld Bros. & Co., Ltd., 25, Budge Row, London, E.C. Priced leaflets as follows:—No. 253, "Gnom" connectors and insulated screw eyes; 254, "Goliath" holders; 255, aluminium illumination strip holder; 256, push-bar holder; and 257, micanite in sheets.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—To aid contractors in securing orders for "Freezor" fans, the company have designed a neat folder with space for overprinting contractors' names and addresses. The folder points out the value of the fans in preventing stuffiness in offices, keeping restaurants cool and pleasant, shops wholesome, and private houses fresh. New Bulletin, No. 9, of 56 pages, contains full information regarding "Witton" rotary converters, with pictures of plant supplied to public and other supply systems. The different sections contain the following :—Standard specification for rotary converters, general principles of ditto, control of ditto, methods of starting and self-synchronising rotaries, and rotary converter sub-stations.

The Naylor Battery Co., Ltd., Lammermoor Road, Balham, London, S.W.—16-page catalogue giving illustrations and particulars, also prices, dimensions, weights, &c., of Naylor accumulators for car lighting, ignition and starting, electric vehicle and launch service. In the traction section the "A," "B" and "C" types are detailed.

Messrs. Matthews & Yates, Ltd., Cyclone Works, Swinton, near Manchester.—8-page illustrated booklet concerning "Cyclone" electric fans, electric blowers and exhausters, "Cyclone" motors, &c.

Messrs. Steinbach & Hohn, Mansion House Chambers, London, E.C.—Price leaflet of porcelain fittings and weatherproof enamelled fittings for half-watt lamp lighting.

Trade Announcements.—Messrs. Morris & Lister (London), Ltd., have now taken over the sole representation for London and the South of England for Messrs. Mickelwright, Ltd., of Alperton, and all inquiries, &c., should now be sent to them at 3 and 4, Palace Chambers, Bridge Street, Westminster, S.W.

Mr. A. J. Hodgson, late joint general manager and previously works manager with Messrs. Crompton & Co., Ltd., has joined the business which has been carried on by Mr. W. Hotton for some years. They will in future trade as electrical, gas and mechanical engineers and contractors under the style of Hotton & Hodgson, Ltd., 71, Southwark Street, S.E.

Mr. J. G. Bomford, of Shakespeare Chambers, Stratford-on-Avon, concerning whose business a notice appeared here last week, invites manufacturers and factors to forward catalogues.

The Reliance Electrical Wire Co. have removed to larger premises at Spitalfields Works, 38 and 40, Curtain Road, London, E.C., where they have had a new electrically-driven factory specially constructed and equipped. Telephone No. unaltered (9212 London Wall).

The Crypto Electrical Co. have now removed their office from Bermondsey Street to their new works, Acton Lane, Willesden (five minutes' walk from Harlesden Station, L.N.W. Rly.). Telephone Nos. 233, 2240, and 2241 Willesden.

Mr. Charles H. Jeffcoat ("Lamlok" specialities) has removed to 18, Ranelagh Gardens, Chiswick.

Messrs. Ledward & Beckett, Ltd., have removed their offices to Broadway Chambers, Westminster, S.W.

Bankruptcy Proceedings.—W. R. Wedge, electrical engineer, The Arcade, Northampton.—The adjourned examination of this debtor was fixed to take place at the County Hall, Northampton, on July 14th, but when the debtor's name was called, he did not appear. The Official Receiver (Mr. A. Ewen) stated that he had received another letter from the debtor, from which he gathered that he would like another opportunity of appearing. He was suffering from disablement, and had been advised by a doctor to undergo an operation. The case was, therefore, again adjourned.

Liquidations.—The "Dac" Accumulator Syndicate, Ltd.—This company is winding up voluntarily for the purpose of reconstruction, with Mr. H. C. Bound, of 61 and 62, Lincoln's Inn Fields, W.C., as liquidator. A new company is to be registered under the same name.

The Rapid Light Controlling Syndicate, Ltd.—This company is winding up voluntarily with Mr. R. H. Pritchard as liquidator. A meeting of creditors is called for July 27th, at 7, Victoria Street, S.W

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Electrical Exhibition at Wolverhampton.—An Electrical Exhibition, promoted by the Corporation Electricity Department and held in the West Park on the occasion of the Annual Floral Fête, has just been concluded at Wolverhampton.

In a marquee, covering an area of 13,300 sq. ft., a substantial timber model house was built by the department's staff, with seven rooms, which were tastefully furnished and equipped with samples of electric heaters, cookers and other domestic apparatus.

There were some exhibits by local firms, the principal of which was the well-equipped stall of Messrs. Reed, electrical contractors, and the Electricity Department undertook to exhibit apparatus for outside firms, amongst which were :—

Meters, switchgear and fuse boxes, from the Reason Manufacturing Co.

Vacuum cleaners, motors and cookers, from Messrs. Gillespie and Beales.

Electric drills, from the Westminster Tool Co.

Electric tube cleaners, from Mr. F. Gilman, Birmingham.

Ventilating fans and fittings, from Messrs. Veritys, Ltd.

Heaters and cookers, from the Credenda Co.

Kettles, irons, &c., from the Electrical Co.

Table utensils, from the Brompton and Kensington Accessories Co.

Water-heating apparatus, from the British Electric Heaters Co., Glasgow.

Electric vehicles, from Messrs. Mossay & Co.

Electric cookers, from Messrs. Ferranti, Ltd.

Motors, from the Electric Construction Co.

These firms each had a representative present throughout the Exhibition.

A large assortment of modern electric cooking stoves was on view and in use, including the Tricity, Carron, Ferranti, Eclipse and Credenda types. The food required for the feeding of the staff, representatives and exhibitors, numbering about 40 persons, was cooked at the Exhibition, and a separate tent was used for cooking demonstrations.

No charge was made for admission to the Exhibition, and the total attendance numbered over 50,000 persons.

The Exhibition proved an admirable opportunity for the borough electrical engineer, Mr. S. T. Allen, to get directly into touch with a large number of would-be consumers.

"C. and H." Convention.—Birmingham, which was this year the scene of the I.M.E.A. Convention, had a second Electrical Convention last week, when MESSRS. CHAMBERLAIN AND HOOKHAM held what was also *their* second Convention. While the numbers were necessarily smaller, there were otherwise all the usual features of a convention, including the informal "gathering of the clans" in the hotel smoke-room the night before, papers and discussions, and feasting. The members of the selling staff—Messrs. Bland, Frost, Selley, Sleath, Rouse and Sharp—strengthened by colleagues from overseas—Messrs. Hogarth, from Germany; Lines, from Canada; Munroe, from South America; Carter, who has just returned from a long trip through the East; and Bennett, who is just going out there—met all the heads of indoor departments, and each side told the other what it thought of them. Mr. John Chamberlain umpired, assisted by Mr. Hookham. Mr. Hatfield, so well known for his work on electrolytic meters, was present, and delivered an interesting lecture, illustrated by very large drawings, on the Holden hydrogen meter, which he has been developing for Messrs. Chamberlain & Hookham for the last two years or more. We understand that there seems a likelihood of an important development with this meter. Mr. Griesbach also attended the meeting, and demonstrated the new prepayment meter which he has recently invented, and which is about to be placed on the market by the firm. At the luncheon, to which Mr. Chamberlain invited the party at the Imperial Hotel, Mr. Chamberlain referred to the many other members of the staff who were carrying on the firm's work in various parts of the world, and who were unable to be present that day. Advantage was taken of the opportunity to present a canteen of cutlery to Mr. Lines, who has just entered the "Holy House of Bondage." In the evening Mr. and Mrs. Lines were entertained to dinner at the Queen's Hotel by the other members of the party.

Book Notices.—*Universal Directory of Railway Officials*, 1914. London: Directory Publishing Co., Ltd. 10s.—This annual publication has now reached its 20th year. For all who want information, from time to time, regarding the railway systems of the world, and their *personnel*, it is of great value. As usual, it has been compiled from official sources by Mr. S. R. Blundstone, editor of the *Railway Engineer*. Its personal index of railway officials occupies nearly 200 pages, and more than double that space is devoted to the details of systems placed alphabetically in different geographical sections.

"Electric Traction." By L. Calisch. London: The Locomotive Publishing Co., Ltd. Price 2s. net.

Electric Sign Lamps.—H.M. Consul-General at New York (Sir C. W. Bennett, C.I.E.) reports that a firm of electric sign manufacturers in New Jersey desires to get into communication with United Kingdom makers of miniature metal-filament lamps, of which it is desired to purchase about 100,000. The lamps are to consume about ½ ampere at 4½ volts and to have a useful life of 1,000 hours.—*Board of Trade Journal.*

Strike.—A number of workmen employed by the BRITISH INSULATED AND HELSBY CABLES, LTD., downed tools on July 15th, and on the following day part of the works was closed by the firm until further notice.

Holidays.—The works of the CABLE ACCESSORIES CO., LTD., Tividale, Tipton, will be closed from Saturday, August 1st, until Monday morning August 10th, for the annual holidays.

MESSRS. A. P. LUNDBERG & SONS, of Liverpool Road, N., announce the closing of their works from July 31st to August 10th, for the annual holidays.

The works of the LONDON ELECTRIC FIRM will be closed on Saturday, August 1st, and reopened on Monday, August 10th, for the annual holiday. A small staff will attend to urgent business.

MESSRS. J. H. TUCKER & CO., of Birmingham, announce that their works will be closed the whole of August Bank Holiday week. The offices and warehouses will be reopened on Wednesday, and will deal as far as possible with orders for stock lines. Urgent matters should be notified at once.

The works of MESSRS. H. T. BOOTHROYD, LTD., Bootle, Liverpool, will be closed for the annual holiday on Friday, July 31st, and will re-open on Monday, August 10th. Only urgent correspondence will be dealt with.

MESSRS. COX-WALKERS, LTD., Darlington, announce that their works will be closed from Saturday, August 1st, until Monday, August 10th, 1914, for the annual holiday. Only matters of urgency will be dealt with during that period.

The works of the LIVERPOOL ELECTRIC CABLE CO., LTD., will be closed from Saturday, August 1st, until Monday morning, Aug. 10th.

MESSRS. A. SEAGE & CO., of Hammersmith, announce the closing of their works and offices from August 1st to 10th for the annual holidays.

The WESTERN ELECTRIC CO.'S works at North Woolwich will be closed for the holidays from August 1st to August 10th, and only the most urgent matters will be dealt with.

The works of MESSRS. MUIRHEAD & CO., LTD., Elmers End, will be closed from July 30th (evening) until August 10th.

Annual Outings.—The annual excursion of the employés of the Hull Corporation Electricity Department took place last week, when the party visited Bridlington and Flamborough. From Bridlington the visitors went to Flamborough by motor char-à-banc, and after lunch at the Dog and Duck Hotel, the party investigated the wild beauties of the North Landing. Sports followed. Dinner was served in the evening, and a hearty vote of thanks was accorded the chairman of the Electricity Committee (Alderman Hanger), the vice-chairman (Councillor Pybus), and the secretary (Mr. W. Dyson), who had arranged the outing. Later the party returned to Bridlington, where free admission to the Prince's Parade was granted, and thence homewards to Hull.

The employés of MESSRS. FERRANTI, LTD., Hollinwood, recently went to Scarborough for their outing.

In exceptionally fine weather the annual picnic of the SYNCHRONOME CO., LTD., took place on Saturday last. The party, 30 in number, embarked at Windsor on the launch *Duchess*, and visited Quarry Woods, Marlow, Bispham Abbey and Temple Lock. Mr. Hope-Jones, in one of the speeches, spoke of the loyalty of the staff.

The annual outing of the ST. HELENS CABLE AND RUBBER CO.'S staff took place on July 17th, at Llandudno, the party numbering over 60. The dinner was presided over by Mr. J. H. C. Brooking, the general manager, who, in proposing the toast of "Prosperity to the Company," expressed his gratitude to the staff for working so ably during the past few years as to make a success of what was before then a very struggling concern.

The employés of MESSRS. D. H. BONNELLA & SON, LTD., held their annual outing on Saturday, July 18th, proceeding by rail and boat to Margate. The weather was all that could be desired, and a most enjoyable day was spent. Tea was served at the Albion Hotel. The managing director, Mr. A. J. Bonnella, who presided, expressed his pleasure at being present, and regretted the absence of both Mr. D. H. Bonnella and Mr. D. C. Bonnella, and referred to the continued progress made by the firm, which necessitated enlarged premises. He thanked all the employés for their co-operation which had contributed to this desirable state of affairs. The number of employés was considerably over 100, and that number would, he felt sure, with their continued co-operation, soon be increased. Mr. Farthing, Mr. Frost, and Mr. Burnett heads of machine, assembling and wood-working departments, accompanied the party.

The employés of the GUERNSEY ELECTRIC LIGHT AND POWER CO., LTD., went for their annual outing last Saturday week, a party of 45 going by way of St. Sampson's and Bordeaux Harbour to Fort Doyle, to inspect the Platte Fougère lighthouse station. Mr. Ferguson, the engineer, conducted the party round. A lobster tea was served at the Rockmount Hotel. Sports were indulged in on the sands, and a smoking concert followed in the evening, Mr. C. T. Westlake presiding.

The London Electric Railways Athletic Club held its second annual outing at Stamford Bridge on Saturday last.

Glasgow.—For the lighting of the Glasgow Royal Hospital for Sick Children, which was opened by the King last week, nearly 2,000 "Royal Ediswan" drawn-wire metal-filament lamps are in use.

Stoker Contracts.—We have received the following list of authorities for whom the UNDERFEED STOKER CO. has lately executed orders for stokers and other apparatus:—Edinburgh, St. Helens, Halifax, Ealing, Torquay, Tunbridge Wells, Sunderland, Maidstone, Dumfries, and Barrow-in-Furness Municipal Electricity Departments; Pernambuco Tramways; National Electric Supply Co., Preston; North-Eastern Railway, Hull.

The Next Motor Show.—The next Olympia motor show is to take place from November 6th to 14th, and it is said that practically all the space has been disposed of.

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LIGHTING and POWER NOTES.

Accrington.—Year's Working.—Reporting on the work of the electricity department, Mr. Harold Gray, the borough electrical engineer, states that the gas plant has been kept as fully loaded as possible, turning out 4,099,221 units sold, while the steam plant has been used for the peak loads, producing 1,756,809 units. The fuel cost for the gas plant was 0·220d. per unit, and for steam 0·483d. per unit sold. Wages were respectively 0·126d. and 0·200d. The sale of sulphate of ammonia and tar resulted in a net income of £1,327, or 0·077d. per unit, though the sulphate plant was running for only 88 weeks. Oil, stores and repairs cost 0·069d. and 0·079d. per unit for gas and steam plant respectively, the works costs being 0·338d. for gas and 0·762d. per unit for steam, or 0·466d. per unit for both plants. The distribution system has been extended, and 204 new consumers have been connected—the largest number recorded in any one year; the increase was partly due to the popularity of the rateable value system of charging, which has been adopted by more than 10 per cent. of the consumers, who number 1,136. A chemical laboratory, rendered necessary by the use of Mond gas plant, has been very useful in testing fuel, bitumen, oils, &c. The adoption of the Norwich system has led to a great increase in the sales of heating and cooking appliances.

Aldershot.—New Plant.—The Lighting Committee has recommended the U.D.C. to obtain tenders for a cooling tower at the electricity works, at an estimated cost of £400.

Belfast. — Workhouse Lighting. — Messrs. John Woodside & Co., in a report on the scheme of the Selas Lighting Co. for lighting and heating the workhouse with electricity, state that the capital cost would be £22,308. The maintenance charges under the scheme would be £4,552 per annum, exclusive of loan charges, against £6,889 per annum at present. The Guardians have referred the matter to the Works Committee.

Blackburn.—Gas Scheme Held Up.—Sir Corbet Woodall, Governor of the Gas Light and Coke Co., recently reported to the Blackburn Gas Committee on the reconstruction and reorganisation of the gas works, and recommended the expenditure of over £25,000. The Special Committee, however, has hung up the scheme for the present, as it is considering an equally large expenditure in connection with the electricity undertaking, and both matters are to be referred to the full Council. A special report in connection with the projected electricity extension was prepared a few months ago.

Blyth.—Overhead Wires.—The U.D.C. has consented to the Northern Counties E.S. Co. erecting overhead wires in the district for the transmission of energy at 3,000 volts.

Burton-on-Trent.—Loan Sanction.—Without holding an inquiry, the L.G.B. has sanctioned the borrowing by the T.C. of £7,000 for electricity purposes.

The Constructional Engineering Co., which is establishing works in Wetmore Road, has applied to the Council for a large supply of electricity for power purposes.

Bury St. Edmunds.—Free Wiring.—As a result of the decision of the T.C. to install electric light in houses on the free wiring system, over 50 applications have been received, and 12 houses are to be wired at once.

Canada.—The Cataract Power Co., Niagara Falls, has signed a 15-year contract with the city of Hamilton for lighting the city streets at an increased cost of $88,000 over the present price. The 600 arc lamps are being replaced by 7,000 nitrogen lamps. Sir Adam Beck, chairman of the Ontario Hydroelectric Commission, congratulated Hamilton on being the first city on the Continent of America to adopt this system of lighting.

The Winnipeg Electric Railway Co. has completed arrangements for the erection of a power station at Big Bonnet Falls, 70 miles north of Winnipeg. The plant will have a final capacity of 150,000 H.P., and will cost nearly $8,000,000. Only 60,000 H.P. will, however, be developed at first.

Chippenham.—Street Lighting.—The T.C. has decided to have a report prepared as to the relative cost of lighting by electricity the street lamps now lighted by gas supplied through meters.

Clones.—Public Lighting.—The town is to be electrically lighted for three years by the Clones Electric Lighting Co. The scheme embraces 41 lamps of 500 to 4,000 C.P., the total candle-power being 47,900.

Cuddington.—Proposed E.L.—The Council recently appointed a Committee to confer with the South Metropolitan E.L. Co. on the question of a supply of electricity in the district.

Dublin.—Loan Sanction.—The L.G.B. has sanctioned the borrowing by the Corporation electric supply department of £77,800 for public lighting purposes. The proposed loan of £5,000 for the conversion of gas lighting to electricity has, with the consent of the Public Lighting Committee, been reduced to £2,500, and the matter is to be further considered in a year.

Durham County.—E.L. Scheme.—A joint meeting of the Coxhoe, Cassop and Kelloe P.C.'s has decided to light various parishes with electricity. East Hetton, Kelloe, South View, St. Helen's Terrace, Quarrington Hill and Cassop are to be supplied by the owners of the East Hetton Colliery, and Bowburn, Tursdale, and other districts are to be supplied by Messrs. Bell Bros., Ltd.

Easington.—Hospital Heating.—The R.D.C. has appointed a Committee to consider the advisability of heating the hospital buildings with electricity.

East Grinstead.—Proposed E.L.—The U.D.C., after considering a report by Mr. J. B. Morgan, has decided to apply to the B. of T. for a prov. order for E.L. The capital outlay for the proposed scheme, which includes a refuse destructor, is estimated at £10,000.

Edinburgh.—Loan Sanction.—The T.C. has received the consent of the Secretary for Scotland to the borrowing of £220,000 for the extension of the electricity undertaking.

Glastonbury.—Prov. Order.—The T.C. has received a letter from Messrs. Christy Bros. & Co., of Chelmsford, notifying their intention of applying for an E.L. order for the town.

Goole.—Dock Equipment.—The *Goole Times* gives particulars of recent improvements carried out by the Lancashire and Yorkshire Railway Co. The company has erected several new sheds and warehouses on the dock sides, all of which are equipped with the latest and most approved types of machinery operated by electric power. On the east side of the railway dock electrical overhead travelling cranes, fitted with underhung revolving jibs, of 1½ tons' lifting capacity, have been installed. These can lift direct from the ships' holds and deposit in the shed, or in wagons standing on the lines of railway at the far side of the shed. In addition there is one 3-ton ordinary electric overhead travelling crane without swing jib. Modern free-bollard electrical capstans are fixed alongside the lines to facilitate the movements of wagons. On the west side of the same dock, near Bridge Street, a two-storey warehouse was recently erected. The outside of the shed on the dockside is swept by two 3-ton electrical travelling jib cranes, whilst inside the shed there is one 1½-ton electrical overhead travelling crane. Four 1-ton electrical jiggers are fitted on the upper floor. Electrical capstans transfer wagons to and from the railway sidings. About 2 miles from Goole a spacious shed has been erected, and is fitted with a 1½-ton electric overhead travelling crane and electric capstans. On the west side of the railway dock the Railway Co. is building a modern workshop, stores and offices, for the marine engine department. The motive power in this place, together with that for the operation of the new electric plant and lighting, is being obtained from the Yorkshire Electric Power Co. to the extent of 500 H.P.

Great Yarmouth.—Police Lamps.—The T.C. has decided to provide the police with 30 electric lamps, at a cost of £10 2s. 6d., with £28 10s. for a generator for recharging the batteries.

Guernsey.—Illuminations.—At the fêtes in connection with the recent unveiling of the Victor Hugo statue, which was presented by the French Government, a very complete scheme of illuminations was arranged. Unfortunately heavy rain and wind somewhat spoiled the show so far as gas and candle lanterns were concerned, and we learn from the *Guernsey Advertiser* that "only electric illuminations were at all a success," while another writer in the same paper comes to the conclusion that gas illumination is obsolete. The Guernsey E.L. and P. Co. apparently made an excellent display, including a searchlight.

Hayle.—Proposed Street Lighting.—The Cornwall E.P.S. Co. has informed the U.D.C. that it could install 63 street lamps in the district for £960, provided that wayleaves for overhead wires were granted, and that the company was permitted to fix wires for private supply on the same poles. The lamps would be of 50 C.P. each, and the charge for maintenance would be 30s. per lamp for 1,600 hours of lighting per annum. It is estimated that the Council will save £100 per annum if the scheme is adopted.

Holmfirth.—E.L. Scheme.—The L.G.B. has intimated its willingness to give a favourable decision on the electricity scheme, provided the B. of T. will approve of the site of the generating station, and the proposed method of supply.

Japan.—Notwithstanding the frequent pledges of the Government gradually to abandon State enterprises, it is reported that the idea of nationalising all the water-power undertakings in Japan is gaining ground in official circles. The reason advanced for the new departure is that the nationalisation of the undertakings will remove all inconveniences to the Government in the execution of the waterway administration programme. The Waterway Department at present is not empowered to deal with the use of the rivers as a source of power, the result being that much of the work of the department is rendered futile. At present the law does not provide for the imposition of any burden on the power companies, who, while freely making use of the rivers, do not share the cost of their upkeep.

Keighley.—Prov. Order.—The Corporation has notified the R.D.C. of its intention to apply for a prov. order to supply electricity in the rural district, or some part thereof.

Kirkcaldy.—Year's Working.—Although the output of the Corporation electricity department for the past year was greater than ever before, the net revenue showed a decrease of £174 compared with the previous year. The reduction is attributed to the high price of coal.

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Litherland.—PROV. ORDER.—The U.D.C. having been informed that the Bootle T.C. intends applying for a prov. order for electric lighting in its district, has decided to take steps to obtain its own order. Permission has been granted for the Bootle T.C. to supply current to the premises of Messrs. Geo. Sturla and Son, Ltd., Linacre Road.

London.—L.C.C.—The L.C.C. has been recommended by its Finance Committee to sanction the borrowing of £3,500 by the Battersea B.C., for coal-conveying plant at the electricity works, and of £5,316 by the Islington B.C., for cooling towers at the electricity works, including £3,750 for plant and £1,566 for the site.

On October 28th, 1913, the L.C.C. sanctioned the borrowing by the Hackney B.C. of £56,748 for electricity purposes. A revised estimate, based on tenders received, and making a total of £60,000, has now been sanctioned by the L.C.C. The revised loan includes £2,716 for sites, £10,632 for buildings, £32,652 for mains, and £14,000 for plant.

STEPNEY.—The Electricity Committee has recommended the B.C. to take up a loan of £35,000, for which L.C.C. sanction has been obtained, for new plant at the Limehouse generating station.

The B. of T. has approved of the agreement for the bulk supply of electricity between the Stepney and Shoreditch B C.'s.

ST. PANCRAS.—ANNUAL ACCOUNTS.—The gross income of the Borough Council's electricity department for the year ended March 31st last was £93,483, an increase of £2,944 over the previous year. The net profit was £12,568, an increase of £1,883. The reserve fund now amounts to £44,033.

SHOREDITCH.—The Lighting Committee has recommended the B.C. to lay a main from Coronet Street to Scrutton Street, in connection with the supply of electricity to the premises of Messrs. Waterlow & Sons, at an estimated cost, including switchgear, of £1,350.

Llandudno.—YEAR'S WORKING.—The receipts of the U.D.C.'s electricity undertaking for the year ended March 31st last increased by £105, and the expenditure by £467, over the previous year. The gross profit was £3,905, against £4,268, and the net profit was £462, a decrease of £319. The output increased by 34,846 units.

Lossiemouth.—SUPPLY INAUGURATED.—The electricity supply, which has been installed at a cost of £5,500, was switched on last week. The plant consists of two 50-B.H.P. suction gas engines, built by Messrs. Ruston, Proctor & Co., coupled to 25-KW. dynamos, supplied by Messrs. Johnson & Phillips, Ltd. The whole of the mains work was carried out by the Silvertown Co.

Mansfield.—YEAR'S WORKING.—The profit on the past year's working of the Corporation electricity department amounted to £1,581, against £1,128 in the previous year, and it is proposed to allocate £800 to the relief of the rates.

The question of extending the electricity works has been referred to a sub-committee for consideration.

Midsomer Norton.—PROV. ORDER.—The Midsomer Norton and Radstock E.S. Co. has informed the U.D.C. that it intends applying to the B. of T. for a prov. order for E.L. within the Council's area.

Nelson (near Cardiff).—PROPOSED E.L.—The South Wales E.P.D. Co. is in correspondence with the Caerphilly U.D.C. respecting the public lighting of Nelson by electricity.

New Zealand.—The ratepayers of Wairoa have sanctioned a loan of £4,000 for the extension of the E.L. system.—*B. of T. Journal.*

North Bierley.—WORKHOUSE LIGHTING.—The proposed lighting by electricity of the Union premises at Clayton having been approved by the L.G.B., the B. of G. has instructed Mr. T. Roles, of Bradford, to prepare a scheme.

Oldham.—ANNUAL REPORT.—The report of the Corporation electricity department for the year ended March 25th last states that the gross revenue amounted to £49,608, and the gross expenditure to £26,533. After allowing for loan charges and expenditure on meters, the net profit was £1,995. The units sold numbered 7,058,801, an increase of 595,385 over the previous year. This total includes private lighting, 1,884,226, an increase of 192,366; power, 1,854,596, an increase of 546,499; street lighting, 28,371, an increase of 125; and traction, 3,291,608, a decrease of 143,605. The total receipts from the sale of energy amounted to £48,710, an increase of £2,838, including private lighting, £20,742, an increase of £1,887; power, £7,172, an increase of £1,856; street lighting, £233; and traction, £20,564, a decrease of £906. The amount in reserve now totals £7,435. The capital expenditure during the year was £16,838. Works costs amounted to 0·423d. per unit, a decrease of 0·036d. compared with the previous year, and the total revenue costs were 0·898d. per unit, a decrease of 0·043d. per unit. The maximum demand during the year, exclusive of traction, was 2,424 KW., against 2,136 KW., and for traction 1,430 KW., against 1,480 KW. During the year the H.T. mains were extended by 7,842 yd., and the L.T. mains by 6,078 yd. The charges for energy have remained unaltered.

Portaferry.—PROPOSED E.L.—At a public meeting, held on July 10th, a Committee was appointed to consider an E.L. scheme for the town. Estimates were submitted by Messrs. W. Coates & Son and Messrs. Thomas Somerset & Co., who generate electricity in the town.

Portsmouth.—PROPOSED LOAN.—The E.L. Committee is about to apply to the L.G.B. for a loan of £24,000, for mains and other work during the next three years.

PRICE REDUCTION.—The charge for energy for power has been reduced by the T.C. to 1d. per unit for the first 20,000 units, and ½d. per unit beyond.

Radstock.—PROV. ORDER.—Messrs. Seymour Williams and Co., of Bristol, have notified the U.D.C. of their intention to apply for a prov. order for E.L. within its area.

Ruthin.—The estimate of Messrs. Edwards & Armstrong for wiring and fitting the Town Hall and fire station for E.L. has been submitted, for a report, to Mr. Smith, electrical engineer, Nottingham, who is also to prepare a specification for street lighting.

Sherborne.—E.L. SCHEME.—An E.L. scheme is about to be carried out at Sherborne.

Surbiton.—E.L. TRANSFER.—The District Council has agreed to transfer its electricity undertaking to Messrs. Callender's Cable Co. for 42 years, subject to the approval of the B. of T. and L.G.B. to the terms proposed, under which the Council will be recouped for all its expenditure on the concern up to the transfer, and Messrs. Callender's will afterwards be responsible for capital requirements.

Thelwall.—PROV. ORDER.—The P.C. has decided to support the application of the Warrington T.C. for a prov. order for E.L., to include Thelwall in its area, on condition that the T.C. will guarantee to supply current when requested to do so.

Torrington.—PUBLIC LIGHTING.—The T.C. has decided that electricity be adopted, provided that the E.S. Co. can show that public lighting by electricity will be cheaper than by gas.

Trowbridge.—HOSPITAL LIGHTING.—It has been decided to have the E.L. installed in the wards at the Cottage Hospital.

Wallasey.—LOAN SANCTION.—The L.G.B. has sanctioned the borrowing by the T.C. of £64,500, for a new electrical generating station at Poulton.

Walsall.—SEWAGE PUMPING.—The Electricity Committee is taking steps to extend the D.C. main from Lichfield Street to the R.D.C.'s sewage pumping station at Rushall.

Whitstable.—STREET LIGHTING.—In view of the approaching supply of electricity, the U.D.C. has given the Gas Co. notice to terminate the agreement for street lighting. There are 214 lamps, half of which are to be replaced by electric lamps.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—TRAMWAY SURPLUS.—It has transpired that the Secretary for Scotland insists on inserting a proviso, relating to the tramway surplus, in the prov. order promoted by the T.C., to the effect that the T.C. be restricted to placing £1,000 to the Common Good in any one year. A Committee of the Council has decided that it cannot recognise the right of the Secretary for Scotland to interfere with the decisions of the Parliamentary Committee which dealt with the order.

Dundee.—YEAR'S WORKING.—The annual report of the Corporation tramway department states that the passengers carried during the past year numbered 19,042,344, compared with 17,734,162 in the previous year, and the gross receipts amounted to £69,505, as against £65,044. The gross profit, after crediting the accident insurance fund with £1,000, was £26,066.

Halifax.—PROPOSED EXTENSIONS.—The Tramway Committee has received deputations in respect of suggested tramway extensions, as follows:—From the Southowram D.C., which urged that the Southowram route should be extended to the Pack Horse Inn; from the Hipperholme D.C., which asked for developments in its district; from the Mytholmroyd D.C., which asked for an extension of two miles to Cragg Vale; and from the Halifax Advertising Club, which urged the advisability of continuing the tramways to Elland and Stainland.

India.—According to *Indian Engineering*, Messrs. Gladstone, Wylie & Co. have been licensed to supply electric traction for the Benares scheme, to be completed within three years.

Kirkcaldy.—YEAR'S WORKING.—The revenue of the Corporation tramway department for the past year shows an increase of £1,743 over the previous year.

Lancashire.—An interesting light electric railway scheme is in course of development in South-East Lancashire, along the Yorkshire border. As a result of the great popularity of the electric tramway rides up into the hills, especially the branches from the Rochdale, Stalybridge and Hyde tramways, and the recent Oldham tramway extension to Grains Bar, it is now pro-

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posed to link up the various hill termini by a light railway, following approximately the ridge of the Pennine chain of mountains.

The line will extend from near the Godley terminus of the Oldham, Ashton and Hyde tramways, and along Werneth Low and Mottram to Deep Cutting near the lofty Mottram terminus of the Stalybridge tramways, and thence by the Brushes Waterworks and Mossley, where a trestle bridge will carry the line over the River Tame, and *viâ* Grotton to Grains Bar, near the new upland extension of the Oldham tramways. From this point the line will be continued *viâ* Crompton Moor and the Wicken Hall Moor to Blackstone Edge, and thence to near Littleborough, not very far from the Rochdale tramway terminus, and *viâ* Summit to Bacup, to which town the Rochdale tramways were recently extended. From Bacup the line will continue to Haslingden and Accrington, but the line between Hyde and Bacup, with the intermediate places, will be dealt with first.

The net length of the latter—following the curved route—is 34 miles, but with necessary deviations, largely on account of gradient, the total length is about 52 miles. The line is not primarily intended for quick travelling, but will be a bracing scenic railway—much like the Manx railways—passing through scenery of surpassing interest and beauty.

To minimise the capital cost it is hoped to obtain supplies of current from the six existing tramway authorities whose hill terminals will be touched. As the maximum demand will always be at a time when the generating station loads are at present light, and as the projected line will act as a feeder for their tramways, it is expected that favourable terms will be arranged.

Mr. Lawton, of New Moston, Failsworth, is interested in this very promising project, which will be welcomed by hundreds of thousands of natives who love these hills but find numerous pretty parts difficult of access at present.

London.—L.C.C.—The Highways Committee reports that it is now considering an exhaustive report on the whole question of the tramway system, particularly from the point of view of linking-up and general consolidation. As the Committee has not had an opportunity of fully weighing the views of M. A. Mariage, who was consulted on the subject, it recommends that its report, which will contain proposals for obtaining Parliamentary powers to carry out schemes for linking-up the dead-ends on the system, be submitted after the summer recess. According to the *Daily Express*, the proposals will cost £1,250,000.

The B. of T. has consented to the running of trailer cars on the new line from Rushey Green to Beckenham Lane.

Middlesex.—The Middlesex C.C. (Western Road and Improvements and Finance) Bill, which contains a clause authorising the Council to charge ½d. per mile in respect of each motor-omnibus using the new road, was read a third time and passed by the House of Lords on Monday.

Rawtenstall.—The T.C. has been informed by the Burnley T.C. that it intends applying to Parliament next session for powers to lay a tramway from its terminus in Manchester Road to the terminus of the Rawtenstall tramways at Loveclough. The matter has been referred to the Parliamentary Committee.

Rochdale.—Accident Claims.—Eighteen claims have been made against the T.C. in respect of the tramway accident at the bottom of John Street on February 14th. The whole of the claims have been settled for £1,357, which, with the costs incurred, brings up the total cost to the T.C. to £1,462, of which £1,000 has been received from the Insurance Co.

Goods Traffic.—The Tramways Committee has decided not to co-operate with Bury in the experiment of carrying goods by tramcar during the night.

Worsley.—The D.C. has decided to ask Sir George Pollard, M.P. for the Division, to use his influence again with the B. of T. to procure an independent inquiry into the condition of the cars of the South Lancs. Tramways Co. running through the district, and to ask for a report upon the overcrowding of the cars.

TELEGRAPH and TELEPHONE NOTES.

Cable Rates.—The rate for telegrams to Iquitos and certain other places in Peru is now 4s. 9d. per word by all routes.

Canada.—An automatic exchange for 10,000 subscribers is being installed at Medicine Hat (Alberta).

China.—In consequence of erroneous statements having been published regarding the contract between the Marconi Co. and the Chinese Government, of which some particulars were given in our issue of June 26th, the company informs us that it has every confidence that in due course the agreement will be signed and all mutual obligations will be fulfilled.

Portsmouth.—A deficiency of £1,390 in the accounts of the Corporation telephone department has been disclosed, for which the late Mr. Triggs, chief cashier, is alleged to have been responsible. The method adopted was to misappropriate cheques received near the end of the financial year, and show the rentals as outstanding. A duplicate receipt-book was also in use.

The Imperial Chain.—Replying to a question by Major Archer-Shee regarding a statement of the directors of Marconi's Wireless Telegraph Co. that nearly a year had passed since the ratification of the contract, and that the slow progress that the company had been permitted to make seriously prejudiced their interests, Mr. Hobhouse said it was a fact that delays had occurred in proceeding with the construction of the Imperial wireless stations through difficulties which could not be foreseen, but some further delay had been caused by proposals submitted by the company for an improvement in the working arrangements. The chief difficulties had, however, been removed, and were on the point of solution.

In the House of Commons on Monday, in reply to questions, Mr. Hobhouse said that the Government could not claim compensation from the Marconi Co. in respect of the non-renewal of the "7,777" patent. He had no reason to suppose that the company had delayed its work on the Imperial stations in consequence of the erection of its private station at Carnarvon.

It was stated that the delay in acquiring a site in India for the Imperial station was due to the decision to establish direct communication between India and Egypt instead of East Africa, which rendered the site selected at Bangalore unsuitable. Another site had been provisionally selected, and was at present under examination by experts.

The Telegraph Service.—The Committee to consider the organisation of the telegraph service, and to report what steps can be taken to improve the efficiency and economy of its working, consists of the following members:—Sir Archibald Williamson, M.P. (chairman), Sir Henry Norman, M.P., Sir Charles Stewart-Wilson, Sir William Plender, and Mr. A. M. Ogilvie, Third Secretary to the Post Office. Mr. W. E. Weston and Mr. W. R. Birchall, of the Secretary's Office, General Post Office, will act as secretaries to the Committee.

The Telephone Service.—The Postmaster-General recently stated that the disagreeable clicks heard in telephone receivers, concerning which complaints had been made, were due to the stronger currents employed in the more modern exchanges. Inquiries had been addressed to Chambers of Commerce as to the desirability or otherwise of discontinuing the practice of interrupting local conversations when trunk calls are made.

Wireless on Board Ship.—On Tuesday the Merchant Shipping (Convention) Bill was further considered by a Committee of the House of Commons. Mr. John Burns placed before the Committee the draft agreement between the Board of Trade and the Marconi Co., by which the charges made by the latter to shipowners for installations will be regulated; in case of disagreement between the parties, the matter will be decided by a referee. No shipowner will be obliged to use Marconi apparatus.

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—August 4th. U.D.C. One natural-draught chimney-type cooling tower. See "Official Notices" July 10th.

Ashton-under-Lyne.—Corporation. July 29th. Arc lamp globes, lamp carbons, D.C. motors and D.C. motor starters. See "Official Notices" July 10th.

Australia.—Sydney.—August 31st. Sydney Harbour Trust. Four electrically-operated semi-portable travelling cranes. Forms of tender from Mr. H. F. Norrie, Secretary to the Trust, Sydney.

September 14th. Municipal Council. 22,500 yd. of 33,000-volt, three-core, paper-insulated, lead-covered cable. Deposit £200. Specification, 10s. 6d., from the City Electrical Engineer; a copy may be seen at the B. of T. Commercial Intelligence Dept., London.

Perth.—September 2nd. Telephone instruments and parts, glassware, battery material, chemicals for batteries, wire—cotton, silk or wool covered—telegraph and telephone insulators, for Postmaster-General. See "Official Notices" to-day.

Melbourne.—Eight 50-ton, one 30-ton, three 10-ton electric overhead travelling cranes, Contract No. 25,756, for the Victorian State Railways. Specifications from Messrs. John Coates & Co., Ltd., 115, Victoria Street, S.W.

Richmond.—Nov. 30th. Refuse destructor and auxiliary plant. Specification, &c., from Mr. C. C. Blazey, Town Clerk, Richmond, Victoria.

Brisbane.—September 2nd. Measuring instruments, protectors and parts, telephone and telegraph instruments, for the Postmaster-General. See "Official Notices" to-day.

Adelaide.—September 2nd. Telephone material, bells, &c., condensers, diaphragms, generators, for the Postmaster-General. See "Official Notices" to-day.

Austria.—September 1st. The Austrian State Railway authorities in Vienna are inviting tenders for the supply and installation of a 60-ton electrically-operated travelling crane.

Innsbruck.—August 6th. Circular saw, with electric motor; smith's hammer, with electric motor; air compressor, with 40-H.P. electric motor; electric hand-boring machine, and other machinery. Particulars from Abteilung IV der k.k. Staatsbahndirektion, Innsbruck.

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Birkenhead.—August 10th. Corporation. Cooling tower. See "Official Notices" to-day.

Blackburn.—August 1st. Twelve months' supply of steam coal for the Electricity Department. Mr. P. P. Wheelwright, Engineer and Manager.

Canada.—July 27th. 23 knots single-conductor submarine telegraph cable (107 lb. copper and 150 lb. gutta-percha per knot), delivered at Halifax, N.S., and 14 knots ditto, delivered at Vancouver, B.C. Also 270,000 lb. galvanised iron telegraph wire, delivered at Montreal, and 342,000 lb., delivered at Vancouver. Specifications from General Superintendent of the Government Telegraph Service, Department of Public Works, Ottawa. A copy of the specification may be seen at the B. of T. Commercial Intelligence Dept. in London.

China.—TIENTSIN.—August 4th. Boilers, turbines, electrical power plant and coining machines, for the Government Mint. Specifications, &c. (two at 5s. each), from Sir Douglas Fox and Partners, 56, Moorgate Street, E.C.

Croydon.—July 28th. Installation of electric fire-alarms, for the B. of G. Mr. Henry Berney, architect, 33 35, High Street (returnable deposit of £2 2s.).

Dover.—July 31st. Small coal (other than Welsh), for eight months, for the Corporation electricity works. Borough Electrical Engineer.

Eastbourne.—August 18th. Corporation. Main machine and feeder switchboard for the electricity works. See "Official Notices" to-day.

Epsom.—July 28th. 500 tons of Nixon's navigation large washed nuts, for the U.D.C. Electricity Dept. Particulars from Mr. A. C. Gilling, engineer, Church Street.

Kingston-upon-Hull.—August 22nd. Corporation. Electrical fittings for the Guildhall Council Chamber, &c. See "Official Notices" to-day.

London.—L.C.C. The Highways Committee recommends that tenders be invited from selected firms for the supply of fittings required in connection with the maintenance of overhead line equipment.

Oldham.—August 16th. Corporation. D.C. motor-generator and extension to E.H.T. switchboard. See "Official Notices" to-day.

Rochdale.—The Corporation General Purposes Committee has decided to recommend the renewal of electric wiring in some of the Town Hall Departments, at an estimated cost of about £150.

August 5th. Paper-insulated cables for 12 months. Particulars (£2 2s. returnable) from Mr. C. C. Atchison, Engineer and Manager, Dane Street.

Salford.—Flame arc lamps and lowering gear, for the electricity works. See "Official Notices" July 17th.

July 28th. Suspended iron gangways, Central Car Depôt. General Manager, 32, Blackfriars Street, Salford.

Southampton.—August 6th. Installation of lighting plant, cables, &c., at the Farm Institute, Sparsholt. See "Official Notices" July 17th.

The T.C. has decided to invite tenders for automatic coal conveyers at the electricity works (estimated cost £1,330).

Spain.—August 20th. Tenders are being invited by the municipal authorities of Herrera de Pisuerga (province of Palencia) for the concession for the electric lighting of the town during a period of 10 years.

September 9th. The Spanish Ministry of Public Works, in Madrid, are inviting tenders for the concession for the construction and working of an electric tramway between Ferrol and Santa Maria de Neda.

Tenders have just been invited by the municipal authorities of Cabra (province of Cordoba) for the concession for the public electric lighting of the town during a period of five years. The municipal authorities of Moncofar (province of Castellon) have also lately called for tenders for the concession for the electric lighting of that town.

Stalybridge.—E.H.T., three-core, lead-covered, paper-insulated cable, for the Stalybridge, &c., Tramways and Electricity Board. See "Official Notices" to-day.

Walsall.—August 11th. Corporation. Coal conveyer and measuring apparatus, jib coaling crane, ash-handling plant, travelling crane. See "Official Notices" July 17th.

Wisbech.—July 29th. Wiring of the workhouse for electric light installation, for the Board of Guardians. Particulars from Mr. R. W. Faircloth, Clerk.

CLOSED.

Aberdare.—The U.D.C. has accepted the tender of Messrs. Heenan & Froude for a refuse destructor, at £3,416.

Bennis Contracts.—Messrs. E. Bennis & Co., Ltd., have recently received contracts for their stokers from three municipal electricity supply authorities as follows:—

Wimbledon Corporation.—Two chain-grates, each 9 ft. 8 in. long × 6 ft. wide (repeat orde).

Burton-on-Trent Corporation.—Two machine stokers and self-cleaning compressed-air furnaces for an 8 ft. 6 in. diameter Lancashire boiler (repeat order).

Altrincham Corporation.- Two chain-grate stokers, each 5 ft. wide × 12 ft 6 in. long (per Stirling Boiler Co.).

Bolton.—The T.C. has accepted the tender of Messrs. Witter & Sons, Ltd., for the installation of automatic sprinklers and fire alarms.

Burton-on-Trent.—The T.C. has accepted the tender of Messrs. Manlove, Alliott & Co. for refuse destructor plant, at £2,340.

Buxton.—The U.D.C. has accepted the tender of Messrs. Day & Ferguson for Presley & Denby nutty slack combined, for the electricity works.

Canterbury.—The T.C. has accepted the tender of Mr. E. J. Philpott for electrical illuminations during the Cricket Week, at £27.

Fleetwood.—The Wentworth Silkstone Collieries, Ltd., and Messrs. Adam Bromley & Sons have each secured a contract for the supply of 1,000 tons of coal to the electricity works.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

ADMIRALTY, CONTRACT DEPARTMENT.

Tungsten filament lamps.—Cryselco, Ltd., Dick, Kerr & Co., Ltd., Pope's Electric Lamp Co.

WAR OFFICE.

Distributing boards.—General Electric Co., Ltd., Spagnoletti, Ltd.
Parts of electric cells.—Siemens Bros. & Co., Ltd.
Installation of electric light, Cavalry Barracks, Redford.—Lowdon Bros. and Co.

INDIA OFFICE, STORES DEPARTMENT.

Insulator cups.—Bullers, Ltd.

CROWN AGENTS FOR THE COLONIES.

Battery material and cable.—Siemens Bros. & Co., Ltd.
Telegraph materials.—Bullers, Ltd.. Siemens Bros. & Co., Ltd.
Telegraph poles.—Siemens Bros. & Co., Ltd., J. Spencer, Ltd.
Telephone equipment.—Automatic Telephone Mfg. Co., Ltd., I.R., G.P. and Telegraph Works Co., Ltd., Siemens Bros. & Co., Ltd.
Telephone materials.—British L.M. Ericsson Mfg. Co., Ltd.
Terminal boxes.—Siemens Bros. & Co., Ltd.

H.M. OFFICE OF WORKS.

Erection of Liscard new telephone exchange.—J. Henshaw & Sons.

POST OFFICE.

Protective apparatus.—British L.M. Ericsson Mfg. Co., Ltd., Western Electric Co., Ltd.
Telephonic apparatus.—Automatic Telephone Mfg. Co., Ltd., British L.M. Ericsson Mfg. Co., Ltd., General Electric Co., Ltd., Peel-Conner Telephone Works, Ltd., Phœnix Telephone & Electric Works, Ltd., Siemens Bros. & Co., Ltd., Western Electric Co., Ltd.
Telephonic cable.—Henley's Telegraph Works Co., Ltd., Johnson and Phillips, Ltd., Western Electric Co., Ltd.
Laying lines of multiple-way ducts, Hampstead, N.W., Swiss Cottage—St. John's Wood.—Grounds & Newton.
Ditto, Liverpool—St. Helens (section 2).—H. E. Buckley.
Ditto, Manchester—Oldham (section 2).—H. E. Buckley.
Laying lines of pipes and "U" shaped earthenware troughing, Fenham (Newcastle-on-Tyne).—G. H. Mauchlen.
Laying lines of self-aligning ducts and Mannesmann tubes, North Walsham—Bacton.—R. J. May.
Laying lines of single tube ducts, Newington Causeway—Walworth Road, S.E.—Grounds & Newton.
Lifts, Birmingham H.P.O., new parcels office.—R. Waygood & Co., Ltd.
Electric lifts to replace hydraulic lifts, Birmingham H.P.O.—W. Wadsworth & Sons, Ltd.
Manufacturing, supplying, drawing-in and jointing lead-covered cable, Leeds—Bradford.—Western Electric Co., Ltd.
Ditto, Leeds—Castleford.—W. T. Henley's Telegraph Works Co., Ltd.
Ditto, Huddersfield.—Western Electric Co., Ltd.
Ditto, Manchester—Oldham.—B.I. & Helsby Cables, Ltd.
Telephone exchange equipment alterations, Paddington.—Western Electric Co., Ltd.
Electric trolleys.—Edison Accumulators, Ltd.

Haslingden.—Mr. A. M. Cramp has received the following installation contracts:—

For Messrs. J. H. Birtwistle & Co., Ltd., Grane Road Mill, Haslingden, the electric lighting of their mill; also the electric lighting of their Park Mill, Helmshore.

For Messrs. C. Whittaker & Co. (1900), Ltd., engineers, of Accrington, electric driving of the whole of their Union Foundry, Haslingden.

For Councillor T. Baxter, Mayor of Haslingden, electric lighting, heating and bells at his residence, Helmshore House.

For Mr. Geo. W. Hardman, electric lighting, heating and bells for his residence, "Danesmoor," Haslingden.

Huddersfield.—The following tenders have been accepted:—

One "Pendulum" truck.—Peckham Truck and Engineering Co.
Rail grinder.—Equipment and Engineering Co.
Cable.—W. T. Glover & Co.

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London.—L.C.C.—The Highways Committee reports having received the undermentioned tenders for either 3,000 driving-wheel and 2,000 pony-wheel tires for tramcars, or alternatively 6,000 driving-wheel and 4,000 pony-wheel tires :—

	Total for 3,000 driving-wheel tires and 2,000 pony-wheel tires.	Total for 6,000 driving-wheel tires and 4,000 pony-wheel tires.
A. Brown & Co. (agent for Société Anonyme des Aciéries d'Angleur, Belgium)	£4,408	£8,817
John Batt & Co. (London), Ltd. (accepted)	4,558	9,117
Phœnix A.G. (Germany)	4,729	9,458
Fried. Krupp A.G.	5,150	10,300
Bochumer Verein für Bergbau und Gussstahlfabrikation, Bochum (Germany) ..	5,200	—
H. Bessemer & Co., Ltd., Bolton	5,300	10,600
J. Baker & Co. (Rotherham), Ltd.	5,550	11,100
Workington Iron and Steel Co., Ltd. ..	5,667	11,333
Brown Bayley's Steel Works, Ltd.	5,800	11,600
J. Brown & Co., Ltd.	5,850	11,450
Steel, Peech & Tozer, Ltd.	6,575	—
Midvale Steel Co. of Philadelphia and London, Ltd.	7,900	15,800
Vickers, Ltd.	9,150	18,300

The lowest tender is that of Messrs. A. Brown & Co., the British agents for the Société Anonyme des Aciéries d'Angleur, who state, however, that they cannot agree to the clause respecting rates of wages, as their works are situated in Belgium, where no universal rates of wages or hours of labour obtain. They state that the works pay the highest wages for the best labour in the district concerned. The next lowest tender is that submitted by Messrs. John Batt & Co. (London), Ltd. The firm proposes to sublet the manufacture of the tires to the following firms :—Vereinigte Stahlwerke van der Zypen und Wissener Eisenhütten A.G., Cologne, Germany, and/or other approved German works, including Fried. Krupp A.G., Bochumer Verein, and Phœnix A.G.

The lowest tender for British-manufactured tires is that of Messrs. H. Bessemer & Co., Ltd., and amounts to £10,600, being an increase of £1,483, or 16 per cent., over the prices tendered by Messrs. John Batt & Co. (London), Ltd.

For the supply of four portable electrically-driven drilling and grinding machines the following tenders have been received :—

Geo. Robson & Co.	(accepted)	£288
Do. (alternative)		280
Do. Do.		320
Bambridge Flexible Shaft Co., Ltd.		299
United States Metallic Packing Co., Ltd.		540
Selson Engineering Co., Ltd.		654
James Gibb & Co., Ltd.		286

For the supply of 150 sets of plough collector gear, required in connection with the equipment of Class A and D cars with trolleys and collector gear :—

		Per set.
British Westinghouse E. & M. Co., Ltd.	(accepted)	£7 17 6
Brush Electrical Eng. Co., Ltd.		7 19 0
Spagnoletti, Ltd.		10 5 0
Estler Bros.		11 0 0
Siemens Bros. Dynamo Works, Ltd.		12 2 6

For the provision of a vertical drainage pump for draining water out of the tramway cable manholes :—

Drysdale & Co., Ltd.	(accepted)	£179
Rees Roturbo Manufg. Co., Ltd.		212
British Electric Plant Co., Ltd.	Incomplete tender.	

BATTERSEA.—The B.C. Electricity Committee recommends that the contract with the Foster Engineering Co., Ltd., for metal-filament lamps for street lighting be extended for one year, and that it include also the supply of half-watt lamps for outside lighting under the hire scheme ; also that the tender of Messrs. R. Dempster & Sons, Ltd., be accepted for coal telpherage plant to specification, for £3,060.

HACKNEY.—The B.C. Electricity Committee reports having considered the tenders for open white arc lamp carbons. The three lowest were :—

General Electric Co., Ltd.—40,000 pairs at 70s. per 1,000, and 40,000 pairs at 60s. per 1,000, £260.
Henrion Carbons, Ltd.—40,000 pairs at 68s. 11d. per 1,000, and 40,000 pairs at 57s. 8d. per 1,000, £253.
H. Tuchman.—40,000 pairs at 68s. per 1,000, and 40,000 pairs at 57s. 6d. per 1,000, £251.

There being very little difference between the English and foreign prices, the Committee recommends that the tender of the General Electric Co., Ltd., for English-made carbons be accepted for :—

18 mm. by 12½ in. cored carbons } at 70s. per 1,000 pairs.
18 mm. by 11½ in. solid ,, }
18 mm. by 10½ in. cored ,, } at 60s. per 1,000 pairs.
18 mm. by 9½ in. solid ,, }
Subject to test on samples proving satisfactory.

For the supply of yellow flame arc lamp carbons the five lowest tenders were as follows :—

General Electric Co., Ltd.—100,000 pairs at 62s. 6d., £312.
Electrical Co., Ltd —100,000 pairs at 61s. 6d., £307.
Sloan Electrical Co., Ltd.—100,000 pairs at 60s. 6d., £302.
Ship Carbons, Ltd.—100,000 pairs at 57s., £285.
W. Geipel & Co., Ltd.—100,000 pairs at 51s., £255.

The price of the English carbons being so much the higher, the Committee recommends that the tender of Messrs. W. Geipel and Co., Ltd., be accepted for :—

8 mm. by 12 in. cored carbons } at 51s. per 1,000 pairs.
7 mm. by 12 in. ,, ,, }
Subject to the test on samples proving satisfactory.

Tenders were also invited for special higher-grade carbons, but the prices being out of all proportion to the difference which their use would make to the lighting, the Committee does not submit any recommendation in regard to these.

SHOREDITCH.—The following tenders have been received by the B.C. for a battery in connection with the new converters :—

D.P. Battery Co. (recommended)	£181	Electrical Power Storage Co.	£200
Tudor Battery Co.	196	,, ,, ,,	*179

*Not in accordance with specification.

POPLAR.—The following tenders were received by the B.C. for a steam turbine-driven boiler feed pump :—

Worthington Pump Co.	£190
G. & J. Weir	(recommended) 285
Rees Roturbo Co., Ltd.	366
Willans & Robinson	380
Belliss & Morcom :	
(1) Belliss-Worthington	360
(2) Belliss-Mather & Platt	387
(3) Belliss-Rees Roturbo Co.	375

Messrs. G. & J. Weir also submitted an offer to install an air eliminator and heater, at £130, and their tender is recommended.

The following tenders have also been recommended for piping and valves :—

Babcock & Wilcox, Ltd.—Piping, £82.
J. Hopkinson & Co.—High-pressure feed non-return valves, £42.
J. Wilson, Ltd.—Low-pressure suction valves, £10.
Dewrance & Co.—Stop valves, £15.

Margate.—The T.C. has received the following tenders for fairyland electrical illumination plant at the Queen's bandstand :

Kingstone & Co.—£115 and £150, latter accepted.
Franco-British Electrical Co.—£142 and £162.
Imperial Lighting Co.—£125.

New Zealand.—The Wellington City Council has accepted the tender of Messrs. T. Ballinger & Co., at £357, for an electric lift at Reynold's Building, Victoria Street.—*N.Z. Shipping and Commerce.*

Ramsgate.—The contract for the electric light installation at Christ Church has been secured by the Ramsgate and District Electric Supply Co., Ltd.

Rawtenstall.—The T.C. has accepted the tender of Messrs. E. Green & Co. for an economiser (480 pipes).

Southampton.—The T.C. has accepted the following tenders for a refuse destructor at Portswood :—

T. Warrington.—Cells and boilers, £1,221.
Dyer & Sons.—Foundations, buildings, lighting, &c., £1,827.
Britannia Construction Co.—Chimney, £889.

Stoke-on-Trent.—Messrs. Chamberlain & Hookham, Ltd., have received the Corporation contract for meters.

Walthamstow.—The U.D.C. is recommended to accept the tender of the Whessoe Foundry Co., Ltd., at £65, for a c.i. tank for the blow-down sump at the electricity works.

FORTHCOMING EVENTS.

Association of Mining Electrical Engineers.—Saturday, July 25th. At 1 p.m. At Hebburn-on-Tyne. Visit to Messrs. Reyrolle & Co.'s, Bauxite Refining Co.'s, and Tharsis Copper Co.'s works.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION.)

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued :—

Headquarters will be opened daily for the transaction of regimental business from 10 a.m. till 4 p.m., except Saturdays, on which days the opening will be from 10 a.m. till 12 noon. Headquarters will be closed for all purposes on August 3rd and 4th, 1914.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

The London Electrical Engineers.—According to a Plymouth newspaper, an advance party of the London Electrical Engineers, some companies of which were to commence their training on Saturday, arrived at Staddon on 15th inst.

Municipal Ownership Commission.—According to the *Morning Post* a large commission is at present in this country from the United States, inquiring into municipal work in Great Britain, particularly so far as it concerns sanitation, water supplies, transport, lighting, and other matters under municipal control. Its members have been taking part in the Congress at Shepherd's Bush this week.

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NOTES.

Electricity in the London Fire Brigade.—Electricity plays an important part in the latest addition to the motor equipment of the London Fire Brigade, an opportunity of inspecting which was afforded us at the headquarters of the brigade in Southwark Bridge Road, S.E., one day last week. The vehicle itself, which is known as an emergency tender, resembles an ordinary motor-van, except that there are at the front two rows of seats instead of one, there being accommodation for six persons in addition to the driver. The van body is divided into a number of compartments, in the largest one of which, at the rear, is mounted a dynamo arranged to be driven, by suitable gearing, off the four-cylinder petrol engine which propels the car. The generator, which has a capacity of 100 amperes at 100 volts, is employed to furnish the current for two portable searchlights, each of 3,000 C.P., and two clusters of three 100-C.P. electric lamps. The lighting sets are intended for use in searching among the ruins of burned-out buildings, and for this purpose the searchlights, which are mounted on tripods, and the lamp clusters, are provided with reels of cable 100 yd. long, so that the lights may be used at that distance away from the vehicle, which acts as the central station. The reels are carried in cupboards mounted on the running boards of the car. Another feature of the vehicle is the provision of an electrically-operated fan capable of discharging 400 cb. ft. of air per minute, this being intended for use in driving out smoke from basements and sewers, and so facilitating the work of the firemen. At the rear of the firemen's seat is a large switchboard containing the switches for controlling the searchlights, cluster lights, &c. The vehicle is also equipped with lockers, in which are stored four sets of breathing apparatus, such as is used in colliery accident rescue work, and by means of which it is possible for men to live for an hour in an irrespirable atmosphere. The men who have been appointed to duty in connection with the new van—which is stated to be the first of its kind to be adopted for fire brigade purposes in the world—have been specially trained at a mining rescue station in Yorkshire. The chassis of the van was built by Messrs. Dennis Bros., Ltd., of Guildford, while the electrical part of the work was carried out by Messrs. Crompton & Co., Ltd., of Chelmsford.

"F"-Rays Exploded.—It is reported that Signor Ulivi, the inventor of the "F-ray" sensation, has secretly left Italy on the eve of official tests of his system, taking with him the daughter of Admiral Fornani, one of his chief patrons. We have on a previous occasion pointed out the absurdity of the claims which he put forward; a solution to the method by which he was able to explode bombs immersed in water is now forthcoming. A quantity of sodium was found in his deserted workshop, and it is stated that he bored a tiny hole in the outer jacket of the bomb, and packed it on the inside with cotton wool, in contact with sodium. In the course of 10 or 20 minutes after the bomb was submerged the water percolating through the cotton wool reached the sodium, which consequently ignited and exploded the charge. In corroboration of this theory, it is pointed out that he never used any bombs that he had not made himself, and he never succeeded in exploding a bomb unless it was immersed in water. In his long-distance experiments he would never assist in putting the bombs into the water before proceeding in a motor-car to the spot where his apparatus was fixed. His accusers say that he had not time to do it. He dared not take the risk of being far from his "generating station" at the time of the immersion of the bombs, lest they should go off prematurely and give away the whole trick. He always insisted on night performances, and on the flashlight signals being sent to him at the very moment the bombs were placed in the water, and again when the bomb-layers had regained their ship or the shore.

E.C.C. Horticulture.—Recently a Horticultural Society has been formed in connection with the Electrical Construction Works at Bushbury. The first exhibition in connection therewith took place in the mess room on Saturday, when there was an attendance of 200 employés and friends. Mr. P. E. Beachcroft (chairman of the company), in opening the show, congratulated the competitors on their excellent exhibits. There were in all 30 exhibitors, divided into two classes:—"A," persons cultivating their own gardens without expert assistance, and not growing for sale; and "B," an open class. The show was in every respect a success.

Inquiry.—A correspondent writes:—"Do you know any good ready reckoners suitable for calculating consumers' accounts? The ordinary ready reckoner books go up to values which are never used for making out consumers' accounts, and furthermore, they are unduly compressed as regards useful figures. I think that a ready reckoner would be very useful if made out on strong linenised varnished cards. These could be kept handy, and it would be much easier to use them than to turn over the leaves of a book."

Battery Vehicles in Boston, U.S.A.—Since the Edison Electric Illuminating Co., of Boston, began its vehicle campaign three years ago there has been an increase of 250 per cent. in the number of electrical commercial vehicles in Boston, while the number of electric passenger cars has increased over 110 per cent. The number of cars and garages in Boston on January 1st was 463, there being 208 commercial cars, 255 passenger cars and 185 garages, as compared with 50, 117 and 57 respectively on January 1st, 1911. The company itself operates the largest fleet of cars, although the express companies have nearly 50 trucks and the coal companies more than 20. The breweries also operate more than 20 trucks.—*Engineer.*

American Westinghouse Strike.—A big strike has lately been in progress at the various Westinghouse works at Pittsburg, U.S.A. Copies of local newspapers have been received, depicting street scenes and describing the dispute. The Pittsburg *Leader* says that the prime cause of the strike seems to be that the Westinghouse interests refused to reason with the workers. "The employers either would not, or could not, see that conditions are different from 25 years ago, and it is impossible to deal with men and women as was done then. The times have changed, are still changing, and men and women with them. It is the changing views of men and women that make the changed times. The wages of workers are as important as dividends."

In the New York *Electrical World* for June 20th, the principles of both sides are stated. The declaration of the Allegheny Congenial Industrial Union sets forth the principles of the men thus:—

"We affirm the irreconcilable difference of interests between the employer who buys labour power in the labour market for the purpose of making a profit, on the one hand, and the wage-earner who sells his ability to produce wealth to some employer in order to secure the necessities of life, on the other. We know from bitter experience that the buyer and seller in the labour market can never see things from a common viewpoint, as the employer always buys as cheaply as possible, and we, as wage-earners, wish to sell our labour power for the highest possible wages.

"We are, therefore, determined to band together in an industrial union which recognises no distinction as to craft, sex, religious creed, political affiliations, age or nationality, for the purpose of compelling our common employers to give us every concession we can force from them by industrial solidarity.

"To such an object we pledge our united effort and call upon all workers in every industry of the Pittsburg district to join with us immediately in the organisation of a great democratic union which will include every man, woman and child that works for wages."

The principles to which the Westinghouse companies stand committed are expressed as follows:—

"1. Westinghouse shops shall be open shops. We stand for the principle of an open shop in which Union and non-Union men may work without molestation or being forced to join any organisation.

"2. Westinghouse employés may or may not be members of any organisation. We do not require of our employés that they shall refrain from joining labour organisations any more than we attempt to restrain them from joining any other bodies, but we maintain for all our employés the right to refrain from joining any organisation without prejudice to their positions, or their security, or their comfort in our employ.

"3. The pay of skilful and productive Westinghouse employés shall not be regulated by the pay of the inefficient and less productive. We pay wages and maintain shop conditions which compare favourably with other manufacturers in our industries. By this means, and by the added inducement of steady employment, we endeavour to attract the best workmen. In order to compete with other firms, both at home and abroad, we must introduce all of the agencies by which the best efficiency is obtained. We reserve the right to determine the compensation of our employés on the basis of the service they perform for us as well as by the day rate, which measures only the time spent in our works.

"4. Every Westinghouse employé has the right of conference with the management. We receive any one employé, or any number of employés, from any department, or any properly-chosen committee whose selection shall be truly representative from any department, or of the whole body of our employés.

"5. Every Westinghouse shop shall be safe, sanitary and comfortable, and all suggestions of employés for improvement in shop conditions are welcomed by the management. We seek to maintain the best standard of sanitary and working conditions in our factories, as we believe that to provide as good surroundings as the character of our operations permits is the best guarantee we have of obtaining and holding the best class of employés.

"As opposed to the principles advocated by the Allegheny Congenial Industrial Union:

"We assert that the interests of the employé and the employer are identical, and that there can be no success for either party unless each recognises the necessities of the other.

"We deny that employers and employés can never see things from a common viewpoint, and assert that the success of any business undertaking is dependent upon each endeavouring to view their common interests from the same viewpoint.

"We assert that in seeking for concessions neither party should attempt to obtain them either by force or compulsion."

Information which has reached us since the above was put into type shows that the strike was expected to come to an end on Monday, July 13th, a meeting of 4,000 strikers having resolved to return to work in a body on that day. The president of the Westinghouse Electric Co. said that no union would be recognised, nor would the men expect it to be. The strike began on June 5th. It was organised by the Allegheny Congenial Industrial Union, which was formed in February among the employés of the various plants of the Westinghouse group for the purpose of enforcing improved working conditions and, in some instances, advances in pay.

Science and the State.—The Executive Committee of the British Science Guild has appointed a Special Committee to report upon various matters arising in connection with science and the State and the encouragement of discovery, referred to in the address delivered by Sir Ronald Ross at the annual meeting of the Guild on May 22nd last.—*Times.*

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Institution and Lecture Notes.—JUNIOR INSTITUTION OF ENGINEERS.—A party of members of the Junior Institution of Engineers paid a visit last Saturday afternoon to the Tunnel Cement Works, Purfleet. In the power-house the 1,200-KW. turbo-alternator is of the A.E.G. impulse type, having a steam consumption of 13·8 lb. per KW.-hour on full load, with a cooling water supply of five gallons per lb. of steam. The motors have been assembled in special motor rooms, so that they are in a large measure protected from the dust inseparable from cement manufacture. It has by this means been found practicable to use open-type motors. A certain amount of dust is, of course, inevitable, and the motors have therefore been provided with special insulation and dust-proof bearings, with heavy cast inspection covers.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—At a meeting held at the Town Hall, Hackney, on Saturday last, a paper was read by Mr. L. L. Robinson, the borough electrical engineer, on the refuse destructor works and the electricity undertaking of the borough.

S.A. INSTITUTION OF ENGINEERS.—The prize of the Central Mining and Investment Corporation has been awarded to Mr. G. M. Robertson, for his paper, "Central Power Station Working, with special reference to De Beers Central Power Station."

SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS.—At the monthly meeting on June 18th, Mr. E. A. Wallers (President of the Transvaal Chamber of Mines) presented the gold medals of the Institute to Mr. S. E. T. Ewing for the paper, read in 1912, entitled "Some Practical Aspects of Electric Hoisting," and to Mr. W. Elsdon Dew for his paper, read last year, entitled "Water Power Plants." Mr. Wallers said that he was keenly interested in the "Safety First" movement, and they were to be congratulated, and the men under them, on the few accidents that were due to electrical machinery, notwithstanding the enormous amount of electrical machinery there was in use, and the miles of cables there were on the Rand.—*South African Mining Journal.*

MIDLAND INSTITUTION OF MINING, CIVIL AND MECHANICAL ENGINEERS.—At the annual meeting at Sheffield on Tuesday, Mr. E. K. Scott read a paper on "Switchgear for Mines."

Fatalities.—On July 15th an inquest was held into the death of Samuel John Dorsett (28), an electrician, of Wolverhampton, who was killed on the previous Monday, at the Beehive Works of Messrs. J. S. Jordan & Sons, enamellers, Bilston.

John Butler, labourer, said he was assisting Dorsett to change a belt from one pulley to another in order to start the motor. For this purpose Dorsett was standing on two rolls about 4 ft. high. Witness suddenly heard him cry out, and saw that his hand had been caught between the belt and the motor. Witness seized his arm to pull him away, but received an electric shock and fell to the ground. Another workman ran to Dorsett's assistance, and, after working the belt (which was then stationary) in an opposite direction, Dorsett also fell to the ground, death taking place shortly afterwards.

In reply to the Factory Inspector, witness said he knew nothing of motors.

Walter Parkins, electrical engineer, of Wolverhampton, spoke to being summoned to the Beehive Works on Monday and to finding the motor alive owing to the insulation having given way. There would be no means of detecting this except by testing. The motor was operated by two switches, and could be made secure by an efficient earthing system. There was a cable near the motor, but it was not connected. The voltage was 200.—In reply to questions, witness said he put his hand on the motor and received a shock, which, under normal circumstances, he said, was not sufficient to kill a man. If the safety cable had been connected the shock would have been negligible. The operation of transferring the belt would have been perfectly safe if the current had been switched off.

Mr. Sidney Jordan, one of the proprietors of the works, said no complaint had ever been made to him about the motor; and it was Dorsett's duty to see that the safety cable was properly attached.

The jury stated they were of opinion that death was due to injuries to the head sustained by a fall after receiving an electric shock. They thought, however, that no blame could be attached to anyone.

Appointment Vacant.—Assistant electrical engineer for the Gun Carriage Factory, Jubbulpore, India (280 rupees per month). Particulars are given in our advertisement pages.

Educational Notice.—UNIVERSITY OF LONDON, KING'S COLLEGE.—Particulars are given in our advertisement pages to-day of the engineering courses that have been arranged, also a series of advanced electrical and other courses by experts.

The Coal Strike.—The report of Mr. G. Stuart Robertson, Chief Registrar of Friendly Societies for 1912, shows a decrease of nearly three-quarters of a million sterling—11 per cent. of the funds at the beginning of the year or over 10*s.* per member—in Trade Union funds, due almost entirely to the coal strike, which cost the miners' union considerably over a million pounds, and reacted upon the many other trades which are more or less dependent on the coal industry.

Birmingham Electrical Golfing Society.—The summer meeting of this Society was held at Sandwell Park on Tuesday afternoon, July 21st. There was up for competition a Challenge Cup, presented by Dr. Railing. H. F. Foster was the winner, with a net score of 79.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. A. C. TICEHURST, assistant engineer at the Bexhill-on-Sea Corporation electricity works, who is resigning, is commencing business as an electrical engineer at the Crossing Works, Dorset Road, Bexhill.

Tramway Officials.—The Highways Committee of the L.C.C. recommends that the following temporary assistants, engaged in professional and technical work in the Council's tramway department, be appointed on the permanent staff from April 1st, 1914:—First Class—Messrs. G. B. Dunn, R. Barron, J. S. Ashley, and F. W. Brock, at £270 per annum; Second Class—Messrs. J. J. Harding, F. H. Wigner, £237 10*s.* per annum; G. G. Ringrose, A. W. Leath, R. S. Good, F. E. Gregory, £212 10*s.* per annum; Third Class—Messrs. N. H. Thomas, £200 per annum; C. W. Fourniss, A. F. Bentall, G. Clark, £190 per annum; H. F. Stanford, W. J. Thomas, R. E. S. Macintyre, T. McCrossan, £180; A. Wyatt, £170; Fourth Class, Section (*a*)—L. S. Price, £150; R. A. Nichols, £140. The Committee also recommends that Mr. J. R. Wignall, temporarily employed in the tramways department, be appointed, as from July 1st, 1914, permanent way inspector in the tramway department, at £330 per annum, rising by annual increments of £10 to £350.

The Southport Council has approved of the recommended increase (from £200 to £250) in the salary of MR. KENDREW, the tramways manager, in recognition of the improved returns on the system during the year, the gross profit being £1,621 better than in the previous year.

General.—We regret to learn that MR. HERBERT BERRY (Messrs. Berry, Skinner & Co.) has been laid up with a serious illness resulting from an accident to the knee. We are pleased to know that he is now making progress, though it will be some time before he is able to resume business at his office. We understand that the poison having spread in the limb, three or four operations were necessary, and these naturally reduced Mr. Berry to a very weak state. Last week he appeared to be progressing well, but it was found that a still further operation must be performed. After that operation, Mr. Berry's condition was very critical, but his physicians anticipate that after its immediate effects have passed away, a decided turn for the better may be looked forward to.

The *British Australasian* states that MR. J. G. BALSILLIE, the Australian Commonwealth wireless engineer, will sever his connection with the service in September next. Mr. Balsillie proposes to devote his attention to scientific experiments, and particularly to his scheme for producing rain. MR. E. B. JONES, acting secretary to the Victorian Railways, and MR. J. B. MOLOMBY, have left London for Germany on a tour of inspection of the electric railways of that country. MR. E. E. HIRST, managing director of the British General Electric Co., Ltd. (Australasia), will leave Marseilles on July 31st for Australia.

The daily Press states that MR. ARTHUR HURST, who since 1899 has been signalling engineer of the North-Eastern Railway, has retired, and is succeeded by MR. E. F. FLEET, of Newcastle-on-Tyne.

On July 17th, at James Street Congregational Church, Blackburn, MR. TOM SPEAK, electrical engineer, of Penny Street, was married to Miss Hannah Clegg.

MR. B. RAIKES, Electrical Inspector to the Government of Burma, is leaving shortly for Home, on nine months' leave. During his absence, MR. HARRY W. NIMMO, of Rangoon Electric Tramway and Supply Co., Ltd., will officiate.

MR. E. S. SMITH, who has been employed by the United Electric Car Co., Preston, for 15 years, and who held the post of superintendent of the finishing department, is leaving for Brazil to take up the position of assistant engineer to Messrs. J. G. White & Co., Pernambuco. The officials and employés at the car works at Preston have presented him with a gold watch and a dressing-case.

The marriage took place at Burford (Oxon.), on July 14th, of MR. GUY H. RIDGE, who is engaged on the electrical staff of the Western Union Telegraph Co., at Bay Roberts, Newfoundland, and Miss E. Pether, of Burford.

The marriage has taken place at High Street Church, Huddersfield, of MR. NORMAN WILSON, electrical engineer, Swansea, and Miss A. N. Hobson, of Huddersfield.

COL. D. R. STREET, secretary of the Ottawa Electric Co., was re-elected president, at the annual meeting last week, in Montreal, of the Canadian Electrical Association. The secretary-treasurer elected is MR. ALLAN SULLIVAN, Toronto.

Obituary.—Many members of the Oldham Corporation, and of the Corporation departments, attended the funeral of the late MR. S. W. NEWINGTON, borough electrical engineer of Oldham, on July 16th. Tribute to the ability of the deceased was paid at a meeting of the Electricity Committee on the previous day.

MR. J. BROADHURST, an electrical engineer of Colwyn Bay, who was about to open a shop in the town, died on July 16th, after a short illness.

Will.—The late SIR J. WILSON SWAN, F.R.S., whose death occurred in May, left £58,344 net personalty. He left his electrical and laboratory equipment, &c., to be presented to any person or institution or corporation that his executors might select to receive them. His bequests included one of £100 to the Royal Society (says the *Times*) for "defraying the cost of scientific publication."

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THE NEW CABLE SHIP "EDOUARD JÉRAMEC."

We recently had the pleasure of inspecting in the Thames the new cable ship *Edouard Jéramec*, which has been built for the Compagnie Française des Câbles Télégraphiques (the principal French Trans-Atlantic Cable Co.), by the Société Anonyme des Forges et Chantiers de la Méditerranée at Havre. This is the first cable ship built in a French shipyard, and will be employed in the repair of the company's cables, including deep-sea cables, in the North Atlantic; she will be stationed at Halifax, replacing her predecessor the *Contre-Amiral Caubet*, which has been in service for 17 years.

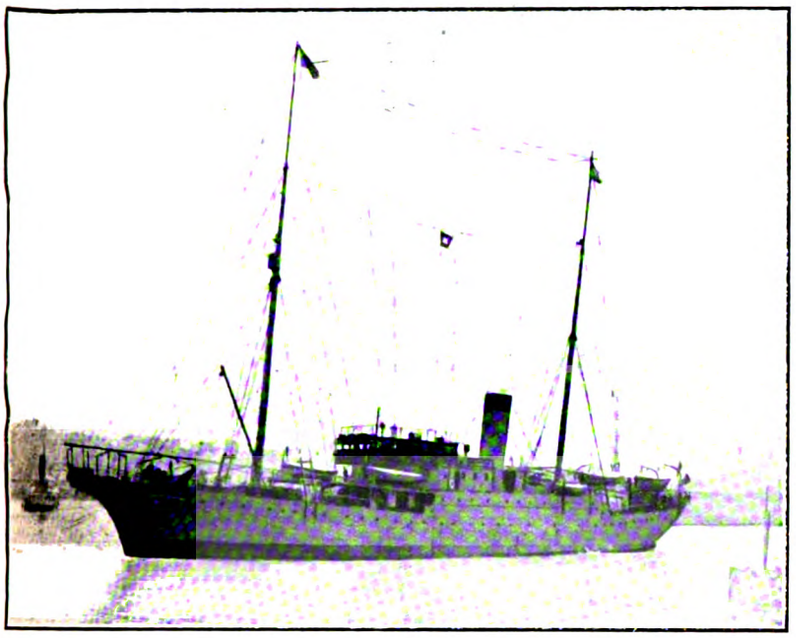

Fig. 1.—The Cable Ship "Edouard Jéramec."

The vessel is destined to operate in a cold climate, and therefore every effort has been made in her design to ensure the greatest possible comfort to the *personnel*, in order to compensate as far as possible for their long absence from home. For this reason the quarters of the officers and crew have been planned and fitted out on a lavish scale, and include a saloon, separate cabins, mess-rooms, a hospital and dispensary, lavatories, bath rooms, cold stores, kitchens, bakery, laundry, drying rooms, &c. Special provision has also been made for heating with steam, electric lighting, and the ventilation of the living quarters, as well as of the navigating bridge, which is completely enclosed.

The ship has been built under the supervision of the Bureau Véritas, and is provided with cellular water-ballast throughout her length, a double shell amidships, and a very complete system of transverse water-tight compartments. Her principal dimensions are as follows:—Length, 82 m. between perpendiculars; beam, 12·5 m.; depth to keel at spar-deck, 7·9 m.; draught when laden, 5·35 m.; displacement laden, 3,800 tons. The steel shell is strengthened beyond the requirements of the Bureau Véritas to provide for navigation amongst ice.

There are three cable tanks, 8·5 m. in diameter, and capable of carrying in all 800 tons of cable. The coal bunkers have a capacity of 850 tons, and generally provision is made for a cruise of 40 days at a distance of 1,500 km. from the base without calling anywhere in the interval.

The cable-handling gear was supplied by Messrs. Johnson & Phillips, Ltd., of London, under contract to the shipbuilders, and is illustrated below.

There are two cable machines, one forward for picking-up and dealing with comparatively short lengths of cable over the bows, the other aft for paying out long lengths of cable from the stern.

The forward equipment comprises two separate machines, with independent engines, so arranged that either or both of the engines may be used with either machine, so that for light work one engine only need be used, but for the heavy lifts both engines may be used driving one drum.

The cable drums on this machine are 1,740 mm. in diameter × 483 mm. wide between flanges, and each machine is arranged for two speeds, the picking-up machine for 25 tons at one knot, and 10 tons at 2½ knots, the paying-out machine for 10 tons at 2½ knots, and 6¼ tons at 4 knots. The engines are of the vertical two-cylinder high-pressure type, each capable of developing 110 B.H.P. with steam at a pressure of 160 lb. per sq. in.

The port side machine—for paying-out—embodies a new feature in the brake, comprising two rotary oil pumps geared directly to the cable drums and circulating oil through a system of pipes having a controlling valve. The resistance is regulated by the amount of opening of this control valve,

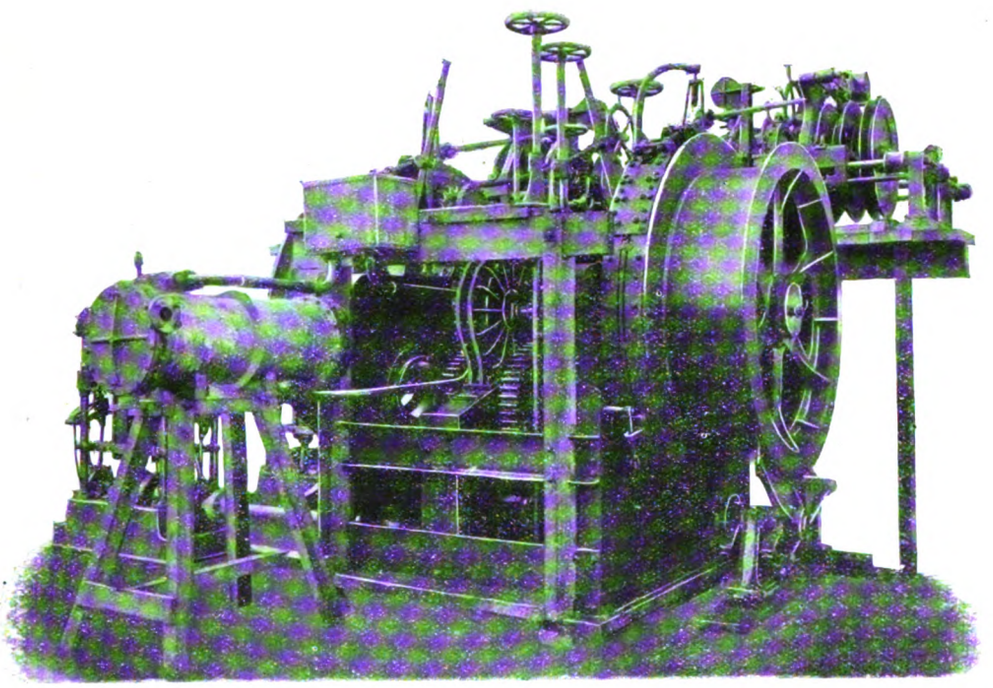

Fig. 2.—Forward Cable-Handling Gear

the power being taken up by heating the oil, which passes through a cooler provided with circulating water from one of the ship's water services. The pumps are very simple, and as all the parts are working in the oil, they are

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perfectly lubricated, with the result that the oil may be subjected to pressures up to 70 kg. per sq. cm.

The gear stands on the main deck, the cable drums projecting through hatches in the spar deck. All the controlling gear is arranged on the spar deck, within the reach of one man, except the control for the fleeting knives, which, when necessary, has to be actuated from the main deck.

Fig. 2 shows this machine as erected in Messrs. Johnson and Phillips's works, and one of the rotary oil-pump brakes may be seen between the frames and just below the top decking.

The aft machine is a single machine, adapted mainly for paying-out cables, but provided with a small vertical engine of 45 B.H.P. for the purpose of hauling back when necessary. This machine stands on the spar deck, with all the controlling gear arranged at the after end of the machine. It is fitted with the patent rotary oil-pump brakes, as mentioned in connection with the forward machine.

Fig. 3 shows the machine as erected in Messrs. Johnson and Phillips's works; the two rotary oil-pump brakes may be seen at the centre of the picture between the two frames, and the double-helical wheel which drives them is seen inside the main cable-drum.

At the bow of the vessel three sheaves are fitted for passing the cable and the grapnel ropes, &c. One sheave only is fitted at the stern, for paying the cable away aft.

Dynamometers are fitted both forward and aft to register the strain on the grappling ropes and cable when picking-up, and on the cable while paying-out. These dynamometers consist of sheaves carried on a slide which is free to travel up and down a vertical cylinder, the inside of which is provided with a plunger working in oil, forming a dash-pot, so as to steady the movement and prevent jumping.

For transferring the cable from one tank to another, an electric hauling gear has been provided. This consists of a "V" sheave with frames and suitable gearing and an electric motor of 6 B.H.P. supplied from the ship's lighting circuit. The gear is erected on a cast-iron bedplate provided with runners for portability about the deck.

For deep-sea sounding work an electric sounding machine is provided, having a motor of 3 B.H.P. and suitable for sounding in depths up to 5,000 fathoms.

The auxiliary machines include a donkey-boiler and steam telemotor; two steam windlasses; a Seagers refrigerator; a Buhring filter; submarine signalling apparatus; two Sautter-Harlé electric generating sets of 20 and 7 KW. at 110 volts; two electric fans rated at 500 m.³ per hour, to ventilate the workrooms, living quarters and officers' cabins; a projector, and a Morse signal lantern. The bridge is provided with an electric log, and Graham loud-speaking telephones with connections to all parts of the vessel. Most of the electrical testing apparatus will be taken over from the *Contre-Amiral Caubet*.

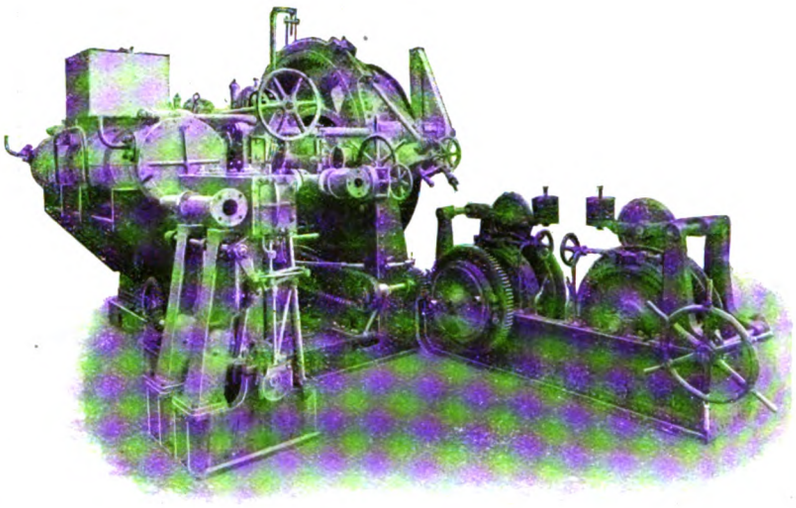

Fig. 3.—Paying-Out Machine of c.s. "Edouard Jéramec."

The boat equipment includes a launch 10 m. long, propelled with a heavy-oil engine of 40 H.P., launched with Welin davits, which are also provided for the boats used for work on the cables.

The twin-screw propelling machinery comprises two triple-expansion engines, with condensers and independent pumps, and two return-tube boilers with Howden forced draught. The speed guaranteed was 11·75 knots; that actually attained was 12·56 knots, with 2,100 H.P. During a test run of 24 hours at 11·36 knots, the coal consumption was 74·15 kg. per mile, against 89 kg. specified.

In view of the nature of the work for which this ship is designed, it was very important that the engines should be able to run without stopping at a very low speed, and that they should be capable of quick reversal; under test, a speed of 11 R.P.M. was maintained, corresponding to about 1 knot, and at normal speed reversal was effected in 5 seconds.

The wireless telegraph installation, provided by the Cie. Générale de Radiotélégraphie, is of a type recently installed on some French warships, but not on any other steamship, and is at present the most powerful in the French mercantile marine. Its range by day, at sea, is 900 to 1,000 km., and at night 3,500 to 4,000 km. The power employed is 5 KW. alternating, and the system uses musical emission with shock excitation, combining with ease of regulation great facility for tuning, as the wave is simple and very little damped. For normal running current is supplied at 500 cycles by a converter fed from the ship's direct-current circuit. The latter, however, can be dispensed with; the converting set is then driven directly by a petrol engine, the D.C. motor serving as exciter.

Including the staff, there are about 80 persons on board. The chief engineer is M. Loriot, and the captain M. Lemarteleur. Our thanks are due to the shipbuilders, and the makers of the cable machinery, for assistance in the preparation of this article, as well as to M. P. Neyreneuf, engineer to the Compagnie Française, for his courtesy in conducting our representative over the vessel.

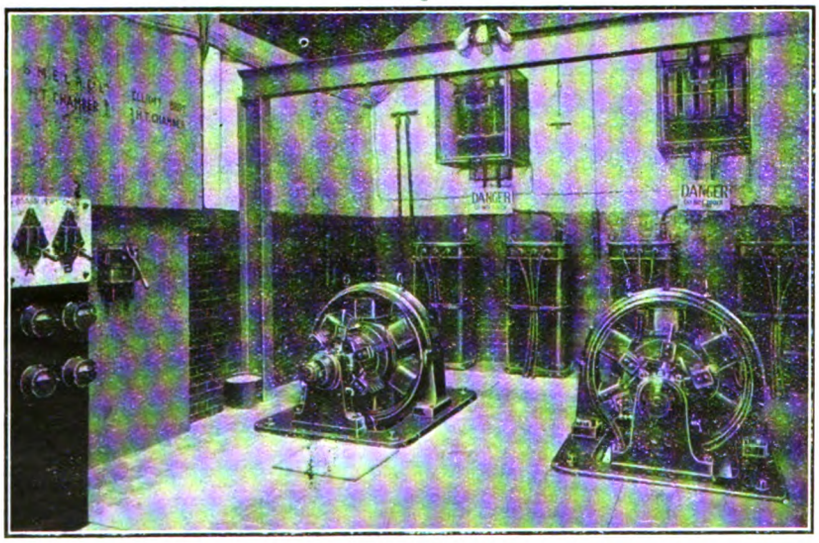

Fig. 1.—Messrs. Elliott Brothers' Works Sub-Station. (See p. 141.)

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POWER AND LIGHT AT MESSRS. ELLIOTT BROTHERS' WORKS.

Through the courtesy of Messrs. Elliott Brothers we were recently enabled to inspect some developments in connection with the power supply to and lighting of their well-known works at Lewisham. In connection with the former matter a modern rotary converter sub-station has now been built, in which are installed two Westinghouse 135-kw. rotary converters, with transformers, and both H.T. and L.T. switchgear. The supply is derived from the two-phase 3,000-volt circuits of the South Metropolitan Electric Light and Power Co., and our view (fig. 1, p. 140) shows the company's oil-switches mounted on the wall to the left, with a H.T. chamber containing instrument fuses and transformers, while close beside it is the works H.T. chamber containing the consumers' instrument transformers and fuses.

Below is the H.T. starting-switch for the rotaries, which is connected, through isolating links mounted on the end wall, to four Westinghouse oil-cooled transformers below, a pair of transformers—one in each phase—supplying each converter.

The rotaries are started up from the A.C. side by voltage tappings on the transformers and change-over switches; the L.T. board, shown in fig. 2, includes two A.C. starting panels and two D.C. generator panels, while the remaining panels carry switch-fuses for 18 feeders, and battery switchgear in connection with a 100-cell Chloride battery used in instrument testing and for overtime working. The direct-current supply for the works motors is at 200 volts. As would be expected, the board is liberally equipped with instruments, the rotary panels being provided with a total consumption recording wattmeter for measuring the alternating-current input in both phases, and a H.T. recording voltmeter; direct-current polarity indicators are also fitted, and a power-factor indicator. A direct-current integrating wattmeter enables the generated energy to be checked against that received from the alternating mains; a direct-current voltmeter and ammeter of the recording pattern are also provided.

Although the group drive is employed in the works to a considerable extent, it is worth noting that Messrs. Elliott Bros. have found it profitable, under the conditions obtaining in their business, to employ individual driving in connection with the numerous small lathes, drills, &c., required for instrument work, and about a hundred motors of from $\frac{1}{16}$ to $\frac{1}{4}$ H.P. are in use. The normal load-factor of the works is some 30 per cent.

The opportunity has also been taken to reorganise the lighting throughout the works, the general scheme—which was suggested by Mr. Haydn Harrison and carried out by Messrs. Elliott Bros.—consisting of low-voltage, low candle-power units for the individual lighting of benches, machine tools, &c., and of four and six-light clusters for general illumination.

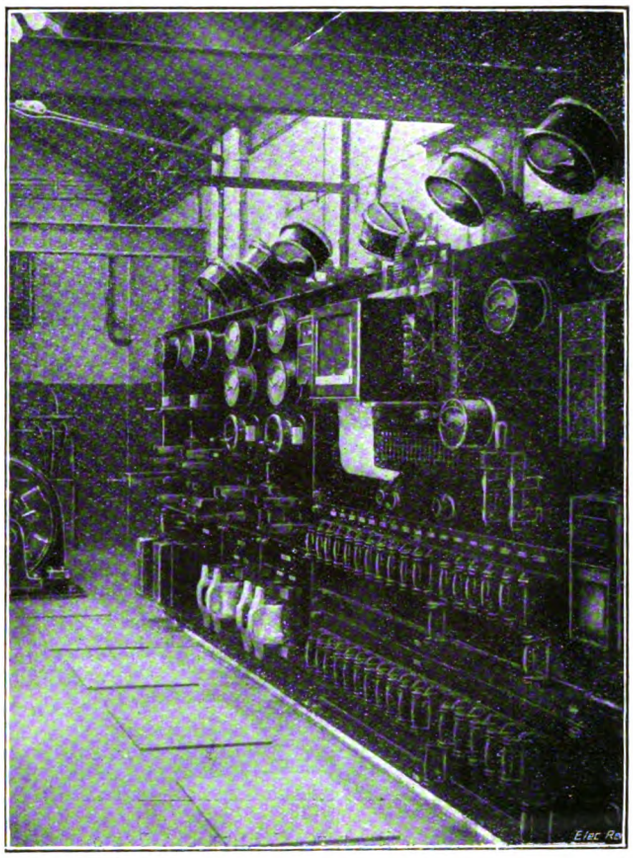

Fig. 2.—Low-Pressure Switchboard in Sub-Station.

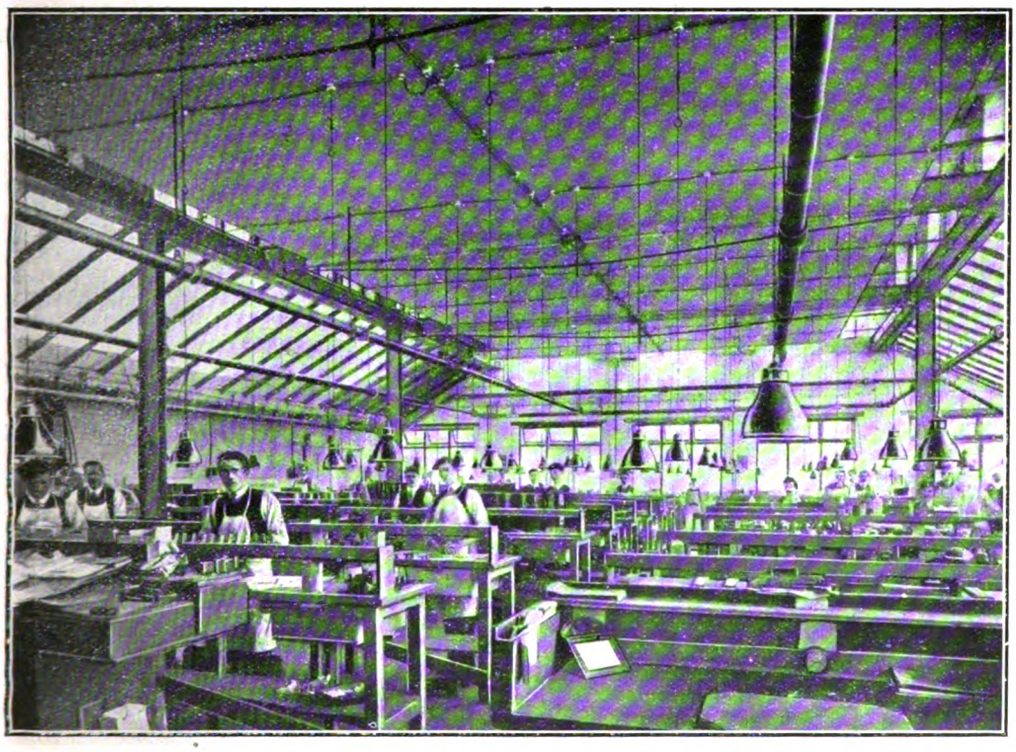

Fig. 3.—Interior of One of the Workshops, showing Wiring.

The wiring, which is all exposed and run overhead, is arranged on a three-wire system with 100 volts across the outers and an earthed neutral; braided cable is used, attached to porcelain insulators, and the lighting units—10-watt tungsten lamps in Benjamin focusing steel shades—are suspended from detachable G.E.C. ceiling roses, enabling the whole pendant to be quickly removed to a new position, or replaced by a spare fitting if any failure occurs. The pendants are arranged in groups of from five to eight on one switch and fuse, a neat Vedovelli-Priestley wall-fitting being used for this purpose.

About 1,000 lamps have been installed, and these are supplied from the South Metropolitan Co.'s 400-volt single-phase system, through a 10-kw. Berry transformer,

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secondary tappings being provided to give 50, 52½ and 55 volts to allow for pressure regulation.

Fig. 3 gives a good idea of the exposed wiring, pendant lights, &c., in one of the shops with a flat ceiling. In the machine shop, with an open roof, the wiring is carried on insulators in the roof principals, with branches to either side taken from small bus-bars and leading to suitable positions for pendant or machine lighting. In the case of the latter, where pendants are inadmissible, the wiring is carried from overhead, down vertical steel barrel, to a special machine-lighting fitting, which has been developed for the purpose by the firm.

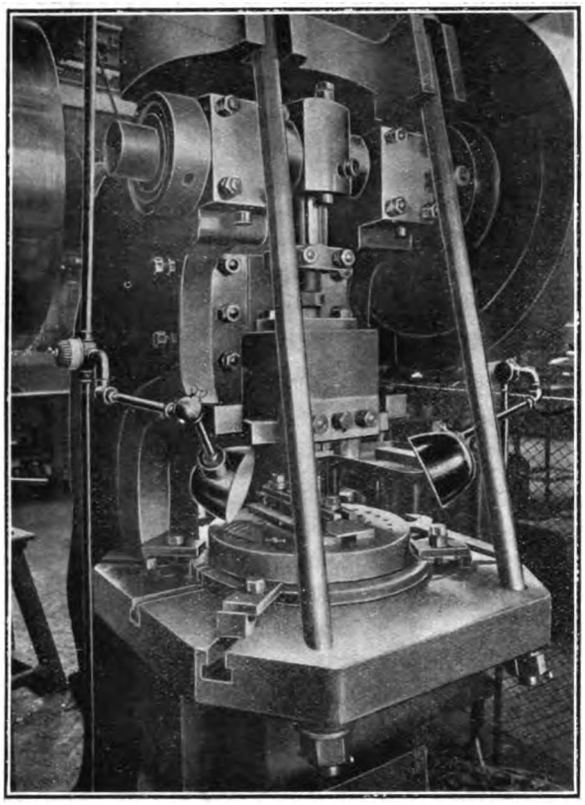


Fig. 4.—Arrangement for Lighting a Press.

Fig. 4 shows a press with one of these fittings on either side; as will be seen, they are built up of short lengths of barrel with movable joints to give flexibility. The lamp, in an anti-vibration holder, is carried in a parabolic reflector, the base of which is not attached rigidly to the tube, but arranged to turn round so that the light may be directed as desired. The bracket is attached to a junction-box, which also carries the tumbler switch controlling the light. The press is a difficult machine to illuminate on account of the inaccessibility of the work, while for accurate tool-setting good light is essential. The new fitting gives adjustment in every direction, and is much superior to the portable lamp, as the light can be directed on to the work and away from the eyes of the machinist. Generally the illumination provided on benches is 2½ to 3½ foot-candles; on machines a usual figure is 10 foot-candles, but in exceptional cases as much as 20 foot-candles is provided.

In the foundry six K-type Cooper-Hewitt mercury-vapour lamps are employed, run two in series on 200 volts. Each of these gives 1,000 c.p., making in all 6,000 c.p. for a floor area of 60 ft. by 40 ft.

In conclusion, our thanks are due to Messrs. Elliott Bros. and to their engineer, Mr. Phillips, for their assistance in the preparation of these notes.

EDISON 'BUSES FOR SOUTH SHIELDS.

Recently a preliminary trial was held of one of two battery 'buses which Messrs. Edison Accumulators, Ltd., are supplying to the South Shields Corporation. These 'buses are intended to act as feeders to the tramway system, over a route about 1¼ miles long, with two short gradients due to railway crossings which were unsuited to tramway working.

The trial run, in London, took place over 13 miles of busy streets in the West-End. A hill-climbing test was made at Aubrey Road, Holland Park, where the maximum grade is 1 in 8, and the average grade 1 in 10, this hill being smoothly negotiated from a dead stop at about 6 miles an hour.

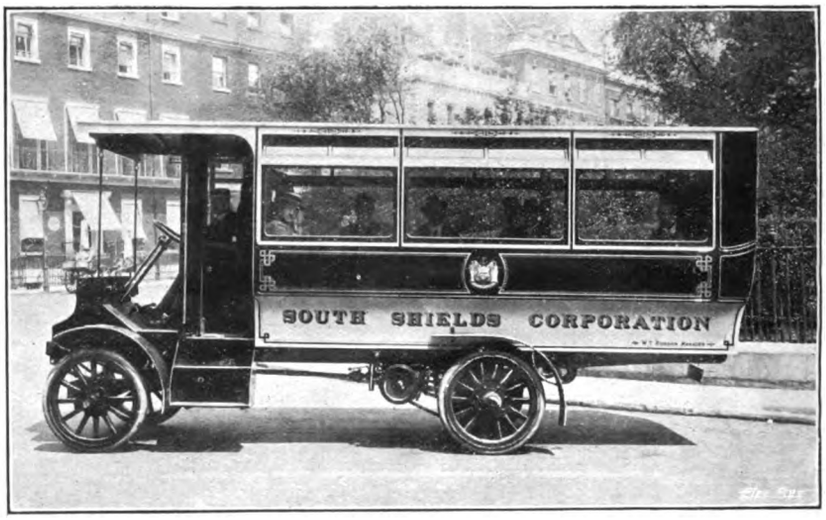
The vehicle, which we illustrate below, has several features of constructional interest. The body is of the single-deck type, with a front entrance only, so that the driver can collect fares; seating is provided for 22 passengers and a driver, both longitudinal and cross seats being fitted. The battery consists of 60 Edison A-8 type cells, for 65 volts, 300 ampere-hours capacity; it weighs 1,800 lb., and is placed under the seats to facilitate inspection.

The motor, mounted under the driver's footboard, is a 4-pole series-wound totally-enclosed machine, fitted with dust-proof ball bearings, and easily replaced copper-faced carbon brushes; the motor drives through a propeller shaft to a differential bevel lay shaft mounted behind the accumulator housing, and thence to the rear hubs by roller chains. The controller is of the drum type, giving four forward and two reverse speeds; internal expansion brakes are fitted to the rear wheels, and all the wheels are fitted with Timken roller bearings and solid rubber band type tires.

The lighting, both internal and external, is supplied from an independent six-cell Edison battery, arranged to be charged in parallel with the traction battery at night. The complete vehicle weighs 8,000 lb., and it has a mileage of 40 to 50 per charge on good roads, which can be increased to from 80 to 100 miles per working day, by short boosts between trips.

We are indebted to Messrs. Edison Accumulators, Ltd., for the foregoing particulars.

An Electric Hotel Omnibus.—An electric eight-passenger station omnibus has recently been put in service by the Marine Hotel, North Berwick. The vehicle, which is stated to be the first of the kind in this country, is intended for the conveyance of passengers and their luggage to and from the railway station. The chassis is of the standard Edison 20-cwt. design, and is equipped with a battery consisting of 60 Edison A4-type cells, the approximate mileage per charge being normally about 40. The body of the 'bus, which was built by Messrs. James Young and Co., of Bromley, Kent, is designed to accommodate eight passengers, the driver and luggage.



Edison Electric 'Bus for South Shields.

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NEW COMPANIES REGISTERED.

International General Artificial Coal and Fuel Co., Ltd. (136,881).—This company was registered on July 8th, with a capital of £100,000 in £20 shares, to carry on the business indicated by the title and that of manufacturers, and preparers of, and dealers in manure and manurial products, manufacturers of chemical and electro-chemical products, &c., and to adopt an agreement with J. Pfeiffer, G. Weiss, and W. Zeitler. The subscribers (with one share each) are :—R. H. Dulow, 117-18, Leadenhall Street, E.C., secretary; L. de Sarandy, 6, Broad Street Place, E.C., secretary; T. Wood, 44, Blenheim Grove, Peckham, S.E., accountant; S. A. Romain, 6, Broad Street Place, E.C., secretary; I. Hinton, 12, Brunswick Place, City Road, E.C., clerk; C. E. Best, 117, Leadenhall Street, E.C., director; H. Martelli, 117, Leadenhall Street, E.C., clerk. Minimum cash subscription, 50 shares. The number of directors is not to be less than three or more than five; the first are J. Pfeiffer, W. Zeitler, and G. Weiss. Remuneration, £50 each per annum (chairman £100). The profits of the company, when it shall from time to time be determined to distribute, are to be applicable:—5 per cent. for sinking fund, 10 per cent. for board of directors, 5 per cent. at the disposal of such board, and 80 per cent. to the shareholders. Registered office, 117, Leadenhall Street, E.C.

Horrabridge and District Electric Supply Co., Ltd. (136,863).—This company was registered on July 7th, with a capital of £2,000 in 10s. shares, to carry on the business indicated by the title. The subscribers (with 40 shares each) are :—W. G. Broad, Walkham Villa, Horrabridge, architect; A. H. Hanns, Post Office, Horrabridge, post master; G. Harrds, Roslyn, Horrabridge, purveyor; H. H. Netherton, Station Road, Horrabridge, baker; J. B. Sargent, Phœnix House, Horrabridge; C. Tregilius, The Highlands, Horrabridge, corn merchant; J. Tucker, Glenfinlas, Horrabridge, retired draper. Minimum cash subscription, £200; the first directors are W. G. Broad, A. H. Hanns, G. Harris, H. H. Netherton, J. B. Sargent, C. Tregilius and J. Tucker; qualification, 40 shares. Registered office, 12, Station Road, Horrabridge, Devon.

Electrical Sales Promotion, Ltd. (136,876).—This company was registered on July 8th, with a capital of £1,000 in £1 shares, to prepare and design advertising and other trade literature, to enter into arrangements with manufacturers of, and dealers in, electrical goods and appliances; to carry on the business of advertising contractors and agents, &c. The subscribers (with one "B" share each) are :—R. M. F. Robertson, 22, Tudor Street, E.C., director of Dobson, Molle & Co., Ltd.; W. T. Gibb, 22, Tudor Street, E.C., stationer. Private company. The directors are to number not less than two or more than five. So long as Dobson, Molle & Co., Ltd., hold 500 shares, they may appoint one half of the directors, one of whom shall be chairman. The first directors are R. M. F. Robertson (chairman), and J. C. Price. Registered office, Craven House, Kingsway, W.C.

Patentees Attorneys, Ltd. (136 845).—This company was registered on July 6th, with a capital of £1,000 in £1 shares, to carry on in the United Kingdom and elsewhere the business of agents for English, Colonial, and foreign patents, agents de brevets, attorneys for patentees, international patent experts and advisers, &c. The subscribers are :—G. Gilman, 1, Arlington Park Mansions, Chiswick, W., miller, 10 shares; E. J. Lacombe-Lane, 8, Arlington Park Mansions, Chiswick, W., patent expert, 80 shares; Mrs. G. Lacombe-Lane, 8, Arlington Park Mansions, Chiswick, W., 10 shares. Private company. The number of directors is not to be less than two or more than four; the first are G. Gilman and E. J. Lacombe-Lane. Solicitors, Brandon & Nicholson, 3 and 4, Suffolk Street, Pall Mall East, S.W.

Bachelet Levitated Railway Syndicate, Ltd. (136,897).—This company was registered on July 9th, with a capital of £50,000 in £1 shares, to carry on the business indicated by the title, and to adopt an agreement with Emile Bachelet. The signatories (with one share each) are :—W. Simpill, 7, Bennett Street, St. James's, S.W., gentleman; R. G. Wightman, Sherwood Park Road, Sutton, Surrey, gentleman. Private company. The first directors (to number not less than three or more than seven) are to be appointed by the signatories: qualification, £25. Registered office, Trafalgar House, 11, Waterloo Place, S.W.

S. Smith & Sons (Motor Accessories), Ltd. (136,013).—Registered July 15th, by Clifford, Turner & Hopton, 81, Finsbury Pavement, E.C. Capital, £100,000 in £1 shares. Objects: To take over the business of manufacturers of speedometers, carburettors, dynamos and other accessories of all kinds carried on by S. Smith & Sons, Ltd., at 179-185, Great Portland Street, W., and to adopt three agreements (1) referred to as the "sale agreement" with the said company, and (2 and 3) referred to as the "management agreements" (a) with A. G. Smith and (b) with R. A. Smith. The subscribers (with one share each) are :—H. W. Hill, 74, Grantham Road, Clapham, S.W., clerk; W. A. Sumsion, 52, Ronald's Road, Highbury, N., clerk; E. Newton, 3a, Maryville Terrace, Sydney Road, Muswell Hill, N., clerk; E. King, 11, Oxford Terrace, Albert Road, South Norwood, S.E., clerk; G. Clements, 14, St. Margaret's Avenue, Harringay, N., clerk; W. G. Banning, 78, Holland Road, Brixton, S.W., clerk; H. R. Parkes, 12, Stafford Road, Walthamstow, N.E., clerk. Minimum cash subscription, seven shares. The first directors (to number not less than three or more than nine) are S. Smith, 50, Redington Road, Hampstead, chairman (governing director of S. Smith & Son, Ltd.); C. W. Nicholls, 35, Craven Gardens, Wimbledon (manager, Provincial Sales Department, S. Smith & Son, Ltd.); R. A. Smith, 56, Redington Road, Hampstead (manager, Carburettor Department, S. Smith & Son, Ltd.); G. W. Arnold, 9, Caversham Avenue, Palmer's Green (export manager, S. Smith and Son, Ltd.); and A. G. Smith, Hook Farm, Aldingbourne, Sussex, managing director (manager, Motor Accessories Branch, S. Smith & Son, Ltd.); qualification, £250; remuneration, £50 each per annum (chairman £100). Purchase consideration £50,000 payable by the allotment of 50,000 fully paid shares. The vendor company will also receive in respect of the profits of the business, from March 31st down to completion, the estimated and agreed amount of £4,000. Secretary and registered office, F. A. Cotterell, 179, Great Portland Street, W.

British Chamber of Commerce in the Argentine Republic (Incorporated).—(The word "Limited" is omitted from the title by licence of the Board of Trade).—Registered July 14th, by Corbould, Rigby & Co., 1, Henrietta Street, Cavendish Square, W., as an association limited by guarantee, with not more than 1,000 members, each liable for £5 in the event of winding up. Objects: To carry on the business indicated by the title (politics expressly excluded). The Chamber is to consist of British incorporated companies, merchants, traders, representatives and/or agents trading in or with the Argentine Republic. The first members of the Council are the following (all of Buenos Ayres) :—Hope Gibson, produce broker; H. H. Long, finance; T. Lloyd, banker; T. S. Boadle, steamship agent; J. W. Barclay, importer; D. G. Anderson, representative; C. H. Pearson, railway manager; A. G. Thornton, merchant; H. Tudor, merchant; J. K. Cassels, merchant; F. H. Chevallier-Boutell, Lloyds' agent; G. Lloyd Davies, company manager; J. Begg, merchant; R. A. Sumner, merchant; P. A. Grassick, accountant and auditor; J. Walker, merchant; R Paton, manager of insurance company; W. A. Agar, merchant; E. M. Simpson, contractor; W. E. O. Maxell, company manager; and H. C. Thompson, merchant. Registered office, 1, Henrietta Street, Cavendish Square, W.

Granville, Burgess & Co., Ltd. (137,054).—This company was registered on July 17th, with capital £500 in £1 shares, to carry on the business of electricians, mechanical engineers and manufacturers, workers of and dealers in electricity, motive power and light, &c. The subscribers (with one share each) are :—H. Hart, 14, Swale Street, E., solicitor's clerk; K. Roberts, 37, Walbrook, E.C., typist. Private company. The number of directors is not to be less than three or more than five; the subscribers are to appoint the first; qualification, one share. Solicitors B. A. Woolf & Co., 37, Walbrook, E.C.

British Electrical Accessories, Ltd. (136,958).—This company was registered on July 13th, with a capital of £1,000 in £1 shares, to take over the business of an electrical supplies factor carried on by C. Pullan, at 80, King's Parade, Bradford. The subscribers (with one share each) are :—C. Pullan, 80, King's Arcade, Bradford, engineer; J. S. Rhodes, Station Road, Keighley, electrical engineer; W. D. Wilson, 43, Swan Arcade, Bradford, electrical engineer; W. H. Wilkinson, 182, Harris Street, Bradford, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are C. Pullan, J. S. Rhodes, W. D. Wilson, G. V. Laycock and W. E. Shuttleworth; qualification, 50 shares. Registered office, 17 and 19, Fawcett Road, Bradford.

Market Securities Co., Ltd. (137,009).—This company was registered on July 15th, with a capital of £20,000 in £10 shares, to carry on the business of bankers, capitalists, financiers and concessionaires, dealers in stocks and shares, &c. The subscribers are :—E Garcke, 1, Kingsway, W.C., M.I.E.E., 50 shares; C. G. Tegetmeier, Normanhurst, Brighton Road, Purley, director, 50 shares; C. H. Dade, 1, Kingsway, W.C., manager, one share; W. J. Allen, 1, Kingsway, W.C., secretary to the Electrical and Industrial Investment Co., Ltd., one share; H. Kingsbury, 1, Kingsway, W.C., chartered secretary, one share; C. F. James, 1, Kingsway, W.C., secretary, one share; J. P. Savage, 1, Kingsway, W.C., clerk, one share. Minimum cash subscription 5 per cent. of the shares offered to the public. The number of directors is not to be less than two or more than five; the first are E. Garcke and C. G. Tegetmeier; qualification, £250; remuneration as fixed by the company. Registered office, 1, Kingsway, W.C.

Economic Electric, Ltd. (136,987).—This company was registered on July 14th, with a capital of £10,000 in £1 shares, to take over the business of merchants, manufacturers and warehousemen of electric and other goods carried on by S. G. Frost and D. Poupart, at Twickenham, as the Economic Electric Co. The subscribers are :—S. G. Frost, 64, London Road, Twickenham, electrician, 100 shares; D. Poupart, 64, London Road, Twickenham, electrician, 100 shares; A. Holt, 3, Duke Street, Adelphi, W.C., gentleman, 200 shares. Private company. The number of directors is not to be less than three or more than five; the first are A. Holt, and others to be appointed by the shareholders; qualification, 100 shares. Registered office, 64, London Road, Twickenham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Kingolite Co., Ltd.—Particulars of £800 deb., created June 24th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £400. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

James Keith & Blackman Co., Ltd.—Issue on July 6th, 1914, of £100 deb., part of series of which particulars have already been filed.

Everett, Edgcumbe & Co., Ltd. (84,764).—Capital, £25,000 in £1 shares (5,000 6 per cent. cum. pref., 19,997 ord. and three "A"). Return dated July 1st, 1914. 3,300 pref., 18,643 ord. and three "A" shares taken up. £1 per share called up on 2,500 pref., 8,595 ord. and one "A." £11,096 paid. £10,850 considered as paid on 800 pref., 10,048 ord. and two "A." Mortgages and charges: £1,600.

Electrical Co., Ltd. (36,819).—Capital, £100,000 in £5 shares. Return dated April 20th, 1914. All shares taken up. £2 12s. 6d. per share called up on 17,000, and £2 per share on 3,000. £50,625 paid. £9,000 (£3 per share) considered as paid on 3,000. Mortgages and charges: Nil.

General Electric Tramway Co., Ltd. (43,428).—Capital, £50,000 in £1 shares; return dated March 23rd, 1914; 18,500 shares taken up; £18,500 paid. Mortgages and charges: £11,000.

Eastern and South African Telegraph Co., Ltd. (13,306).—Capital, £600,000 in £10 shares; return dated May 27th, 1914; all shares taken up and paid for in full. Mortgages and charges: Nil.

I.T.C., Ltd. (99,612).—Capital, £10,000 in £1 shares. Return dated February 10th, 1914. All shares taken up. £10,000 paid. Mortgages and charges: £1,000.

Electromotors, Ltd. (60,826).—Capital, £50,000 in £1 shares. Return dated May 28th, 1914. 42,370 shares taken up. £42,370 paid. Mortgages and charges: Nil.

Shipston Electrical Co., Ltd.—Particulars of £300 second debentures created July 9th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled and unpaid capital. No trustees.

Bagdad Tramways and Electric Lighting Syndicate, Ltd. (124,213).—A memorandum of satisfaction to the extent of £8 400 (being amount issued) on May 7th, of trust deed dated April 2nd, 1914, securing £15,800, has been filed. (The charge has now been cancelled.)

Particulars of Work and Wages.—We have received from the Home Secretary the draft of an Order which he proposes to make under Sec. 116 of the Factory and Workship Act, 1901. The effect is to require particulars of work and rate of wage to be given to all persons paid by the piece who are employed in factories and workshops in which the manufacture of articles of metal (not being machinery) is carried on, or who are employed in that class of work as outworkers. The Order is drawn so as to apply to the same classes of work (other than the manufacture of machinery), as are covered by the definition of "metal works" in paragraph (13) of the sixth schedule to the Act, with the inclusion, however, of workshops as well as of factories, but it will not apply to any of the other works (*e.g.*, blast furnaces, copper mills, iron mills, or foundries) defined in the other paragraphs of that schedule; nor will it apply to any work to which the Order of September 23rd, 1907, relating to the mixing, casting, or manufacture of brass or articles of brass and the electrodepositing of brass, applies. Any communication relating to the draft Order should be addressed before August 13th next to the Under Secretary of State, Home Office London, S.W.

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CITY NOTES.

Buenos Ayres, Port and City Tramways, Ltd.

MR. GEORGE KITCHIN, presiding at the annual meeting, held at Salisbury House, E.C., last week, said there was an increase in receipts of £8,393 for the year, and the net profit was £6,764, compared with a loss of £1,148 in the previous year. As the profit only represented one-fifth of the debenture stock and bond interest, there was a debit balance for the year of £27,534, making the total debit £79,756. Only construction work that was absolutely necessary was being proceeded with. The chairman later referred to the difficulties which were mainly responsible for the high percentage of their working expenses. These difficulties could not be got rid of. They could not hope to materially alter the rough character of their traffic, and the high price paid for energy was a considerable handicap; they were under contract with the German Power Co. for a considerable term of years. It appeared that they would have to be satisfied with working expenses of a ratio of somewhere about 75 per cent. Last year the figure was 87·49. The improved management was beginning to make itself felt in the direction of reduction of expenses, but the fixed charges were abnormally heavy. They had had to borrow money to meet their obligations, but that could not continue, and they had a scheme in preparation which they would submit shortly for reducing the fixed charges and getting rid of large items on the credit side which did not represent tangible assets. The report was adopted.

British Continental Electricity Co., Ltd.

THE directors' report on the position of the undertaking at the end of the year 1913-14 shows that after writing off £224 depreciation at the usual rates in respect of furniture, tools, meters, &c., and £200 depreciation of plant, the balance standing to the credit of revenue account, after deducting the interim dividend paid on the 5½ per cent. cumulative preference shares for the half-year ended October 31st, 1913, and including the amount brought forward, is £1,249, out of which has been paid an interim dividend at the rate of 3 per cent. per annum on the ordinary shares for the half-year ended October 31st, 1913, leaving £1,099, which is to be appropriated as follows:—Final dividend at the rate of 5½ per cent. per annum on the 5½ per cent. cumulative preference shares for the half-year ended April 30th, 1914, £275; final dividend at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares for the half-year ended April 30th, 1914 (making 3½ per cent. for the year), £200; addition to reserve fund, £300; leaving to be carried forward £324. £1,534 has been expended on capital account during the year, largely due to an extension of the company's network to serve the Madonna della Guardia district, which network has been completed since the close of the financial year, and shows every prospect of justifying the expenditure incurred thereon.

The Paris Tramways Co.

THE report for 1913 of the *Compagnie des Tramways des Paris* states that a considerable portion of the works connected with the transformation of the tramways, was executed in 1911 and 1912 without, however, yielding tangible results. On the other hand the completion of certain sections in 1913 opened up access to the centre of the city and now permitted of the realisation on many lines of the advantages resulting from the reorganisation of the services. As far as concerns the electrification of the lines formerly worked by steam and battery cars, the report points out that the works comprised the installation of the overhead trolley on the whole of the suburban network and on a zone in Paris limited in general by the outer boulevards, whilst the conduit system was stipulated for elsewhere. The installation of the trolley had proceeded rapidly, and out of 112 miles of line for this method, 102 miles were already in operation. The mileage on the conduit system was to be 21.70, of which 12.40 miles had been completed. It had therefore been possible to discontinue the use of accumulator cars on all lines with the exception of three, and to bring the new service of cars to the two most important termini in the centre of Paris. The three lines still worked by battery cars were the two proceeding from the Pont de l'Europe and that from Puteaux to the Madeline, the latter of which was on the point of being brought into operation on the conduit system. 200 new motor cars had been placed in service.

The general course of working was satisfactory. The reorganisation had yielded good results, and the number of passengers carried increased by 8,940,000 over the preceding year. Not only so, but the cost of working per car kilometre had been reduced by 11 per cent, thus bringing the economy realised since the reorganisation was commenced up to 24 per cent. The number of car kilometres run advanced from 14,951,000 in 1912 to 16,211,000 last year, and the total receipts from £450,000 to £494,000 in the two years respectively, and the increase became of a more pronounced character in the early months of 1914, during which the working expenses per car kilometre were further reduced notwithstanding a large augmentation in the kilometres run. The net profits amounted to £88,000, and after placing 5 per cent. to the legal reserve fund, the balance has permitted of the payment of a dividend of 4 per cent. on the ordinary share capital of £2,200,000.

Marconi's Wireless Telegraph Co., Ltd.

COMMENDATORE G. MARCONI presided on Tuesday, at the Hotel Cecil, over the annual meeting. There was a large attendance of shareholders.

The CHAIRMAN, in moving the adoption of the report (ELEC. REV., p. 105), said he was afraid the report and figures had been somewhat disappointing, but judging from some of the criticisms which he had heard and read, he did not think that the full meaning of what was said in the report or the figures which it contained had been altogether appreciated. After the few remarks which he proposed to make upon them perhaps they would regard them with a little less pessimism. But he would like to preface what he was going to say about these matters by drawing their attention to the following facts:—(1) Although they had existed as a company for quite a number of years the wireless industry was a very young one; even now it was only in its infancy. (2) Their business could not be compared with any other; they did not trade in bales of wool or sacks of flour in which there was an almost unlimited market, their market was a somewhat limited one and their revenue was derived from three sources:—(1) Sales made mainly to governments and contracts entered into with them. (2) Dividends from their holdings in subsidiary companies, and (3) Receipts from telegraph services which they conducted or in which they were interested. With regard to the first, so long as they did a good proportion of all the business which governments offered, they could not complain. They could not do much in the way of creating business when the financial conditions of the world were unfavourable and every government was aiming at reducing its expenditure by avoiding any outlay which was not immediately essential. In the second case, they could give all the assistance in their power to their subsidiary companies, but they could not make them, and did not try to induce them, to pay bigger dividends than their directors thought prudent. These companies were all subject to much the same conditions which influenced their company, and they too were in the course of development and expansion. They took time to build up. As they improved so did their revenues. Thirdly, in regard to the telegraph service; they did a great deal of work, and last year they did a great deal of work from which the profits were to be derived in the future. They had more than once said that the principal revenue to be derived from wireless lay in the creation and working of telegraph services. And they had told them that the policy of the company was to build telegraph stations as far as possible for their own account under concessions or licences, and in cases where these could not be obtained, they would build them for others, they remaining interested in one form or another in the receipts. Whichever of these courses was adopted the stations had to be built and the telegraph services created, and both took time. Neither produced profits during the course of construction or creation, but they would, they trusted, insure to them sure and regular revenues in the future. To this they attached the greatest importance; but they recognised that their profits might vary considerably according to demand as regarded that section of their business which related to contracts and sales; but when they should have reached the stage of developed telegraph services at which they aimed, they hoped to be quite independent of the contract and sales section as regarded profits, without neglecting that part of their business. In the meantime it must be recognised that a considerable proportion of their work did not give them any immediate profit, unless they elected to sell outright or in substantial part. But that was not their policy. They preferred to build up a sound future even though they had an occasional year with a profit and loss account less favourable than they would all like to see it. As an example of what he meant, they had been engaged during the past year in the construction of their Welsh Trans-Atlantic stations. They constituted the most important work ever carried out by the company. They looked to them, in conjunction with those constructed simultaneously in America, to produce large and regular revenues both to the company and to the American company, in which of course they participated through their large shareholding in that company. Those stations were very nearly ready to start a direct telegraph service to New York. The Trans-Oceanic Wireless Telegraph Co., Ltd., would conduct that business; they held all the shares in that company; they could have sold them very easily they thought if they had wanted to and so reimbursed the money they had expended and made a substantial profit besides. This would have materially improved their profit and loss account for last year, but it would have been bad business indeed if, as they hoped, the company would earn *yearly* and for many years to come as much as or more in each year than the single profit they could have derived by an outright sale. For such reasons as these their actual profits for the year were less than they otherwise might have been, but their assets were materially improved by the addition of these securities, and at their par value, which they hoped and believed they were worth, they showed a substantial profit, but that profit not having been realised it was not carried to profit and loss account. If they realised, or whenever they might decide to realise, whatever sum might be produced above cost became available for distribution and would be included in the profit and loss account of the year, but not before; meantime it remained an asset and was treated in their accounts accordingly. In the balance sheet, the amount representing the

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cost of shares in associated companies and patents, which was a very important asset, increased during last year to £1,298,744, which was £442,624 more than appeared in the accounts of the preceding year; the par value, however, represented by that increase was £826,637, and they hoped and believed that the additional interests acquired were worth at least par. If they were they would represent a profit of £384,012 when realised, but at present there had been no attempt to turn them into cash. They were subjected to some criticism and some of their shareholders would seem to be dissatisfied because they did not again set out particulars of shares in associated companies. He could assure them that the directors themselves regretted having to come to that decision; and in doing so it was not that they had any wish to keep information from the shareholders, but solely because they were all convinced it was not in their interests that the information should be made public. Much the same remarks applied in the profit and loss account under the item "By balance of contracts, sales and trading account." They did not give more information respecting that item because they were satisfied it would be against the shareholders' interests to do so, and for no other reason. With superior knowledge of the company's affairs that was their opinion and that was their advice. The directors had no personal interests to serve and no desire to keep anything from them and if, notwithstanding their advice, a majority of the shareholders wished all the details under both or either of these heads published it should be done in the future. But the board recommended reflection before they took such a decision. He could, however, inform them that the list published last year was practically unchanged. They had not sold any of their shares and he would like it known that they never dealt in the market in any shares in any of their subsidiary companies. They had never bought any such shares and except on some few occasions when they had received advantageous offers for blocks of shares which they had considered it wise to accept, they had no transactions of any kind. He made that statement because he frequently heard it stated that the company was buying or selling as the case might be in the market, which accounted for the rise or fall in shares. Whenever they heard such statements as these they could deny them with his authority—for he repeated that the company never dealt in any of its shares in any way whatsoever other than that which he had described. Having decided they ought not to publish the particulars of their holdings it seemed to them important that the shareholders should have some idea as to whether their shares, representing so important an item in the balance sheet, were worth their cost, at which they were taken into account. They therefore proceeded to make a careful valuation of them, taking the price at the 30th June last for all the shares quoted on the Stock Exchange, and on that day, the prices were perhaps lower than they had ever been before, and forming their best judgment upon those unquoted, and they had told them that that valuation exceeded the amount at which it stood in the accounts and according to their valuation, the amount in excess was considerable. If their shares were worth the figure at which the shareholdings and patents together stood in the balance sheet, their patents were not represented by any sum whatsoever. Turning to other figures in the balance sheet of the year, he thought they must agree the comparison was a favourable one. Sundry debtors showed an increase of £115,000. Stock at cost was nearly doubled, namely £151,141 as compared with £81,206, which was an indication of increased business in hand. When all these things were taken into consideration, although the actual realised profit for the year was disappointing, they would agree that the results of the year as a whole were good, and the company's position showed a marked improvement. Reverting for a moment to the profits for the year and the recommendation of a final dividend of 10 per cent., he would explain why the directors recommended this distribution. At the end of 1912 a sum of £146,726 was carried forward, after placing £100,000 to special reserve account. The object of carrying forward so large an amount instead of distributing it was admittedly for the purpose of averaging dividends. In those circumstances the directors were of opinion that unless they could say that it was essential at this moment for the purpose of the company's business that they should refrain from distributing the profits earned, the shareholders would have just cause of complaint if the directors did not use a part of the monies earned in the previous year for the purpose of averaging for which it was carried forward. In September, 1913, a circular was issued informing them of an arrangement which had been made for the acquisition by the company of the majority of the shares of the Compagnie Universelle de Telegraphie et de Telephonie sans Fil of France, which company not only commanded a valuable influence in certain foreign countries, but also owned the world-wide rights, other than those of Germany, of Professor Goldschmidt's inventions, including his high-frequency alternator, and in order to fulfil the company's programme they issued 250,000 new shares at the price of £3 5s. 0d., which was below the market value at the time, and at this price they were able to get the whole issue guaranteed. They did contemplate that the profit and loss account for the year would have shown a bigger realised profit, and they certainly did not expect to see their shares depreciate on the market as they had done lately, but for these fluctuations they were no more responsible to-day than they were some time back when movements were in the other direction. Speaking in a general way their business had suffered and their whole programme had become somewhat dislocated and retarded by the non-ratification of the contract they entered into with the Government in March, 1912. A long drawn out Parliamentary Committee followed and a hearing and world-wide publication were given to any witness who had something to say against the company and in favour of other systems and foreign interests; and notwithstanding their applications to be heard and the promises given to them that they should be given an opportunity to reply fully upon all matters before the committee closed, their managing director was never heard at all upon anything which related to the merits of the contract. And when a contract was eventually ratified, the construction of the Imperial stations had not progressed at the rate they had hoped and expected. They had every reason to believe that they should have been allowed to get to work on all the six stations simultaneously and had made all their preparations accordingly. They also expected to erect them with all speed possible, and contemplated that the whole might have been completed within 18 months of the ratification of the agreement which was what was contemplated in the contract. Besides being occasioned a great deal of additional expense, they were affected in other ways, not the least important of which was the non-receipt of their royalties and the effect the delay had upon their royalty period. These were matters which were receiving the most serious consideration of the board. He observed that the Postmaster-General had stated that some delay had been caused by reason of them suggesting an improvement. He could not admit that there was any reason whatsoever for delay on this account. Approval could and should have been given, in his opinion, within forty-eight hours. If the erection of the stations was delayed a few more years, there might be more improvements suggested, but they must not be told on that account that they were responsible for delay. He could not say more on this subject at the moment. He had referred already to the new Trans-Atlantic stations. They hoped to have these opened very soon now; the stations would have been completed ere this but for some imperfections in manufacture of material, which were being remedied. When this new means of direct communication with New York was established, they thought the true value of wireless telegraphy would be recognised, and so also the profits to be derived from it. Another important telegraph service about to be started was that between this country and Spain and the Canary Islands, which would of course also embrace a service to and from Spain and the Canary Islands and the United States of America and Canada. This service should make a material difference to the Spanish company in which they were largely interested. By reason of legal and other proceedings their managing director was prevented from visiting America and Canada as was his intention ever since the beginning of last year, and the progress of their companies in both countries had been hindered in consequence. It was responsible for the delay in the appointment of a manager in New York and for matters equally important as regards Canada. It was hoped that his visit might not have to be much longer deferred. They continued to maintain good relations with a number of foreign countries for whom they were engaged in carrying out important contracts and their works were kept well occupied. Early this year their 7777 patent expired in this country, but they owned nevertheless a number of very important patents, and to these they added very considerably during the last year. Some of these new patents might and they thought would prove to be of very great value indeed. Shareholders probably knew, but he wished to emphasize the fact, that at the present time whatever new patents the company became possessed of if they were his inventions or those of members of the staff, they did not cost the company anything at all beyond the expense of their research department and the cost of the fees for the patents themselves. One of the branches of their work which had made great progress during recent times was that of wireless telephony. He was enabled, with the valuable assistance afforded him by the Italian Government, to carry out some very important experiments and tests, which had assisted materially in their being now able to produce a practical standard set for wireless telephony over moderate distances. This was a first tangible step and should lead to further developments. He was now occupied in making the necessary arrangements to carry out tests between this country and America, from which he hoped to get some practical results before the end of the year. This was a new branch of their work which should be productive of a new and additional source of revenue, not only to the parent company but to all the subsidiaries, which, at present, had the advantage of all their inventions and work. He must now deal with a matter which affected them and the whole board—a matter too, which reflected more particularly upon the honour of their managing director. Unhappily, he was not at liberty without risking the charge that he was showing a want of respect to the Court, to speak with that freedom which he desired, and it was for that reason that he could only tell them in language which must necessarily be somewhat guarded about the action which Mr. Locker-Lampson, a Member of Parliament, and a Mr. P. E. Wright, had instituted against the board of this company and other persons. So far as the board other than the managing director were concerned the claim was of comparatively small importance. It depended upon what might fairly be regarded as technicalities which could have but comparatively small interest for

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them. But with regard to their managing director a very different charge was made. It was alleged against him that he had been a party to frauds upon the company with the object and result of putting large sums into his own pocket. Defences had been delivered and these, he need hardly tell them, contained a categorical denial of all the charges. He might add a word as to the interest in the company of the two gentlemen who were bringing this action and preferring these charges. Mr. Lampson at the commencement of the proceedings was the registered holder of two shares, one preference and one ordinary. A few weeks afterwards he tempted fortune by acquiring a further 20 shares, and was thus to-day the holder of 22 shares. Mr. Wright was the registered holder of one share only. He was not, as a matter of fact, registered in respect of this cherished possession until after the writ was issued. But seriously, the fact remained that these two gentlemen had a combined interest of 23 shares in the capital of this great company which as they knew was a million and a half sterling. Possibly they were merely stalking horses for gentlemen with larger interests but less courage—gentlemen who for reasons at which they might guess, preferring discretion to valour, remained in obscurity. He was told that Mr. Locker Lampson and Mr. Wright had been and were industriously busying themselves in an endeavour to obtain the support of other shareholders. To what extent, if at all, their efforts had been successful, was a point upon which he desired complete enlightenment, and his method of obtaining it was by retiring from the board and offering himself for re-election. The managing director would do the same. It was not his turn to retire, and as for the managing director he had waived his privileges for he was never under an obligation to retire. He ought to mention that the Plaintiffs, through their Counsel, had openly declared in the Courts that expense in this action was not a matter of any consequence. The board entirely dissented from this view. But what more seriously concerned the board and the shareholders was the inevitable dislocation and interruption of the steady work of the company which must result when its officers were compelled to employ so considerable a part of their time and energies in resisting legal proceedings. The damage to their interests by the continuance of the proceedings by no means rested there, for the seeds of suspicion which had been sown bore fruit not only in this country but throughout the civilised globe. An opportunity was thus afforded to those who were antagonistic to the company of damaging its reputation and prestige with its chief customers —the various governments of the world. It would be within the recollection of many of them that when the managing director came to the company its affairs were far from satisfactory and its chances of reaching a dividend-paying stage seemed remote. It was, he hoped, hardly necessary for him to remind them of the great results which the managing director had achieved for them—it was his loyal devotion which they must thank for the commercial prosperity of the company and its great industrial position in the wireless world. Mainly upon his shoulders had fallen the great and complicated problems which almost daily presented themselves in a new industry. Scarcely a year ago they acknowledged his services in a worthy and generous spirit and he could not think their feelings towards him had altered. They should not permit themselves to be influenced by statements in the Press or by those whose interests were not the shareholders' interests. They might rest assured that all charges would be investigated by the Courts at the earliest moment possible—the fullest enquiry was courted and in the meantime he recommended them in their own interest to remain staunch to those who had guided the fortunes of the company through manifold difficulties. At this time domestic dissension was dangerous—undisguised enmity was displayed in more than one quarter and a united front was essential if the company was to enjoy that prosperity for which so stern a struggle has been fought. He was also reminded that it was due to their managing director that wireless telegraphy had become an important British industry, a matter which might be vital to the whole nation. It would otherwise have been entirely in foreign hands. He brought this position about by the aid of foreign capital at a time when no money could be found for the purpose in this country. It was he who was responsible for the great Imperial scheme of placing all the Dominions across the seas into wireless communication with each other, and it was due to him that a British company was able to carry out this work and that this country would possess the biggest and most powerful wireless stations in the world. Their great value might one day be put to a great practical and critical test; then perhaps there would be a true appreciation of the greatness of the work. Not only had their managing director turned their own work to account but he obtained the control for this British industry, of an important foreign invention and by so doing, he had given it in the face of contrary opinion, the opportunity of practical development, which it otherwise had very little prospect of receiving. And, finally, allow him to say a few words about himself—an invidious enough task since it compelled him to refer to his own services to the company. He could not refrain from telling them how bitterly he had felt the association of his name with those political quarrels with which they were all familiar and to all of which he was fortunately a stranger. Many times had he been tempted to return to Italy where the pleasures of his native land awaited him, and where he could continue his scientific pursuits under ideal conditions and with the enthusiastic co-operation of the authorities, whether scientific, civil or military, and with the full and unstinted appreciation of his countrymen, independent of any party politics or political opinions. He had always had large interests in Italy derived from sources wholly unconnected at any time with this company, and if he were only to consider his personal interests he should return permanently to his country tomorrow and he could assure them that it would be to his advantage in every way to do so. He would return immediately were it not for a sense of duty and loyalty to his colleagues on the board and the wholehearted and sympathetic support which he had hitherto received from them all, and which he expected they would extend to him and to the managing director that day.

Mr. Godfrey Isaacs (managing director), in seconding the motion, said he did not wish to refer too much to the time and work and energy which he had given to the company's affairs since he joined it. The Chairman had told them something of the position in which he found the company when he came to it, and he had done his utmost independently of his own interests in furthering the interests of the company. When he joined the board the shares of the company were practically unsaleable at the price of 10/- or 14/-, and no dividend had been paid upon them. With the development of the company's business the shares rose materially in value and not unnaturally the holders of the shares took advantage of the high price and sold them. Consequently he was in the somewhat unfortunate position of being before a large body of shareholders who had bought their shares at a high price. With regard to the action pending against the company the Chairman had referred to him in terms loyal and appreciative, for which he was deeply sensitive. He had decided that in view of the extraordinary false rumours which were constantly circulating and the poisoned atmosphere with which he had been recently surrounded, it would be impossible for him to continue unless he had the complete confidence of the shareholders. For that reason he waived all his privileges as managing director, and he left it to them to say whether it was their wish or not that he should continue to direct their affairs.

Mr. R. Corry expressed the opinion that it would be a good thing if something could be done to restore the credit of the company.

Mr. S. Cole said that in consequence of the lack of candour on the part of the board he proposed as an amendment that the report and accounts be adjourned and a proper detailed balance sheet and profit and loss account be submitted to the shareholders. He asked how much of the profit for 1912 was applicable to dealing in shares and company promoting and how much was made in 1913. The speaker who was very imperfectly heard, asked for information of the company's holding in the French company, and further called attention to the fees paid to the directors who acted as directors of the subsidiary companies. He asked what profits the directors had made on the dealings of the company and its subsidiary companies since 1910. His criticism, he said, was directed not against the company but against its management.

Mr. G. Isaacs suggested that each speaker should give the amount of his holding. He found that Mr. Cole registered 5 bearer shares on Saturday.

Mr. J. Webb, who said he held 500 shares, remarked that he had come to criticise, but after the candid statements of the chairman and the managing director, he thought they would be very foolish people if they found fault with the directors. He believed they had a wonderful property and if they stuck to their chairman and directors they would carry them through. He heartily believed that Mr. Marconi was a genuine man.

Mr. H. Bright asked the managing director to deal with their criticism and not with their notions. He had not a word to say against the chairman, but they had to look at facts, and one fact was that there was a cloud of litigation at the present moment which one of their directors appeared to attract to his person like a magnet. The speaker proceeded to criticise what he termed "the obscurity of the balance sheet," and said he had never seen an auditor's certificate in which the auditors had taken greater trouble to protect themselves from future litigation. Why had they not seen the certificates of the shares owned by the company? Mr. Bright next touched on the American Marconi Co., and asked if a subscription of 5/- per share on 119,000 shares was not due from the English Co. to the American Co., and when was the sum going to be paid? The speaker proceeded to deal with the inflation of the shares of the English Co. in 1912, and said it was a common denominator in most of Mr. Isaacs's companies that they should have a sudden inflation of shares followed almost immediately by a sudden decline.

Mr. Isaacs: That matter was dealt with at the Central Criminal Court and has been settled with once and for all.

Mr. Bright returned to the same subject but the Chairman said he could not allow it. The shareholders must keep to the Marconi Co.

Mr. Bright said what they wanted was steady evolution and sober progress. Shareholders felt a great deal of favouritism had been shown in the company from time to time. If they got shares pushed up to inflated prices that was nice for the stock jobber and those in the know——

The Chairman again called the speaker to order and asked him to confine himself to the business of the company.

Mr. Bright again made reference to favouritism shown, by

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which people who were "in the know" came also to deal in shares. In conclusion, he asked that the shareholders should be taken fully into the confidence of the board, and that the managing director should make every statement as candid as he could.

Mr. ARNOLD STATHAM said he had listened to the last speaker with the utmost indignation. What facts or evidence had been given and what right had he to assume that the shareholders suspected their own board? He claimed that the shareholders cherished no doubt of the integrity of Mr. Isaacs, and that the charges at the meeting were part of a conspiracy to bolster up actions which were pending. He was a strong Conservative and had fought an election, but he was absolutely ashamed of his party making political capital out of personalities. He appealed to the Chairman not to be unduly sensitive as none doubted his capacity and integrity.

Mr. VERDY pointed out that if they believed in the chairman they must believe in the managing director who was brought in by the chairman.

Mr. TARRINGTON, an Irish shareholder, addressed the meeting in a most excited manner and said the shareholders cast no reflection on Mr. Marconi, but the best man in the world fell amongst thieves. He represented the body of men who had lost. Would Mr. Isaacs tell them what he had made? (Cries of "Sit down.") He was an Irishman and would not sit down. (Laughter.) He had no hesitation in saying that Mr. Isaacs was a scoundrel. (Uproar and cries of "Sit down.") He was not going to sit down for the bullying of a lot of Saxons.

The CHAIRMAN said he could not allow that spirit to be introduced. He was part of an Irishman himself.

Mr. TARRINGTON proceeded to deal with the issue of the Marconi shares due, he said, to a misleading circular of the managing director; and then made a violent attach on the Lord Chief Justice.

The CHAIRMAN: If you proceed in that way, I shall exercise the powers of the chairman and have you removed.

Several other shareholders having spoken,

The CHAIRMAN said that most of the remarks and criticisms were concerned with the managing director personally. The managing director had much more knowledge of the business side of the company than he had, and he would ask him to reply. At the same time he could not but repeat what he had already said as to his appreciation of the honesty and straightforwardness of Mr. Isaacs. What he had heard there had not changed his opinion as to Mr. Isaacs' integrity.

Mr. GODFREY ISAACS said he did not understand that any specific charge had been made. The only thing was that Mr. Tarrington had called him a scoundrel. He could not disprove that, but he must leave it to the meeting to judge. He had also asked how much money the managing director had made by buying and selling shares. When he joined the company, having confidence in it, he did not hesitate to buy as many shares at the time as he could afford, and he bought them with the intention of holding them so long as he was associated with the company. He saw them go up to £9 15s.—a fact which he deplored—but he did not sell one of those shares, and he would have held the whole of the shares that day had it not been made clear to him by what was taking place that he was laying himself open to a series of sinister suggestions by being largely interested in the company. Therefore, when in the autumn of 1912 the market fell, he determined not to have a large holding in the company, and he sold some of his shares at a price of about £4, and he had never bought or sold a share in that company or any other from that day to this. Therefore whatever profit he had made he had made perfectly legitimately, and merely because the business developed as the result of work put into it. As regarded company promotions, they had made no money out of company promotions whatever. All those things were merely the class of rumour put about to damage the company by certain individuals who desired to damage it, and they were passed from one to another and very soon assumed an importance, although there was not an atom of foundation behind them. It was true that in the balance sheet of the American Company it was stated that they had £119,000 shares. Although that was perfectly correct it was not quite a representation of the facts, because they had a large amount to their credit with the company and the two accounts had not been squared. If they had have been squared that item of 119,000 shares would not have appeared to their debit. Whatever circular he issued from the Marconi Company was issued with the full concurrence of the whole board, and the circular to which reference had been made expressed exactly what they believed to be true, and they held the opinion that day that there was nothing in the circular in any sense misleading. Mr. Isaacs then referred to the negotiations with regard to the Chinese contracts, and said that unfortunately by some means or other which they had not been able to fathom, a good deal of information got into the Press, and when he was asked he was obliged to inform the Press that the contracts had been sent forward to Pekin and might be signed at any moment. Since then, unfortunately, his and other statements had been copied into Pekin newspapers, with the result that the company had issued a full statement to the Press which no doubt they had all seen. In conclusion, Mr. Isaacs said there was no person whom he had done business with in the last 35 years who would echo one of the sinister suggestions an innuendoes against him that they had heard that day.

Mr. PEARS (of the firm of auditors) said the form of the certificate was the same as in previous years. The certificate, in his opinion, gave the information that shareholders should know. They could not see the certificates of shares which were in foreign countries, but they were fully satisfied that the shares were held for the company.

The motion for the adoption of the report was carried unanimously.

Mr. ARNOLD STATHAM proposed the re-election of the Chairman as a director, and this was carried with acclamation.

Mr. CORNWELL (Cork) proposed the re-election of Mr. Isaacs to the board, and this was carried with one dissentient.

An extraordinary meeting was afterwards held, at which a resolution was passed altering the Articles of Association so as to give the Board power to establish and support a fund for the benefit of employees of the company.

Underground Electric Railways Co. of London, Ltd.

ON Tuesday a petition by this company was heard by Mr. Justice Joyce, in the Chancery Division. Mr. Younger, K.C., for the company, said the object of the petitioners was very definite. Their object in abandoning powers was that they might become a trust company carrying on no constructive policy and no business operations, but merely holding large blocks of stock and paying dividends without reference to the actual value of the stock. It might possibly be shown that by converting themselves into a trust company they would be able in the future to distribute as dividends moneys that would not otherwise be distributable. But the creditors and debenture-holders were mainly interested in that, and there was no opposition. Apart from this question, however, the figures in the case were very large, and the directors did not want to have any serious responsibility where they felt there was any doubt. The position would, however, be regularised if the resolutions in question were confirmed.

His LORDSHIP: I don't see what harm I can do.

The resolutions were accordingly confirmed.

Prospectuses.—*S. Smith & Sons (Motor Accessories), Ltd.*—**The list is to close to-day (Friday), in an issue at par of 50,000 ordinary shares of £1 each in this company, which was formed for the purpose of acquiring as a going concern as from March last, that part of the business of S. Smith & Son, Ltd., concerned with speedometers, carburettors, dynamos, self-starters and other motor accessories. The chief object in the formation of the company is to provide additional working capital to meet the demands of the business, and to provide funds for the production on a large scale of Smith's self-starters, which will shortly be placed on the market. A statement of past profits is given in the prospectus, and the directors estimate those of the future as being sufficient to pay not less than 10 per cent. dividend from the inception of the company.**

Paris North-South Railway.—The Nord-Sud Underground Electric Railway, which had an average length of 8·75 miles in operation in 1913, reports gross receipts amounting to £400,000, as compared with £348,000 in 1912. After defraying general expenses, interest on loans and other charges, the net profits are returned at £78,000, as compared with £80,000 in the preceding year. It is proposed to pay a dividend of 5s. per £10 share on the capital of £3,000,000, being the same rate as in 1912.

Liverpool Overhead Railway Co.—The directors have declared interim dividends at the rate of 5 per cent. per annum on the preference shares, and 2½ per cent. per annum on the ordinary shares (for the half-year), against 2½ per cent. per annum for the corresponding period last year.

London and Suburban Traction Co., Ltd.—The directors have declared an interim dividend on the ordinary shares at the rate of 1 per cent. per annum for the six months to June 30th, and also the dividend on the 5 per cent. cumulative preference shares for the same period.

Stock Exchange Notices.—The Stock Exchange Committee has been asked to allow the following to be quoted in the Official List:—

Compania de Electricidad de la Provincia de Buenos Ayres, Ltd.—£900,000 5 per cent. first mortgage gold bonds of £20 each, Nos. 1 to 45,000 (renewed application).

County of London Electric Supply Co., Ltd.—Further issue of 6,000 ordinary shares of £10 each, fully paid, and 10,000 6 per cent. cumulative preference shares of £10 each, fully paid.

Central London Railway Co.—Interim dividend at the rate of 3 per cent. per annum on the undivided ordinary stock for the past half-year, and on the preferred ordinary stock 4 per cent. per annum.

City and South London Railway Co.—Interim dividend for the past half-year at full rate of 5 per cent. per annum on the preferred stocks of 1891, 1896, 1901, and 1903.

Kaministiquia Power Co.—A dividend at the rate of 6 per cent. per annum on the common shares for the quarter ending July 31st is announced.

Bournemouth and Poole Electricity Supply Co., Ltd.—Interim dividend on the ordinary shares at the rate of 5 per cent. per annum for the half-year to June 30th last.

St. James' and Pall Mall Electric Light Co., Ltd.—Interim dividend for the half-year ended June 30th, 1914, at the rate of 10 per cent. per annum on the ordinary shares.

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The British Electric Traction Co., Ltd.

THE new capital will be as under if effect be given to the proposals contained in Mr. E. GARCKE'S recent circular to the stockholders :—

There are to be two classes of stock only, viz. :—

(*a*) 6 per cent. cumulative preference stock entitled to priority in a distribution of capital; but not to any further share in profits in capital.

(*b*) Ordinary stock entitled to all surplus profits and capital.

The 6 per cent. cumulative preference stock will be made up as follows :—

As now existing as per table given below ...	£403,592 10 0
Add amount of the present 7 per cent. non-cumulative preference stock to be converted into 6 per cent. cumulative preference stock	269,061 13 4
Total ...	£672,654 3 4

The new ordinary stock will be composed as under :—

Amount of existing 7 per cent. non-cumulative preference stock to be converted into ordinary stock	£538,123 6 8
Amount of existing preferred ordinary non-cumulative stock to be converted into ordinary stock	535,048 15 0
Amount of existing deferred ordinary stock to be converted into ordinary stock ...	199,951 10 0
Amount of existing income certificates ...	93,230 0 0
Total	£1,366,353 11 8

The authorised capital will consist of :—
£1,000,000 6 per cent. preference stock.
£2,000,000 ordinary stock.

Summarised, the new capital will therefore be :—

6 per cent. cumulative preference stock ...	£672,654 3 4
Ordinary stock	1,366,353 11 8
Total ...	£2,039,007 15 0

Note. The amount of existing stock and income certificates	£3,213,751 1 0
The new capital will be	2,039,007 15 0
Leaving amount which will be lost or surrendered by stockholders and income certificate holders as shown in the following table	£1,174,743 6 0

Class.	Present Capital. Description.	Amount. £	Changes proposed in scheme.		Amount which will be lost or surrendered by stockholders and income certificate holders under the scheme.
1.	6 per cent. cumulative preference stock ...	403,592 10 0			
2.	7 per cent. *non*-cumulative preference stock	807,185 0 0	p.c. 33⅓ of this class to be converted into class 1 = £ 269,061 13 4 66⅔ of this class to be converted into new ordinary stock ... ... = 538,123 6 8 100 807,185 0 0		
3.	6 per cent. preferred ordinary non-cumulative stock ...	1,070,097 10 0	£ To be reduced by 50 per cent. ... ... = 535,048 15 0 Remaining 50 per cent. to be converted into new ordinary stock ... ... = 535,048 15 0 1,070,097 10 0		£535,048 15 0
4.	Deferred ordinary stock	666,505 0 0	£ To be reduced by 70 per cent. ... ... = 466,553 10 0 Remaining 30 per cent. to be converted into new ordinary stock ... ... = 199,951 10 0 666,505 0 0		£466,553 10 0
	Total ...	£2,947,380 0 0			
	Add non-interest bearing income certificates redeemable out of profits only	£266,371 1 0	£ To be reduced by 65 per cent. ... ... = 173,141 1 0 Remaining 35 per cent. to be converted into new ordinary stock ... ... = 266,371 1 0 266,371 1 0		£173,141 1 0
	Total capital and income certificates	£3,213,751 1 0	*of which will be lost or surrendered*		£1,174,743 6 0

Nairobi Electric Power and Lighting Co., Ltd.

THE annual meeting was held at the offices, 50, Mark Lane, E.C., on July 8th.

GENERAL SIR STANLEY EDWARDES, K.C.B., presided, and in moving the adoption of the report (ELEC. REV., p. 957, Vol. 74) said they had increased the expenditure on works by £1,345. Stocks on hand and in transit showed an increase of £757. Sundry debtors appeared as £3,992, a considerable increase of £1,763 over the figures of the previous year. The amount of outstanding debts at Nairobi was unusually large, due to special temporary circumstances. The issued share capital remained the same, while the issued debentures had increased from £16,700 to £19,000. The remainder of the ordinary shares were now in course of being issued. Sundry creditors at London included the item of £3,600 for arrears of cumulative preference dividends, all of which had since been paid off. Reserve account appeared for the first time in the balance sheet and consisted of £855 realised by the sale of property, and £1,145 appropriated from revenue account. As they were aware, the satisfactory results of last year's working had made it possible to clear off all arrears of dividend and they carried forward £414. Passing on to the revenue account, their principal source of income, the sale of current, had yielded an increase of £1,712. The installations and other work carried out by their contract department also showed an exceptional increase, which they did not anticipate being continued that year. Many of the items of expenditure showed considerable decreases, as was forecasted at their last annual meeting. The principal increases were in salaries and wages, due to an increased staff in their contract department; in legal expenses, due to the issue of new debentures replacing the original issue; and debenture interest, due to the increased issue. The London office expenses at £207 and directors' fees at £44 both showed material decreases. The net profit for the year, after payment of all charges and debenture interest, amounted to £4,984 against £2,643. Having cleared off their liability to the preference shareholders they started the year 1914 with a clean sheet before them. A year ago they hoped that if they had a very favourable year, that result might be attained. They had had such a year, and he was sure the shareholders would consider the accounts now presented to be very satisfactory. As mentioned in the report of the directors, the protracted negotiations with the Government had been concluded satisfactorily. The letters which had passed and which embodied the alterations, were in course of drafting into a new agreement by the colonial authorities. The company had made an exchange with the Government of the various small falls on sundry rivers granted by their original concession for the important falls situate on Thirka River, commencing some 10 miles below the Fort Hall Road, which were capable of being developed to the extent of a minimum of about 6,600 H.P. The company's concession was extended to 50 years, with the proviso that it continued thereafter by periods of five years until bought out by the Government or municipality at a market valuation of the plant and other assets of the undertaking. The Secretary of State for the Colonies had agreed to the alteration of the Customs Ordinance of the Protectorate so as to admit free of duty all necessary plant for the generation and distribution of electric current, which would be a material benefit to the company. Unfortunately, on account of the very protracted nature of those negotiations, it had been impossible for the company to cope with the increased demand for current in a way that it would have liked to meet the needs of the case. Immediately the details were agreed upon by the company and the local Government, and approved by the Secretary of State for the Colonies, steps were taken to deal with the situation, and a steam engine suitable for driving the spare generator at the present power station had been ordered, and was expected to be shipped at the end of this month. It was anticipated that this would deal with the increase of load until the new water power plant for the falls on the Thirka River was installed. It was proposed to utilise these new falls without delay by embarking on a scheme which would give a minimum of 2,000 H.P. in the driest season; and it was hoped, with the financial arrangements that the directors had in view, to commence by laying down a new plant of a capacity of 750 KW., and then to remove the present plant of 360 KW. to the new station. The increases due to the rapid

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strides in the demand for current would probably necessitate an increase of the share capital, and the directors anticipated that their proposals on this matter would be submitted to the shareholders at an early date. The contingent liability mentioned in the previous year's balance sheet, being the cumulative preference dividends at 6 per cent. per annum, had been paid off by the declaration of interim dividends, as soon as the accounts for 1913 showed the same to be justified, and the directors anticipated commencing to declare regular half-yearly interim dividends on both classes of shares as soon as possible after the results for the respective half-years came to hand. The original ordinary shareholders had now waited seven years without any dividend, but developing their business, and the directors were very pleased that the time had come when they would begin to get the just reward of their patience and enterprise.

Mr. A. W. Mayo-Robson, C.V.O., seconded the resolution, which was carried.

County of Dorset Electric Supply Co., Ltd.

Dr. J. A. Hosker presided on June 15th at the first ordinary general meeting, held at Moorgate Court, E.C. He said that no substantial revenue was included in the report to December, 1913, because the Dorchester undertaking had then only been running two months and Blandford three weeks, while Swanage supply was not commenced. The progress down to date showed the number of consumers in their four towns as follows:—Lyme Regis, 120; Dorchester, 57; Swanage, 50; Blandford, 29. The aggregate of the whole of the towns was the equivalent of 6,411 thirty watt lamps; thus very satisfactory progress was being made. At Blandford the Council had asked them to submit a scheme for lighting the Corn Exchange. The initial cost of wiring had an intimate bearing upon their progress, and they hoped soon to complete arrangements for free wiring on a quarterly rental basis. It would mean considerable outlay, and it might be policy to do it independently through an electrical contractor. New plant had been installed at the three stations under the supervision of Dr. Purves, the consulting engineer. The Lyme Regis undertaking had now been working for four years, and its first year under the County of Dorset Company had been its best, giving the County Company 10 per cent. upon its investment. Swanage ought to exceed what Lyme Regis could do. A scheme for Wimborne and Broadstone was under consideration, and Sherborne and other towns would follow later. The company would need at least another £15,000 capital for these schemes, and would raise it by an issue of ordinary and preference shares. The contractors (Messrs. Callender's Co. and Messrs. Crompton and Co.), and the engineers and staff, were thanked for the manner in which they had carried out their work.

Chili Telephone Co., Ltd.

The annual meeting was held on July 15th at 42, Old Broad Street, E.C., Mr. George Keith presiding.

In proposing the adoption of the report (Elec Rev., p. 64) the Chairman, after alluding with regret to the death of Mr. F. W. Jones, one of the original directors, and the retirement from the board through ill-health of the Hon. Herbert T. Allsopp, said he was pleased to report that the business of the company had made good progress during the year, although the increase did not come out so large as it did for the preceding year. The general state of trade in Chili was adversely affected in the northern districts by the price of nitrate, and in the central and southern districts by failure of the crops and an outbreak of disease among the cattle. There was also a serious shortage of money, and trade generally was very restricted. Notwithstanding those adverse circumstances there was an increase of about 11 per cent. in the revenue of the company. The working expenses had also, unfortunately, increased in a larger proportion, and they amounted to 51 per cent. of the revenue, or 2 per cent. more than last year. That increase in working expenses was principally due to higher salaries and wages due to the rise in the cost of living in Chili. The average rate of exchange for the year was about 9⅛d., or ⅛d. less than in the previous year; so that the increase in net revenue had been more than required to compensate for the low value of the currency. The income of the business in Chili when converted into sterling showed a small decrease of £169, the total amounting to £62,497. The total expenditure had increased by £576. The result of the year's business was a credit balance of £57,244, of which £15,683 was expended in Chili on replacement and renewals to plant and had been charged direct to revenue. An interim dividend of 3 per cent. was paid last January, and, after placing £15,106 to the reserve, the directors recommended a final dividend of 5 per cent., carrying forward £3,956, as compared with £3,901 brought forward. The capital expenditure account had increased by £16,724 expended in Chili during the year in increasing and extending the property. Everything considered, he thought they might be satisfied with the result of the year's business. Chili continued to suffer from the fluctuations of the value of its paper currency. In January last the exchange fell below 9d., and now stood at 9⅜d. A proposal was before Congress for fixing the value of the Chilian paper dollar at 10d., and if that became law and could be successfully carried out it would be of immense advantage to the commercial and economic interests of the country. The business of the company continued to progress favourably; the property and plant was kept up to a high standard, and every attention was being given to provide the authorities and the public with an efficient and satisfactory service.

Mr. E. B. Butler-Henderson seconded the motion.

Replying to a shareholder, the Chairman said the reason of their revenue not having increased last year was solely on account of the fall in the value of the dollar. As he had said, at one time it fell below 9d., and it came out on the average ⅛d. less than in the previous year. What it really meant was that their customers had got the benefit of the progress made last year owing to the fall in exchange.

The report was adopted.

Continental.—Belgium.—The balance-sheet of the Société Belge pour l'Eclairage Public par l'Electricité (système Tudor), of Brussels, for the last financial year, shows a profit of £1,381.

Germany.—The Brown, Boveri Co., of Baden, is declaring a dividend of 9 per cent. for the last financial year, as compared with only 8 per cent. for the preceding 12 months.

France.—Among the new electrical companies recently formed in France are the Société de l'Electricité de Wambaix, formed to establish a small central electric lighting station at Wambaix (Nord), and the Société le Nord Triphasé, organised at Valenciennes, with a capital of £13,000.

The balance-sheet of the Société des Accumulateurs Tudor, of Paris, for the last financial year shows a net profit of £20,700.

Brazilian Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent. on the issued ordinary capital stock. A circular was issued to the shareholders last week stating that there was not the least foundation for the various rumours, or any ground for uneasiness, with reference to the company's affairs. "The operation of the company's business is very satisfactory. The earnings are steadily increasing, and the outlook and prospects in all departments are good." Lengthy statements have been circulated both by the Brazilian company and by Messrs. Guinle & Co. concerning the competition that the latter will offer next year through their Companhia Brazileira de Energia Electrica, in Rio de Janeiro.

W. & T. Avery, Ltd.—The directors announce for the half-year ended March a dividend at the rate of 15 per cent. per annum, making, with the interim dividend, 15 per cent. per annum, placing £11,500 to reserve, and carrying forward £9,997.

Companies Struck Off the Register.—The following companies have been struck off the Register, and are accordingly dissolved:—

Aluminium Syndicate.
Bombay Hydro-Electric Syndicate.
Pearson Fire Alarm.
Titan Vacuum Cleaner Syndicate.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers, during the four weeks ended April 24th, 1914, amounted to 1,260,697, compared with 1,204,906 units in the corresponding four weeks of 1913. The figures for five weeks ended May 29th, are 1,645,309 this year, compared with 1,478,251 in 1913.

Metropolitan District Railway Co.—For past half-year an interim dividend at rate of 3 per cent. per annum on the second preference stock is announced.

Betulander Telephone Co.—The *Financial Times*, after referring to the Betulander automatic telephone system, says: "In all probability a public issue of shares will be made in the near future."

Aluminium Corporation, Ltd.—The resolutions passed at a previous meeting were confirmed at an extraordinary meeting held on 16th inst.

London Electric Railway Co.—Interim dividend for the half year ended June 30th at rate of 1 per cent. per annum on ordinary shares.

Montreal Light, Heat and Power Co.—A dividend of 2½ per cent. for the quarter ending July 31st is announced.

STOCKS AND SHARES.

Tuesday Evening.

Politics persist in oppressing prices. There seems to be no disentangling of the one from the other, but this week the influence has so far been beneficent, and hopes took Consols with them as they ran high, that peace might spring from the Buckingham Palace Conference. There are better prices in the markets connected with Mexican matters. Marconis have been wildly fluctuating. Stock Exchange humourists invented a little joke to the effect that Tuesday's Conference was adjourned at noon in order to allow a certain prominent Minister to attend the Marconi meeting held on that day, and the jest enlivened depression caused by rumours of war between Austria and Servia. It is the Mexican issues that make the best showing in our lists. The resignation of General Huerta, although suspiciously sudden, fanned the smouldering impression that the civil war, rebellion, or whatever the con-

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fusion may be called, approaches its conclusion. As it has been pointed out frequently before, the amount of physical damage inflicted upon private property appears to be surprisingly small, and the market in Mexican Utility issues displays rises ranging from one to six points. The principal gain Mexican Light and Power bonds secured. Prices were re-adjusted to the cheerfuller conditions with comparatively little stock changing hands. We don't want to be doleful, but disappointing news would certainly put down quotations again.

Shawinigan Water capital stock recovered 1½, and Montreal Light and Power reacted 3 after its rise of twice as much. The Canadian companies continue steady payment of their usual dividends, thus counteracting to some extent the nervousness that still surrounds many Canadian investments. It is universally acknowledged that the Dominion depends more than ever, this year, upon a bumper harvest in order to provide the ready money Canada badly needs even yet. Happily, indications point to the crop being a bountiful one, so far as may be gleaned from information supplied by the people most interested.

Battles royal are being fought out over Brazilian Traction shares. Financial difficulties in Berlin, Brussels and Paris combined to force down the price to 71½ the other day. Within a short time it had rallied to 77, and stands, as we write, at 75. The company's emphatic denials of vague market reports, and the assertion that all was going well, formed the motive-power for the recovery. On the other hand, it is considered practically certhat the company will encounter competition in Rio de Janeiro, as soon as its present profitable concession expires. The return at the present rate of dividend is about 8 per cent., and the inter-Bourse character of the shares renders them one of the liveliest spots in the Stock Exchange.

It is humdrum work to write about English Electricity Supply shares after mentioning the volatile Brazilian Tractions. The market is very firm, however, and there are half-a-dozen issues ⅛ to ¼ better. Two or three Debentures are rather harder. The curious will observe with interest that the Gas Light and Coke Company has declared a final dividend for the past year of £4 17s. 4d. per cent., carrying forward £535,400. The dividend is unchanged, and the carry forward about £80,000 less than at the corresponding period in 1913.

Dog days are hardly conducive to financial work—or to any other except journalism—but some kind of announcement is quite on the cards before long in connection with the delayed plans for London's Electricity Super-Company.

The electric railways came first into the dividend field in respect of the June half-year. The Metropolitan District announces 3 per cent. on its Second Preference stock, which is an improvement of ½ per cent., and better than the market authorities expected. This stock is all held privately at present, and save for a rise of ¼ in District Ordinary, the declaration has not affected prices. London Electric Railways is paying 1 per cent. on the Ordinary shares, repeating last year's performance, and Underground Electric £10 shares have hardened a shade. City and South London Preferences are to receive their full 5 per cent., but nothing is declared on the Ordinary stock, which got ½ per cent. 12 months ago. The Central London's 3 per cent. is the same as before.

Railway affairs are more unsettled even than usual, because the Conciliation Board agreements expire in October, and it is plain enough that the men mean to make a bold bid for substantial rises as the price of their consent to renewal of the arrangements. Indeed, threats are already in the air of National Strike. So quotations move down a little, or up a little less, more in sympathy with the conditions affecting Consols than from any public interest, this being well-nigh at a standstill in view of labour eventualities.

London and Suburban Tractions gained further small fractions upon the dividend announced of 1 per cent. on the Ordinary. London United Tramways Debenture stock has receded a point, the opinion being frequently heard that tramways nowadays stand little chance against the all-triumphant motor-omnibuses. In the Stock Exchange it is stated that the British Electric Traction Company is carrying the war into the enemy's camp and establishing remunerative motor-bus routes of its own. Meantime, discussion proceeds with heat around the company's preliminary proposals for capital reorganisation, and the crux of the argument concerns the suggestions advanced in respect of the 7 per cent. non-cumulative Preference stock—a very Tyrone in the present situation.

Marconis advanced to 2½ on bear repurchases, the Ordinary and Preference recovering about a half of the previous week's fall. After the meeting, however, the Ordinary dropped back to 2. Market men contend that only by financial miracle can the 20 per cent. dividend be maintained, and that the current price is still too high, in the light of the report. It deserves to be noted that the Preference shares carry a cumulative 7 per cent. Preference dividend, and that they divide profits with the Ordinary after the latter have received 10 per cent. An exchange from Ordinary into Preference is therefore considered by some to be a sound proposition, as to which, however, it may be remarked that both classes move together, as a rule, so that if the Ordinary come down, the Preference will probably bear them company. The meeting proved less acrimonious than was expected; it lasted nearly two hours, and the retiring directors were duly re-elected. Canadians at 5s. 9d. and Americans at 11s. keep fairly steady.

Cable issues remain amongst the firmest in the Stock Exchange. Eastern Extensions are ¼ higher: so are Globe Preference. British Insulated added 5s. to their big rise of the previous week. Anglo-American Preferred is up ½, while New York Telephone bonds improved similarly, West India and Panama Ordinary hardened to 27s. 6d., and the market, as a whole, exhibits pronounced strength. Manufacturing shares are steady as a whole, though Electric Constructions drooped to ⅛, and Willans Preference is down by a point. Edison & Swan "A" shares changed hands at 1s. 3d. last Monday. The Rubber share market is quiescent, and this week's auction sales at Mincing Lane failed to quicken interest in prices.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, July 22nd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	2¾d.	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29	..
a Bleaching powder	,,	£6 5	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£17 10	..
a Copper Sulphate	,,	£20 10	10/- dec.
a Lead, Nitrate	,,	£28 10	..
a ,, White Sugar	,,	£27 10	..
a ,, Peroxide	,,	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£23 10	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Perchlorate	,,	8½d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	,,	7½d.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	,,	£8 10	..
a ,, Recovered	,,	£6 10	..
a ,, Lump	,,	£5 5	..
a Soda, Caustic (white 70/72 %) ..	,,	£10	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£96	..
b ,, Wire, in ton lots (1 to 14 S.W.G.)	,,	£107 6 8	..
b ,, Sheet, in ton lots ..	,,	£112	..
g Babbitt's metal ingots	,,	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c ,, Tube (brazed)	,,	9½d.	..
c ,, ,, (solid drawn) ..	,,	7½d.	..
c ,, Wire, basis	,,	7½d.	..
c Copper Tubes (brazed)	,,	9½d.	..
c ,, ,, (solid drawn) ..	,,	9½d.	..
g ,, Bars (best selected) ..	per ton	£77	£1 dec.
g ,, Sheet	,,	£77	£1 dec.
g ,, Rod	,,	£77	£1 dec.
d ,, (Electrolytic) Bars ..	,,	£68 10	10/- dec.
d ,, ,, Sheets ..	,,	£83	10/- dec.
d ,, ,, Rods ..	,,	£69 10	10/- dec.
d ,, ,, H.C. Wire	per lb.	8 7/16d.	1/16d. dec.
f Ebonite Rod	,,	4/6	..
f ,, Sheet	,,	4/-	..
g German Silver Wire	,,	1/6	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	2/11½	1½d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	51/4	¼d. inc.
i ,, Wire, galv. No. 8, P.O. qual,	,,	£14	..
g Lead, English Pig	,,	£19 12 6	2/6 dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£6 15	..
e Mica (in original cases) small ..	per lb.	4 l. to 2/6	dec.
e ,, ,, ,, medium	,,	8/- to 5/-	dec.
e ,, ,, ,, large ..	,,	6/6 to 10/6 & up.	dec.
o Nickel, sheet, wire, &c.	,,	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	,,	1/1 to 1/8½	..
p ,, ,, rolled bars & rods	,,	1/0½ to 1/3	..
p ,, ,, rolled strip & sheet	,,	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	£66	..
g Tin, Block (English)	,,	£145 10 to £146 10	£1 dec.
n ,, Wire, Nos. 1 to 16	per lb.	2/8	..
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh's (Vieille Montagne bnd.)	,,	£25 2 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Japan.—The Keihin Electric Tramway Co., of Tokio, reports a net profit, including the amount brought forward, of £17,259 for the six months ending with March 31st last. Of this sum, £1,600 is being placed to reserve, and £800 accorded to the directors and auditors; the shareholders are receiving a dividend at the rate of 6 per cent. per annum, which absorbs £12,240, leaving £2,619 to be carried forward.

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SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 21st.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	—	..	Nil
Do. 5 % Pref.	1	5	5	— xd	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	17 — 19	..	..
Do. Do. Deferred	100	..	..	10 — 12	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	85 — 89	..	6 11 2
Do. 7 % Non-Cum. Pr'f.	100	3	3½	54 — 57 xd	..	6 2 10
Do. 5 % Perp. Deb.	100	5	5	91 — 93	..	5 7 5
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 79	..	5 14 0
Central London Railway, Ord.	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	84 — 86	..	4 13 0
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	80 — 82	..	4 17 7
Do. 4 % Deb.	100	4	4	95 — 97	..	4 2 6
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	91 — 94	..	5 6 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1908	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	86 — 88	..	4 11 0
Hastings Trams, 6 % Pref.	1	6	6†	—	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	84½ — 86½	..	5 15 4
London and Suburban, Ord.	1	..	1	—	+	3 10 10
Do. Do. 5 % Cum. Pref.	1	..	5†	—	+	7 12 8
Do. Do. 4½ % 1st Deb.	100	4½	4½	73 — 78	—1	5 15 5
London Elec. Railways, 4 % Deb.	100	4	4	88 — 90	..	4 9 0
London United Trams, 4 % Deb.	100	4	4	53 — 57	—1	7 0 4
Metropolitan Railway Consol.	100	1⅝	1⅝	40½ — 41	— ¾	3 19 3
Do. Surplus Lands	100	2⅝	2⅝	62 — 64	..	4 6 0
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	79 — 81	..	4 6 4
Metropolitan District Ord.	100	Nil	..	25½ — 26	+ ½	Nil
Do. 6 % Deb.	100	6	6	186 —189	..	4 6 0
Do. 4 % Deb.	100	4	4	91 — 93	..	4 6 0
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 86	..	5 4 8
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
Do. 5 % Deb.	100	5	5	85½ — 88½	..	5 18 0
Potteries, Ord.	1	3½	3½	—	..	8 12 10
Do. 5 % Pref.	1	5	5	—	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	81½ — 84½	..	5 6 2
South Metro. Trams, 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Underground Elec. Railways	10	..	..	3 — 3⅛	+ ⅛	Nil
Do. "A"	1/-	..	..	—	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	117 —119	+1	5 0 10
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 0
Do. 6 % Income	100	6	6	90 — 91	— ½	6 11 10
Yorkshire (West Riding), Ord.	5	Nil	Nil	—	..	Nil
Do. 6 % Pref.	5	3	4	4⅛ — 4⅜	..	4 6 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅞ — 5	..	5 10 0
Do. 2nd Pref.	5	5½	5½	4⅞ — 4⅞	..	6 5 9
Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Do. 4½ % Deb.	100	4½	4½	96 — 99 xd	..	4 11 0
Do. 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Auckland Trams, 5 % Deb.	100	5	5	101 —104 xd	..	4 16 3
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11⅝	..	5 2 2
Do. 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9
Do. 5 % 2nd Deb.	100	5	5	99 —101	..	4 19 0
Brazilian Traction, Light and Power	$100	6	6†	74 — 76	+2	7 18 0
Brisbane Trams Invt., Ord.	5	8	8	7⅞ — 7⅞	..	5 8 8
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	+1	4 7 5
B. Columbia Elec. Rly., Def.	100	8	8†	106 —110	..	7 5 6
Do. Pref. Ord.	100	6	6	108 —107	..	5 12 1
Do. 5 % Pref.	100	5	5	103½—105½ xd	..	4 14 7
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 0
Do. 4½ % Vancouver Deb.	100	4½	4½	92 — 96 xd	..	4 18 9
Do. 4½ % Con. Deb.	100	4½	4½	96 — 98	+ ½	4 6 9
Calcutta Trams, Ord.	5	7½	9½	7⅞ — 7⅞	+ ½	6 4 9
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	+	4 16 5
Do. 4½ % Deb.	100	4½	4½	98 —101	+1	4 0 0
Cape Electric Trams	1	5	5	—	..	6 18 4
City Buenos Aires Trams (1904)	5	5	5	5⅜ — 5⅝	..	4 9 0
Do. 4 % Deb.	100	4	4	95 —100	..	4 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	98 — 97	+2	5 3 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	91 — 95	..	5 5 3
Kalgoorlie El. Trams 5% A Deb.	100	5	5	83 — 87	..	5 15 0
Do. 6% B Deb.	100	3	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord.	1	..	..	—	..	..
Do. Pref.	1	4½d.	6	—	..	6 5 0
Lisbon Elec. Trams, Ord.	1	6	6	1⅜ — 1⅝	..	4 9 8
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	92½ — 97½ xd	..	5 2 6
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4⅝ — 5⅛	..	5 14 3
„ Elec. Tr. (1904), Deb.	100	5	5	99 —101	..	4 19 0
Manaos Trams & Lt., 1st Deb.	100	5	5	75½ — 78½	..	6 7 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99 —101	— ⅛	4 19 0
Mexico Trams Com	$100	7	7	72 — 76	+1	..
Do. Gen. Con. 5 % Bonds	..	5	5	84 — 88	+2	5 18 8
Do. 6 % Bonds	100	6	6	77 — 81	+4	7 8 2
Para Elec. Rlys. & Lt., Ord.	5	10	10	4 — 4½	..	11 2
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 18
Do. 5 % 1st Deb.	100	5	5	88 — 91	..	5 10
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	94 — 96	..	4 18 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	97 — 9	+ ½	5 1 0
Do. 5 % Mort. Bonds	100	5	5	89½ — 91½	+1	5 9 3
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	97 —101	..	4 19 0
Singapore Trams, 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	98 —100	..	5 0 0
Un. Elec. Trams Monte Video	5	7	7	4½ — 4⅝	..	7 7 4
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	..	5 17 3
Do. 5 % 1st Deb.	100	5	5	95 — 97	..	5 3 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9⅞ — 10½	..	4 5 9
Do. Second 6 % Pref.	10	6	6	10⅝ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96	..	4 18 9
Brompton & Kensington, Ord.	5	10	10	8⅞ — 9⅜	+ ⅛	5 6 8
Do. 7 % Cum. Pref.	5	7	7	8⅜ — 8⅝	+ ⅛	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91 — 94	..	4 5 1
Charing Cross, West End & City	5	5	6	5 — 5⅛	+ ⅛	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 5⅛	+ ⅛	4 7 10
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4⅞ — 4⅞	..	4 18 8
Do. Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Chelsea, Ord.	5	5	5	4⅞ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	96 — 98	..	4 11 0
City of London, Ord.	10	9	10	16 — 17	..	5 17 8
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	115 —118	..	4 4 9
Do. 4½ % Second Deb.	100	4½	4½	99 —102	+1	4 8 1
County of London, Ord.	10	6	7	11⅞ — 12⅛	..	5 14 8
Do. 6 % Pref.	10	6	6	11⅞ — 12⅜	..	4 17 0
Do. 4½ % Deb.	Stock	4½	4½	101 —104	..	4 6 7
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 1
Edmundson's, Ord.	£8	..	..	—	..	Nil
Do. 6 % Cum. Pref.	5	6	6	4⅞ — 4 xd	..	7 10 0
Do. 6 % Non-Cum. Pref.	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	82 — 85	+1	5 6 0
Folkestone	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % First Deb.	100	4½	4½	93 — 96	..	4 14 9
Hove	5	8	9	8½ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7⅞ — 7⅞	..	5 16 8
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	74 — 78	+ ½	5 15 5
London Electric, Ord.	8	2½	3	1⅜ — 1⅝	..	5 10 7
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛	..	5 14 8
Do. 4 % First Mort. Deb.	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	4½	4½	8½ — 8⅝	..	6 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 4⅞	+⅛	4 18 8
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 99	..	4 11 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	82 — 84	..	4 3 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9½ — 10⅛	..	5 17 3
Oxford	5	7	7	5⅞ — 6⅛	..	5 10 0
St. James' and Pall Mall, Ord.	5	10	12	9½ — 9⅝	+ ⅛	6 3 1
Do. 7 % Pref.	5	7	7	6⅝ — 7⅛	— ⅛	4 18 3
Do. 3½ % Deb.	100	3½	3½	82 — 86	..	4 2 4
South London, Ord.	4	5½	5½	2⅞ — 3⅛	..	6 10 4
Do. 5 % First Mort. Deb.	100	5	5	93 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1⅜ — 1⅝	..	5 6 8
Do. 4½ % First Deb. Stock	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£8	Nil	..	—	..	..
Do. 5 % Cum Pref.	5	3‡	4	—	..	6 13 4
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 8
Westminster, Ord.	5	10	10	8⅝ — 8⅞	..	5 12
Do. 4½ % Cum Pref.	5	4½	4½	4⅛ — 5⅛	..	4 6 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Bonded Certs.

Continued on next page.

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SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 21st.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	£	6	6	5⅛ — 5⅜	..	£ s. d. 5 11 7
Calcutta, Ord.	£	8½	9	7¼ — 7½	..	5 16 2
Do. 5 % Pref.	£	5	5	5 — 5¼	—⅛	4 15 1
Calgary Power, 1st Mort. Bds. ..	100	5	5	86 — 88	—1	5 13 8
Canadian Gen. El. Com.	$100	7	8	98 —108	..	7 15 6
Do. 7 % Pref.	$100	7	7	116 —121	..	5 15 10
Cordoba Lt., Power and T., Ord.	£	5	..	⅞ — ⅝	..	7 12 0
Do. 5 % Deb.	100	5	5	80 — 85	..	5 17 8
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	82 — 83	..	6 19 6
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	95 — 98	+1	5 2 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93 — 95	..	5 5 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/32 — 3/32	..	Nil
Do. 6 % Pref.	£	6	4	¼ — ⅜	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	99 — 102	..	4 18 0
Madras, Ord.	£	Nil	..	1½ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	103 —106	..	4 14 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	61 — 66	+3	7 11 8
Mexican Lt. & Power, Common	$100	4	4†	46 — 49	+1	..
Do. 7 % Cum. Pref.	$100	7	7	73 — 77	+2	9 1 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	82 — 87	+6	5 15 0
Do. 5 % 2nd Mort. Bonds ..	100	5	5	65 — 70	+6	7 2 10

NAME.	Stock or Share.	Dividends for		Closing Quotations July 21st.	Rise + or Fall —	Present Yield p.c.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	* 100	1912. 5	1913. 5	48 — 53	..	£ s. d. .. ..
Montreal, Lt., H. and Power ..	$100	9	10†	232 — 238	—3	4 4 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	10	235 —245	..	4 1 8
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	97 —103	..	5 16 6
Do. 5 % Deb. Stock	Do.	5	5	99 —101	..	4 19 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital ..	$100	5½	6	134 —138	+1	4 7 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	103 —106	..	4 14 4
Do. 4½ % Per. Deb.	Stock	4½	4½	100 —102	..	4 8 3
Toronto Power, 4½ % 1st Deb. ..	Do.	4½	4½	98 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	82½ — 84½	..	5 18 4
Victoria Falls Power, Pref. ..	1	6	6	⅛ — ¾	..	8 0 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 — 105	..	5 14 3

MANUFACTURING COMPANIES.

Aron, Ord.	£1	7	7	1⅛ — 1⅜	..	8 12 4
Do. 6 % Pref.	£1	6	6	3/32 — 3/32	..	7 2 3
Babcock & Wilcox	£1	16	16	2⅜ — 3	..	5 6 8
Do. Pref.	£1	6	6	1⅞ — 1 17/16	..	4 3 6
British Aluminium, Ord. ..	£1	..	5	1⅛ — 1 1/16	..	4 14 1
Do. 6 % Cum. Pref.	£1	6	6	6/32 — 6/32	..	6 9 0
Do. 5 % Prior Liens Debs. ..	100	5	5	95 — 98	..	5 2 0
Do. Deb. Stk.	100	5	5	90 — 95	..	5 5 3
B.I. & Helsby Cables	£5	10	13	10⅛ — 10⅜	+ ¼	6 1 0
Do. Pref.	£5	6	6	6 — 6⅛	..	4 12 4
Do. Deb.	100	4½	4½	160 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref. ..	£2	Nil	5	1⅜ — 1⅝	..	5 6 8
Do. Deb.	100	4	4	73 — 76	..	5 5 3
Do. 6 % Prior Lien	100	6	6	101 —104	..	5 16 6
Browett, Lindley, Ord.	£1	..	..	2/- —3/-	..	Nil
Do. Pref.	£1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	£2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb. ..	100	4½	4½	29 — 33	..	13 12 8
Callender's Cable	£5	15	15	11½ — 12½	..	6 2 5
Do. Pref.	£5	5	5	5 — 5¼	..	4 15 3
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	£1	20	22½	2 7/16 — 2 9/16	..	8 15 5
Do. Deb.	100	4½	4½	104 —107	..	4 4 1

Dick, Kerr	£1	Nil	..	3/32 — 3/32	..	..
Do. Pref.	£1	6	6	3/32 — 3/32	..	6 17 2
Edison & Swan, A, £2 paid ..	£5	Nil	..	5/32 — 5/32	..	Nil
Do. fully paid	£5	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	57 — 61	..	6 11 1
Do. 5 % Second Deb.	100	5	5	61 — 66	..	7 11 6
Electric Construction	£1	5	5	½ — ⅝	—1/16	8 0 0
Do. Pref.	£1	7	7	1 — 1⅛	..	6 4 5
Greenwood & Batley, Pref. ..	£10	7	7	6½ — 7½	..	9 18 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref. ..	£10	6	6	10⅜ — 10⅝	..	5 10 4
Do. Deb.	100	4	4	88 — 92	..	4 7 0
Henley's, Ord.	£5	15	20	14½ — 15½	..	6 9 0
Do. Pref.	£5	4½	4½	4⅝ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	99½ —101½	..	4 8 8
India-Rubber, G. & T.	£10	7½	7½	9½ — 10⅜	..	7 2 10
Do. Pref.	£10	5	5	9 — 9⅝	..	5 2 7
Telegraph Construction	£12	20	20	37½ — 39½ xd	..	6 1 7
Do. Deb.	100	4	4	97 — 99	..	4 0 10
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	..	68 — 67	..	5 19 8
Do. B 4 % Cum. Pref. ..	100	..	£4	37 — 41	—1	9 15 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	£10	4½	4½	6½ — 6¾	..	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 98	..	5 2 0
American Telep. & Teleg., Cap.	$100	8	8	121 —125	..	6 8 0
Do. Collat. Trust	$1000	4	4	91 — 94	..	4 5 0
Anglo-American Telegraph ..	Stock	8	8	64 — 67 xd	..	4 9 7
Do. 6 % Pref.	Do.	6	6	107½—108½ xd	+ ½	5 10 7
Do. Def.	Do.	30/-	30/-	28 — 28	— ⅛	6 10 5
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	103 —104	..	4 16 2
Chili Telephone	£5	8	6†	7¼ — 7½	..	5 6 8
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80½ — 82½	..	4 17 0
Cuba Telegraph	£10	6	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	£10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	£5	4	4	3¾ — 4	..	5 0 0
Do. 10 % Cum. Pref.	£5	10	10	7¼ — 7½	..	6 9 0
Direct United States Cable ..	£10	4	4	6⅝ — 7⅛	..	5 12 8
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	180 —183 xd	..	5 5 8
Do. 8½ % Pref. Stock	Do.	8½	8½	76½ — 78½ xd	+ ½	4 9 2
Do. 4 % Mort. Deb.	Do.	4	4	95½ — 97½	..	4 2 1
Eastern Extension	£10	7	7	12½ — 13½ xd	+ ½	5 5 9
Do. 4 % Deb.	Stock	4	4	96 — 98	..	4 1 8
Globe Telegraph and Trust ..	£10	6	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	£10	6	6	13½ — 13⅝	+ ⅛	4 11 4
Great Northern Telegraph ..	£10	20	20	81½ — 83½	..	5 19 5
Indo-European Telegraph ..	£5	12	12	58 — 60	..	5 8 4
Mackay Companies Common ..	$100	5	5	80 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 72	..	5 10 1

Marconi's Wireless Telegraph ..	£1	20	20	1⅛ — 2⅛	— 1/16	9 13 6
Do. 7 % Cum. Partic. Pref. ..	£1	17	17	1⅞ — 1⅞	+ ⅛	9 7 8
Monte Video Telephone, Ord. ..	£1	6	6	4/32 — 5/32	..	6 8 0
Do. 5 % Pref.	£1	5	5	4/32 — 5/32	..	5 18 6
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100½ 101½	+ ½	4 8 5
Oriental Telep. and Elec. ..	£1	10	10	2 1/16 — 2 3/16	..	4 11 5
Do. 6 % Cum. Pref.	£1	6	6	1⅜ — 1⅝	..	4 12 5
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 11 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	95 — 97	..	4 2 8
Reuter's	£10	10	7	7¼ — 8¼	..	8 9 8
Submarine Cables Trust	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	97 — 99	..	4 11 0
United River Plate Telephone	£5	8	6†	6½ — 6⅝	..	6 0 9
Do. 5 % Cum. Pref.	£5	5	5	5 — 5⅛ xd	..	4 11 0
West Coast of America	£2½	2½	N	¾ — 1⅛	..	Nil
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	£10	1½	1½	1½ — 1⅝	+ ⅛	8 6 8
Do. 6 % Cum. 1st Pref. ..	£10	6	6	8½ — 9½	..	6 9 9
Do. 6 % Cum. 2nd Pref ..	£10	6	6	8¼ — 8⅝	..	6 16 9
Do. 5 % Debs.	100	5	5	98 —101	..	4 19 0
Western Telegraph, Ltd. ..	£10	7	7	18⅜ 18⅞	..	5 0 11
Do. 4 % Debs.	Stock	4	4	97½ 97⅝	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	95 — 100	..	4 10 0

* Unless otherwise stated all shares are fully paid. † Interim dividend. a Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Electricity Supply Rifle League.—The following matches were decided during June:—Brimsdown (Mursell, 98), 577, Central (Robinson, 99), 577; Brimsdown (Mursell, 97), 557, City Co. (Harlow, 96), 565; Brimsdown (Dartnall, 98), 568, St. James's (Young, 98), 560; Brimsdown (Mursell, Perry, Rollinson, 97), 574, Poplar (Tait, 92), 542; Brompton (Bartlett, 94), 551, City Co. (Harlow, 97), 567; Brompton (Mugford, 98), 564, Poplar (Mogg, 95), 537; Central (Gaze, 100), 577, Westminster (W. A. Pearman, 106), 574; City Co. (Dutton, 97), 567, Poplar (Mogg, 93), 524; City Co. (Harlow, 95), 550, St. James's (Young, 95), 549; Hackney (Hilling, 96), 550, St. James's (Young, Barrow, 93), 552; Hackney (Hilling, Self, 96), 554, Shoreditch (Thomas, 98), 583; Hackney (Hilling, Smith, 97), 562, Westminster (H. A. Pearman, Neville, 99), 583; Ilford (Haeger, Glazier, 95), 563, Shoreditch 586.

	Shot.	Matches. Won.	Lost.	Drwn.	Pnts.	Scores. For.	Agnst.	Average. per match.
Shoreditch	8	8	0	0	16	4,625	4,433	578·125
Central	9	6	2	1	13	5,145	5,019	571·66
W'stminst'r	9	6	3	0	12	5,055	5,037	561·66
City Co.	9	6	3	0	12	5,010	4,957	556·66
Brompton	9	5	4	0	10	5,073	5,037	563·66
Ilford	9	4	5	0	8	5,036	5,008	559·55
St. James's	8	3	5	0	6	4,444	4,473	555·5
Hackney	9	3	6	0	6	4,980	5,041	553·33
Brimsdown	9	2	6	1	5	5,002	5,045	555·77
Poplar	9	0	9	0	9	4,775	5,095	530·55

Possibles have been scored during June by Mr. Gaze (Central) and Mr. W. A. Pearman (Westminster).

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EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JUNE, 1914.

The last month's returns of electrical business, both outwards and inwards, make but a poor showing in comparison with the May figures.

As regards the exports, which reached a total of £462,231, as compared with £618,354 in the preceding month, the telegraphic section alone showed a drop of £100,000, and with the considerable shrinkage in machinery and cable export values, almost accounts for the decreased total. Some increase took place in the goods and fittings sections, but otherwise the export return shows a falling off in every direction.

The imports total of £261,770 compared with £290,878 in May, and in this case also the falling off in business appears to have been general.

The re-exports total of £25,025 showed a decrease of some £6,000 on the preceding month's total.

With the June figures, the half-year's totals become available, and these show an export total for the first six months of 1914 of £3,058,000, as against £3,819,000, the corresponding figure for 1913, showing a considerable decrease. On the other hand, the imports total for the last half-year was £1,647,000, an increase on the corresponding total last year, which was £1,440,000.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	2,104	301	56	138	172	1,550	5,785	72	97	36	14,802	12,933	38,046
Germany	3,768	947	111	...	346	51	1,186	97	14	46	212	746	7,524
Netherlands, Java and Dutch Indies ...	530	784	206	40	14	5	1,833	...	191	39	120	132	3,894
Belgium	856	346	181	...	16	134	3,926	57	255	...	1,642	657	8,060
France	390	...	2,796	16	40	36	14,071	164	21	...	64	91	17,689
Portugal	146	...	60	10	57	8	53	...	...	...	842	41	1,695
Spain, Canary Isles and Spanish N. Africa...	1,377	88	337	70	117	10	5,027	50	...	182	247	1,001	8,506
Switzerland, Italy and Austria-Hungary ...	436	88	104	...	378	27	4,854	44	128	63	172	709	7,003
Greece, Roumania, Turkey and Bulgaria ...	660	117	24	12	...	26	1,677	371	57	...	1,480	4,253	8,677
Channel Isles, Gibraltar, Malta and Cyprus...	105	74	144	...	...	...	51	...	...	...	...	279	653
U.S.A., Philippines and Cuba	917	371	553	...	...	14	197	...	40	...	...	669	2,761
Canada and Newfoundland	1,271	1,275	1,934	1,489	124	1,704	18,255	1,195	1,493	11	65	2,622	31,438
British West Indies and British Guiana ...	86	44	79	118	49	101	241	...	34	14	107	16	889
Mexico and Central America	18	66	...	34	...	...	39	...	...	...	...	14	171
Peru and Uruguay	536	63	63	116	...	46	779	120	94	...	...	53	1,870
Chile	199	86	37	...	...	415	1,460	...	198	...	466	878	3,739
Brazil	1,548	1,012	260	517	...	...	7,530	2,610	104	...	61	14,230	27,872
Argentina	12,100	10,320	1,696	825	742	1,166	23,303	13	415	159	455	376	51,570
Colombia, Venezuela, Ecuador and Bolivia...	277	87	108	17	...	...	502	...	1,882	...	58	...	2,931
Egypt, Tunis and Morocco	191	52	39	50	...	6	590	2	16	...	64	179	1,189
British West Africa	146	12	8	76	...	...	93	...	...	147	85	16,313	16,880
Rhodesia, O.R.C. and Transvaal	2,006	3,575	248	786	20	...	1,487	...	17	...	206	1,102	9,447
Cape of Good Hope	1,906	5,677	309	314	147	21	2,560	...	106	...	1,146	2,945	15,131
Natal	1,972	3,782	55	317	56	9	2,997	...	96	46	26	1,187	10,543
Zanzibar, Brit. E. Africa, Mauritius & Aden	127	249	285	346	...	139	982	15	...	...	16	335	2,494
Azores, Madeira and Portuguese Africa ...	179	2,183	39	79	...	...	418	...	36	...	...	88	3,022
French African Colonies and Madagascar...	...	...	...	...	...	...	...	...	...	...	...	...	...
China and Siam	1,108	594	1,070	14	...	619	2,351	33	82	46	...	24	5,941
Japan and Korea	547	...	198	50	...	1,876	7,564	90	80	179	107	348	11,039
India	4,328	6,410	2,407	1,302	45	1,845	27,862	1,975	3,650	476	815	5,065	56,180
Ceylon	526	281	168	44	...	...	840	445	...	...	223	...	2,527
Straits Settlements, Fed. Malay States and Sarawak	1,188	2,000	355	75	33	24	1,409	43	617	46	1,849	483	8,122
Hong Kong	1,735	489	169	16	...	275	1,132	...	66	...	17	78	3,977
West Australia	386	6,358	72	347	13	274	10,000	...	53	28	744	99	18,374
South Australia	286	519	284	376	...	...	2,265	...	9	...	91	86	3,916
Victoria	2,863	3,723	803	1,084	99	96	9,256	368	249	6	317	973	19,337
New South Wales	2,462	4,438	948	1,021	211	315	7,028	2,241	602	295	569	1,442	21,572
Queensland	232	420	118	166	...	19	998	...	69	...	1,257	260	3,539
Tasmania	2	...	60	...	...	13	87	...	53	...	131	...	346
New Zealand and Fiji Islands	3,072	5,303	380	947	144	316	5,374	667	493	...	5,313	1,648	23,657
Total, £	52,086	62,134	16,764	10,812	2,823	11,140	176,540	10,672	11,317	1,819	33,769	72,355	462,231

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	10,468	...	10	...	505	...	4,480	402	2,468	...	508	18,841
Germany	4,192	21,479	1,280	4,474	7,892	1,941	76,867	189	3,707	8,413	9,107	139,511
Holland...	...	792	...	337	452	...	126	...	...	233	...	1,939
Belgium	901	7,451	10	135	60	28	938	...	1,775	95	...	11,393
France	230	300	985	2,443	240	1,067	3,174	...	1,310	3,409	1,984	15,142
Switzerland	1,302	448	...	102	3	433	7,469	...	...	129	24	9,910
Italy	...	1,924	...	...	...	...	...	...	102	...	4	2,030
Austria-Hungary	21	3,188	...	243	...	...	48	...	41	164	...	3,605
United States	4,986	178	1,306	54	313	175	16,771	30,197	1,143	677	2,962	58,762
Total, £	22,100	35,760	3,561	7,788	9,365	3,644	109,872	30,788	10,546	13,120	14,589	261,133

Additional imports: Portugal, electrical machinery, £200; Spain, carbons, £270; Canada, goods, £109; arc lamps, £20; machinery, £38.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above... ...	16,260	615	...	2,044	316	...	4,481	...	123	754	432	25,025

Total Exports: £462,231 Total Re-Exports: £25,025 Total Imports: £261,770

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

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ELECTRICAL ACCIDENTS IN 1913.

(*Concluded from page* 92.)

Of the accidents to skilled persons, described as "electricians," when working on live conductors, 18 were due to short circuits in the use of ordinary uninsulated spanners or pliers on live switchboards. Three accidents—one fatal—occurred to men when trimming arc lamps. In the fatal case several lamps were connected across one phase of a 440-volt three-phase system through an auto-transformer protected by a double-pole switch. In each lamp circuit was a single-pole switch. One of the lamps was burning badly and required adjustment. As the double-pole switch could not be used without putting out all the lamps, the electrician switched off the one lamp only at its single-pole switch, which, of course, did not cut off the pressure. It was stated that he was in the habit of standing on a piece of board when handling the arc lamps, but on this occasion he omitted to do so and was killed. One of the other cases was similar; the man was rendered unconscious, but recovered. The second fatility was not satisfactorily explained. The man was attending to a motor (500 volts D.C.), and had previously switched off at a double-pole switch. Someone, whether unthinkingly or by way of a joke, appears to have turned the switch on and off again, with a fatal result. The third fatality happened to an electrician when engaged in cleaning insulators of crane trolley wires. He was on a ladder when he received a shock and fell to the ground, fracturing his skull. Most of the accidents in this class need not have occurred, the persons concerned being acquainted with the dangers, and having often only themselves to blame for not taking proper precautions.

The corresponding accidents to unskilled persons differ in this respect. The victims, having little or no knowledge of the dangers, are put to work or are permitted to work under dangerous conditions without proper precautions or supervision by competent persons in authority over them. In most cases there could have been no necessity for the work to be undertaken whilst the conductors were "live." Thirteen of the accidents, including the two fatal cases, were due to such persons being allowed to work close to dangerous live conductors, *e.g.*, crane trolley wires, outdoor transmission wires, normally out of reach, but the work (*e.g.*, painting, whitewashing, building) requiring them to get close to the conductors. In one of the fatal cases, a power company's transmission lines (10,000 volts) passed over the factory grounds to a sub-station. A new building was being erected immediately under the wires, and the building work was proceeded with until the wall and scaffold platform were within 4 or 5 ft. of the conductors. A joiner was then instructed to put up a fence on the platform to prevent the bricklayers from getting near the wires. In putting up the fence he touched one of the wires with his head and was killed. In the second case, power wires (440 volts) crossed some pipes about 14 ft. from the ground and 3 ft. above them. A joint on a pipe just below the wires required repairing, and a plumber who was employed to do the work came into contact with the wires and was killed. In another case a labourer was employed to clean the motors, &c., on Saturday afternoons when the works were shut down. The cleaning was effected by means of an ordinary flue brush with metal wire handle. He also had to sweep the floor of the operating side of the sub-station. There was a screen of expanded metal, 6 ft. 6 in. high, protecting all the live apparatus. Having finished his work, he turned his attention to the extra-high-tension gear within the screen, and appears to have stood on a box and reached with his brush over the screen to dust the high-tension fuses of the potential transformer. Although he caused a short circuit and received a severe shock and burns to his fingers, he was not seriously injured.

The number of accidents in electrical manufacturing works has more than doubled. This is no doubt generally an indication of increased activity in manufacturing, leading to pressure of work in the testing departments of the works concerned. The average age of 63 out of the 66 persons injured is only just over 20 years. This is due to the fact which I have pointed out before, that the testing operations are conducted very largely by apprentices or pupils. This arrangement suits the employers, the pupils having generally had a technical college training, and it is of great service to the pupils in giving them practical experience. Many of the accidents would probably be avoided if there were better supervision of the work by an experienced person. The fatal accident occurred in the testing department of a cable works, and was primarily due to a mistake in switching. A cable had been subjected to a high-pressure test, and the high-tension leads from the test cabin had not been disconnected from the cable at the conclusion of the test. A man went to the cable to do this later on when another cable was about to be tested. Unfortunately the pressure was again applied to the first cable by mistake, and the man handling it was killed. The victim of the accident was also at fault in not having observed the rule of the works as to earthing the test leads before handling them.

Amongst the miscellaneous accidents, one was due to an old form of practical joke, a live wire being attached to a door handle. A similar joke a year or two ago had fatal consequences. In the present case the victim received a serious shock, but recovered. In the two fatal cases death was due to fall. In the first a travelling crane stopped suddenly, and the driver, an unskilled man, in order to ascertain the cause, climbed out of the cage and opened the cover of the main switch. He received a shock and fell to the ground. The stoppage of the crane was subsequently proved to have been due to a fuse falling out of its clip contacts. In the second case an electrically-driven winch was being used to hoist a girder in some building operations. The winch motor was controlled by a liquid controller. The controller failed at a critical moment, becoming short-circuited, and in spite of the full application of the brake the motor continued to creep, with the result that a man was thrown to the ground from a height of 50 ft. The main switch by which the motor might have been stopped on such an emergency was so placed that the driver could not reach it unless he first released the brake.

In my visits during the year I found, apart from works where accidents had actually occurred, numerous examples of dangerous conditions, not only in old work, but also in new installations. This observation applies not only to factory premises where no electrician is employed, but even to public electricity supply and traction undertakings. Although the placard of the Regulations is nearly always duly posted in the works, it is the exception to find that it has been studied by any responsible person with a view to its application to the particular works in question. Many occupiers wait until an accident happens or until irregularities are pointed out by an inspector before taking any steps to remedy defects. Although the total number of accidents (509) is very small, averaging no more than one in perhaps 100 works, the conditions conducive to accident are present in a very much larger proportion, and in many works visited it appears to have been purely a matter of good fortune that accidents have not occurred.

Without attempting to make a list of the numerous irregularities dealt with, a few of the more important may be mentioned. Thus, in the case of high-tension switchboards, it is required by the Regulations that all conductors within reach in any switchboard passage-way shall be protected. In a number of cases passage-ways were found in which bare conductors were exposed all along the side and without any protection. Some, however, were closed by a door at the end, having a notice affixed to the effect that only authorised persons were allowed to enter. In these cases it has been overlooked that it is for the protection of these very authorised persons that this Regulation was framed, and that if anyone at all is allowed to enter while the conductors are live, there must be protection. One of the accidents to an authorised person, referred to above, occurred in such a passage-way. Another most important provision in regard to high-tension switchboards is also sometimes over-looked. When work has to be done on such a switchboard, it is required that the switchboard shall be either made dead as a whole, or if a section only is made dead, that section shall be effectively screened from all adjacent live conductors. The first method can only be adopted in the case of switchboards controlling a supply which admits of being shut down. In stations where the supply has to be maintained continuously the second alternative has to be adopted, yet in such stations switchboards were found without any means provided for screening the live conductors, and so designed that even temporary screening was impracticable. Thus, oil switches, which require periodical attention, were placed close to bare bus-bars and other conductors in such a way that although they could be disconnected by isolating switches, the live conductors could not be screened. In one case, in a public supply station belonging to a local authority, the oil switches were connected directly to the bus-bars, and could not be made dead without shutting down the whole station, and, of course, interrupting the electricity supply to the town. Even in switchboards otherwise satisfactory there is often one piece of apparatus—the bus-bar potential transformer—which has been overlooked in this respect. Although it may be placed in a cell together with its fuses, which are either mounted upon it or on the cell walls, it is connected through the fuses directly to the bus-bars. The conductors in the cell up to and including the fuse contacts cannot be made dead without shutting down the station. These transformers should be protected by isolating switches placed in a separate compartment of the switchboard.

Medium-pressure switchboards are not subject to such stringent provisions as regards protection of live conductors. Safeguards are, however, required. Thus, "insulating screens" or "other suitable means" must be "provided and used when necessary adequately to prevent danger." The provision of insulated spanners is frequently neglected, and, as mentioned above, a number of the accidents occurring at switchboards—13 in public supply stations and 18 in other factories—were due to such neglect. On medium-pressure switchboards the switches are usually placed on the front of the panels, the bus-bars and connections being at the back. With alternating currents, however, oil switches are becoming more widely used, and they are generally placed at the back of the panels, the working handles being on the front. Oil switches require periodical attention involving the removal of the oil tanks. Being at the back of the board with bare conductors all about, special care is needed when they require attention. In the case of switchboards which can be shut down every night or at week-ends, any such work can generally be carried out in safety when the whole board is dead. I have, however, found such switchboards on services which do not permit of shutting down, even on Sundays, in one case on a 650-volt three-phase system, the outside limit of medium pressure. All the connections were of bare copper, and the switches were directly connected to the bus-bars without isolating switches. Such an arrangement is obviously very dangerous when a switch requires overhauling. Two accidents recorded above occurred in attempting to remove the oil tanks from live switches. Such switchboards should be arranged in two or more sections, any one of which may be made dead when necessary, or the individual panels should be separated by screens and isolating switches should be provided for disconnecting each oil switch, as is usual with high-tension switchboards.

Several cases were found where new switchboards were erected, having less than the required space at the back, a mistake for

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which there is obviously no excuse. A number of 440-volt three-phase switchboards were found having iron plating for the working platform and no "insulating stands."

A large number of distribution fuseboards for power circuits were found having fuses which could not be handled without risk of touching live metal, and many for lighting circuits having the additional defect that the hand is liable to be burned by the blowing of the fuse. A common type of such fuse, having a porcelain carrier with the fuse wire in a groove on the front, is still widely used. Such fuses do not comply with the Regulations, but are unfortunately widely supplied by contractors. Distribution fuseboards, even of large size for power circuits, are often placed in inaccessible positions, as on a wall 20 ft. from the ground.

One extensive power and lighting installation, 440 volts, three-phase, put up by a foreign firm of contractors, was dangerous in almost every conceivable way. There was bare switchgear over iron floors and some out of doors bare conductors within reach. There was no means of cutting off the pressure from the power circuits except by shutting everything down at the main switch in the sub-station some distance away, and for the lighting circuits the main switch did not cut off the pressure. The lighting was taken from a fourth neutral wire, and one or other of the phase wires. The main switch did not break on the neutral conductor, and this was not earthed, so that it was liable to be live at 250 volts above earth, even with the main switch off.

Many old-type and dangerous hand-lamps were found not only on works, but in public supply stations, and numerous instances of the use of lampholders temporarily rigged up as portable lamps. One of the latter was on alternating current 255 volts to earth, and in a pump house with iron floor.

In drawing attention to these matters, I wish also to record that I have seen many electrical stations and works where attention to safety has been a first consideration and excellent conditions existed. Many electrical engineers to local authorities supplying electrical energy are taking pains to see that their consumers' apparatus is in accordance with the requirements, and notwithstanding the bad examples which I have referred to, more attention is being paid generally to the requirements as to safety. Prosecutions were taken in several districts for breaches of the Regulations, and in some cases heavy penalties were imposed.

Competition and consequent cutting of prices is often responsible for work not being in accordance with the requirements. Thus, the occupier of a factory may order a switchboard from a contractor and may even specify that it is to be in accordance with the requirements of the Regulations, but gives no information as to the conditions under which it is to be used. The contractor asks no questions and supplies an open type switchboard. Such a switchboard is required to have certain space in front and behind and to be in a place set apart for the purpose. The board is, however, destined to be put up in a part of the works quite unsuited for the purpose, where there is insufficient space and where it cannot be fenced off. The purchaser is naturally annoyed when he finds out that it does not comply with the requirements, and the contractor disclaims responsibility as he was not informed as to where it was intended to be placed. Several similar cases were found in regard to high-tension switchboards in public supply stations. In one the engineer had ordered a switchboard, merely specifying that it must provide for the control of so many generators and so many feeders and be in accordance with the requirements of the Regulations, which, however, he had not taken the trouble to study for himself. He obtained from the contractors a switchboard having no protection whatever for the live conductors in the back passage-way, but merely a gate at the end of the passage. The contractor maintains that the switchboard is in accordance with the Regulations, and so it would be if it were not necessary for anyone to enter the passage-way while the conductors were live. Such a condition is, however, impossible in a station which cannot be shut down, and the engineer finds himself with a switchboard which does not comply with the requirements.

With a view to clearing up some points on which there appeared to be some uncertainty as to the requirements, at the request of the British Electrical and Allied Manufacturers' Association, I met in conference a sub-committee of their switchboard section. These conferences have proved very useful, and agreement was arrived at on all the points raised.

BRITISH TRADE IN CANADA.

The following are extracts from a report on the trade of Canada by Mr. C. Hamilton Wickes, H.M. Trade Commissioner in the Dominion, which has just been published by the Board of Trade. The report itself may be obtained at a cost of 7d. from Messrs. Wyman and Sons, Ltd., Fetter Lane, London, E.C. The extracts being taken from different parts of the report are necessarily disjointed, but they have been chosen to give the essence of the report in so far as it is most likely to interest readers of the Electrical Review.

Trade Statistics.

Imports of "trade merchandise" in the fiscal year 1912-13:—

Dutiable:—	
Affected by the Preferential Tariff	£92,960,000
" " General Tariff	2,800,000
Free	40,200,000
Total	£135,960,000

Starting with the figure of £135,960,000 of "trade merchandise" imported, a searching analysis was made in order to ascertain:—

1. What proportion of the "trade merchandise" imports into the Dominion could be classified as consisting of goods for the supply of which British manufacturers are in a position to compete—hereinafter described as "competitive merchandise."

2. What proportion of the balance consists of merchandise not of British origin or manufacture, which could, nevertheless, be supplied by the British merchant—hereinafter described as "entrepot trade."

3. What is the proportion of the merchandise or produce imported, which by reason of its character, or the conditions governing its sale, cannot be supplied either by the British manufacturer or the British merchant to the Canadian market—hereinafter described as "non-competitive merchandise."

4. What proportion of the increase, £31,620,000, over the previous year, was made up of goods the United Kingdom could supply.

Imports of "trade merchandise" in the fiscal year 1912-13:

	Value.	Percentage of Total.
Competitive	£76,000,000	55.8
Entrepot	12,920,000	9.5
Non-Competitive	47,040,000	34.7
Total	£135,960,000	

Every detail concerned with the imports of "competitive" merchandise should be of interest. *Only by the share of this trade which is secured should the efforts of the British manufacturers be judged, and only by these figures should the value of the Dominion market to the manufacturers of the United Kingdom be estimated.*

The following figures show the value of the imports from the United States and other countries after making the deductions from gross imports previously referred to:—

Imports from—	Trade Merchandise.	Competitive Merchandise.
United States	£88,770,000	£43,400,000
United Kingdom	27,560,000	25,000,000
Other Countries	19,630,000	7,600,000
Total ...	£135,960,000	£76,000,000

Marketing of Goods.

In this Dominion it is well known that the activities of the British merchant export house, from the Rockies to the Atlantic, are practically non-existent. As a result the value and volume of trade in goods of British origin with Canada has suffered. The loss has not all been borne by Great Britain—the Canadian trader has suffered too, although perhaps he has not realised it, by reason of the absence of facilities afforded by the activities of the merchant organisation. This in other countries has been found helpful to the smaller traders, and still more so to manufacturers, who are brought into touch with world sources of supply of raw and partly manufactured material. In no country except perhaps its neighbour in the south is the handling and storing of goods on arrival and their subsequent distribution carried on at such an extravagant cost.

There are not many British firms of whose manufactures the Canadian market takes sufficient volume at the present time to support an office and staff of their own.

Many difficulties to direct marketing present themselves in the Dominion without the intervention of a representative or agent; of course, there are Canadian firms who visit England to make purchases, but there are few who have offices of their own in the United Kingdom.

In order to develop business an agent in some form or other is, in practice, necessary. While there are British manufacturers operating on this market through their own office, and others through agents who are unexcelled in the thoroughness of their marketing arrangements, the greater number are less fortunately situated. It will be understood that in the ordinary course of the duties attaching to this office a very large number of merchants, importers, and agents engaged in handling a variety of classes of merchandise have been seen and interviewed in connection with the enquiries received from the United Kingdom, as well as other firms who have sought our services in order to be put into touch with British firms and sources of supply. In this way a great deal of experience has been gained of the views that these firms have formed relative to British methods which, in their opinion, hamper or hinder the position of British trade with the Dominion.

Some of the more important points which have been brought to my notice are set out below:—

1. The necessity for a closer study of the technicalities of the export trade, *e.g.*, freights, insurance, exchange, packing and casing of goods.

2. The requirements necessary to obtain the advantages of the preferential section of the Tariff. Knowledge of the leading features of the Intermediate Tariff in favour of France, Belgium, Italy, and the Netherlands. Intimate acquaintance with the Customs Laws and Regulations as compiled from the Customs Act, Orders in Council, and Memoranda issued by the Customs Department.

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3. A better knowledge of the terms and credits customarily given on this market to Canadian buyers.
4. The importance of fixing such a "Selling cost price," whether "Ex warehouse," or "*f.o.b.*, U.K. Port," as will adequately cover the agent's commission and other incidental expenses. In many instances also more attention should be paid to the price at which the articles are retailed.
5. The necessity for the selection of suitable agents or representatives. In particular, the terms on which they ought to be employed, taking into consideration the prevailing custom.
6. The preparation of catalogues in Canadian currency, and fixing one ruling rate of discount in place of many varying rates.
7. The adequate supply of samples, with due care that such samples are suitable for the Canadian market, and that the samples asked for by the agent are forwarded.
8. Better knowledge of the geographical features of the Dominion, the distance between the various towns, and the time occupied, and the expense incurred by the agent travelling between the different distributing centres.
9. The necessity for the British principal to read the letters of his agent carefully, answering the questions addressed to him, and paying greater attention to the advice tendered. When this is in the nature of criticism, to try and remove the cause, rather than to assume that the agent is at fault and impertinent in making complaints. British principals are blamed for omitting to reply to criticisms, as well as to enquiries made for information about their goods.

Many, if not all of the above points have, from time to time been brought under the notice of British traders. There is, however, another feature in connection with the selection of agents which should be noted, and in the analysis made of the imports under trades, I have, where the class of goods permitted, tried to differentiate between articles of merchandise:—

(*a*) distributed through wholesalers or jobbers, thence indirectly to the retailer, and

(*b*) goods which rarely pass through these channels, consisting of raw material (mainly unmanufactured), *e.g.*, ores, cotton, wool, &c., and manufactured articles, *e.g.*, machinery and equipment, and appliances, the bulk being consumed or utilised by railway corporations, municipal bodies, manufacturers, mining concerns, contractors, &c.

The manufacturer and trader either already doing business or desirous of opening up trade with this market, whichever of the above categories, (*a*) or (*b*) his products come under, should recognise that essentially different methods are required in order economically and at the same time successfully to secure and hold the market in different classes of goods. For example, few, if any, firms of agents are satisfactorily placed for dealing with goods which form part of both the categories mentioned above. It has been failure to recognise this difference, unfortunately, which has on numerous occasions brought about disaster to the interests of British manufacturers represented overseas and the loss of valuable contracts, resulting in such firms not infrequently refusing to consider direct oversea speculation. They return home and place this export business in the hands of agents residing in the United Kingdom. This method while probably satisfactory as safeguarding them against financial risks, does not conduce as a rule to the development of British trade in the overseas markets.

Trade in Metal Manufactures and Machinery.

The gross imports of all classes of metal manufactures, machines, machinery, equipment, and hardware, amounted to £39,700,000, an increase of £11,700,000 over the previous year. This considerable increase was anticipated in the Report published last year. The proportions of the United Kingdom, United States, and other countries' shares of the total imports are shown below.

Gross Imports.

Total imports of Metal Manufactures and Machinery:—

Country of Origin.	Value. £	Percentage of Total.
United Kingdom	4,450,000	11.2
United States	34,320,000	86.4
Other Countries	910,000	2.3
Total ...	£39,680,000	

It is small consolation to find that "Other Countries" (than the United States), in their attempt to secure a share of this very important trade, are in a still more parlous condition than the United Kingdom.

The natural advantages enjoyed by the United States are due to:—

1. Easy and rapid access to the market.
2. The fact that freight rates have not been increased from the chief centres of supply to the points of delivery in Canada for several years, while sea freights have been considerably increased.
3. The cost of providing packages being infinitely less to the American manufacturer in comparison with either the British or European manufacturer.
4. The United States currency being the same as the Canadian.
5. Travellers and representatives from the United States crossing the border and finding the same conditions existing, with a demand for goods closely approximating to their own.
6. The great number of American engineers occupying important posts in Canada as heads of the big railway companies, managers of plants and factories, and as consulting engineers.

These and similar advantages give the United States an extraordinary advantage over their European competitors, and the result is reflected in the figures.

Moreover, by the exercise of thought and skill they have strengthened their position artificially by:—

1. The adoption of standards in various lines differing so essentially from those accepted in Europe that the manufactures made to the European standards are rendered still more difficult to introduce. This has further been assisted by the required inspection of equipment and appliances and material in any way connected with "fire hazard" before they could be utilised. (The recent appointment of a firm in London who can inspect goods before shipment has been, and will be, of great assistance in this connection).
2. Arrangements by which some important British and also powerful continental manufacturers are precluded from quoting or competing with the American in the Canadian market.

When both the above series of advantages have been taken into account, affecting as they do so materially the securing of orders, the relatively poor position occupied by the United Kingdom may to some extent be accounted for. There are many instances, however, of goods suitable to the needs of this country and procurable from the United Kingdom at a competitive cost, which never reach this market owing to the indifferent or inadequate methods employed for their marketing.

In the sale of manufactures of metals and machinery there are, as has been stated with general application elsewhere in the report, two widely different classes of buyers or consumers. Perhaps in no trade is this so clearly marked as in the one with which we are now dealing. In the marketing of machines, equipment for factories, &c., neither the wholesale distributing merchant, nor the jobber, nor the retailer is concerned. The buyers to a considerable extent are:—

1. Manufacturers in various lines.
2. Contractors for building and other class of construction.
3. The buying departments of the very important transportation companies.
4. Municipal and other public bodies.

Imports of Equipment in the Year Ended March 31st, 1913.

	Per cent.*	Per cent.†	Per cent.‡	Dollars.	Dollars.	Dollars.
Apparatus, electric, N.O P. switchgear, insulators, batteries, telegraph and telephone instruments	15	25	27½	991,179	5,832,662	6,984,812
Boilers, steam	15	25	27½	58,716	309,849	368,565
Boilers, N.O.P.	15	25	27½	74,695	324,223	398,918
Cable, wire, insulated or covered	20	27½	30	433 706	774,124	1,219,360
Cranes and derricks	15	25	27½	32,028	712,683	744,711
Engines, gasoline	15	25	27½	83,612	3,162,446	3,246 676
Engines, steam	15	25	27½	117,004	360,835	477,839
Engines, fire	22½	30	35	—	37,020	37.020
Fire extinguishing machines and sprinklers	22½	30	35	651	136,124	136,775
Grain crushers	15	22½	25	—	3,080	3,080
Motors, electric, generators, sockets, electric	15	25	27½	194,741	1,312,933	1,589,127
Machinery or plant, all other composed wholly or in part of iron or steel, N O.P.	15	25	27½	2,007,898	17,523,172	19,851,639
Portable machines, all other N.O P. and parts	15	25	27½	1,604	128,774	132,546
				3,995,834	30,617,925	35,191,068

* British preferential tariff. † Intermediate tariff. ‡ General tariff applicable to American goods.

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Imports of equipment (including electrical) for workshops, factories, &c., *e.g.*, boilers, cranes, steam and oil engines and electrical transmission apparatus, are by far the most important in value of those under the heading of machinery and equipment, amounting as they do to over £7,000,000. The British share was about £800,000 or 11.1 per cent. The difficulty in dealing with this sub-heading is the enormous value entered under one item, £4,000,000, which includes besides parts of electrical equipment, any or all machinery, not otherwise specified, composed wholly or in part of iron or steel, or iron or steel integral parts of all machinery. This assembly under one heading of articles varying considerably in their character presents great difficulty to adequate treatment.

The imports of insulated wire or cable were some £245,000 from all countries. The United Kingdom secured only about £87,000, although enjoying a 10 per cent. lower duty than the chief competitor.

Quite a considerable proportion of the articles which go to make up this heading are supplied for municipal and other large undertakings. While it is true that there are local manufacturers who are important and have a considerable share of this business, some of these are affiliated with larger American manufacturers in the same lines. It is difficult sometimes when firms are competing for a municipal order to distinguish how far they are quoting on behalf of their own manufacture and how far they are quoting for articles not of Canadian but of American manufacture. Articles of Canadian manufacture are given a preference by many purchasers. There was a recent incident of a great outcry being made by a Canadian manufacturer because his tender was passed, and on investigation it was discovered that he was not tendering Canadian manufactured goods but American.

THE TRAMWAY CONGRESS.

The proceedings of the sixth annual congress of the Tramways and Light Railways Association were opened in Newcastle-on-Tyne on Thursday, July 16, and continued on the following day. An interesting programme had been prepared for the occasion, the papers submitted touching upon some important points in tramway administration, and the social items had been arranged so as to give the members visiting the congress some idea of the environments of the city, while a trip down the Tyne had been planned so that a glimpse of some of the great works and shipbuilding yards for which the district is famous might be obtained. A garden party was designed to be held at Leazes Park, Newcastle, on Thursday, where the visitors would have been the guests of the Lord Mayor and Corporation, but a terrible rainstorm—the fall for the 24 hours exceeded 1½ inches—put an end to this, and instead the members were entertained by their hosts at the Newcastle Picture House—the newest and one of the finest kinematograph halls in the city. This was followed by a banquet given by the Lord Mayor and Corporation. The trip down the river on the second day was also marred by rain, but fortunately the deluge was not so excessive as that of the preceding day. At Tynemouth tea was provided by the chairman and directors of the Tyneside Tramways and Tramroads Co. On each day arrangements were made for the ladies of the party to visit beauty spots in the neighbourhood, and special tramcars were placed at their disposal. As a wind-up to the proceedings a supper and dance were given by the chairman and directors of the Northern General Transport Co., and the Gateshead, Tynemouth, and Jarrow Tramway Companies.

The congress was held in the Connaught Hall, and in the absence of the Chairman, the Hon. Arthur Stanley, and the Vice-Chairman, Mr. Harry England, who was unable to be present on the first day, one of the vice-presidents, Mr. Stephen Sellon, presided.

The Lord Mayor of Newcastle (Councillor Johnstone Wallace) welcomed the conference to the city in the name of the Corporation and citizens. They all regretted, he said, that the President of the Association, Lord Chilston, could not be with them, owing to the death of his daughter, and in his bereavement they sympathised with him most deeply. The welcome he (the Lord Mayor) had to give to the conference was a very cordial one. They in Newcastle had not looked very kindly upon municipalisation, and the only municipal venture in the city was its tramway service. Even the tramways had had a very narrow escape, because there was a large section in the City Council in favour of leasing them. Started under the able chairmanship of Alderman Cail, the tramway service was continued under Alderman Sir Joseph Baxter Ellis, and it was now being carried on under the chairmanship of Alderman Rodgers; they embarked one and a quarter millions sterling in it, and they had paid off the sinking fund, £428,000. They had a reserve fund of about £100,000, so that they had not done badly, especially when they took into consideration the distances they carried the passengers for a penny, and the fact that at some points in the city halfpenny fares were in vogue.

The Chairman suitably thanked the Lord Mayor for his kind words of welcome, and he also expressed the thanks of the Association to those gentlemen and firms who had assisted in drawing up the programme for their entertainment and instruction. He said they all regretted the absence of their President, Viscount Chilston, and suggested that a telegram of condolence should be sent to him, which was done.

The Chairman, proceeding, said they had also to deplore the death of the Duke of Argyle, their late president, and expressed their appreciation of the very great assistance he had rendered to the Association in its early days. Mr. Sellon remarked upon the valuable services of Alderman Rodgers, the Chairman of the Newcastle Tramways Committee, in co-operating and assisting to make the arrangements for their visit, and complimenting the city upon the success of its tramway undertaking, he said that much of the success which attended it was attributable to Alderman Rodgers, to his Vice-Chairman, Councillor Richard Mayne, and to the General Manager, Mr. Ernest Hatton. They were also indebted to the northern companies who had been good enough to offer them entertainment, and to the Tyneside Tramway Co. Remarking that Mr. Andrew Nance, who was held in the highest esteem by them all, was just now celebrating his jubilee of 50 years, he suggested that a telegram of congratulation should be sent to him, and this was agreed to.

Touching upon the question of the maintenance of roads, the Chairman said that the whole question of contributions towards the cost of repairing roads was about to receive consideration at the hands of a special Departmental Committee. The Association considered that the present burdens for road maintenance imposed upon tramway undertakings were very harsh and unreasonable. But the whole matter was mixed up with the question of the contributions of motor 'buses, and also the great question of the amount of expenditure rendered necessary for the maintenance of roads consequent upon the extraordinary traffic that was now upon them. It was, therefore, the desire of the Council that the views of the Association should be heard upon this matter, and the Council had sent a letter to Mr. Herbert Samuel expressing the hope that representatives from the Association might be afforded an opportunity of stating the case of tramways before the Departmental Committee.

Newcastle Corporation Tramways.

By Councillor Richard Mayne.

In a paper on this subject Councillor Richard Mayne, Vice-Chairman of the Tramways Committee, briefly discussed some features of the system, which comprises 62 miles of single track, with a car-mileage of nearly 5,000,000 per annum. He held that while the best value should be given to users, and the best wages and conditions of service to the employees, the best profits, whether in the form of cash or in that of street improvements and the opening-up of otherwise inaccessible districts, should be returned to the ratepayers, whom he regarded as shareholders. Newcastle is very fully covered with tramways, and the facilities thus provided are appreciated, for the population is carried 204 times in the course of a year. Not all his colleagues supported his view that the profits were the property of the ratepayers. The reserve and renewals fund had been built up to and was kept at £100,000, the surplus available after providing for its replenishment being allocated to the City Fund. Great masses of workmen were carried at low rates—over four miles for a penny—by 100 special cars, the average takings covering the average cost, but not the financial charges on account of the plant required to meet the peak load caused by this traffic. It would have been more just to charge the workmen a little more and to extend cheap fares to classes of small wage-earners which at present had to pay full fares. Parcels too large to be carried on the knees of a passenger were deposited on the platform and charged for at the rate of 1d. each, which brought in a sum of £1,800 to £2,000 per annum without any additional outlay. By granting halfpenny fares for the last half-mile of the principal routes the takings had been quadrupled, but the adoption of a halfpenny fare in the centre of the city had resulted in a loss.

Mr. R. Hammond (London) opened the discussion. Mr. Mayne had said that no profits could be deemed divisible until they had brought their reserve fund up to £100,000; that was extremely sound. He took it that the Tramways Committee was making ample provision also for the sinking fund and for renewals. No business was a sound undertaking, whether it

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was run by a municipality or by a public company, which sold a portion of its products at a loss, as in the case of the workmen's fares. Why should one class call for more privileges than another? They might almost call it charity. He did hope that steps would be taken towards giving all the workers some little benefit from the undertaking in Newcastle.

Mr. SHEPHERD (Edinburgh) said that Glasgow could adopt halfpenny fares and make them pay, because it had its population living in a congested area, whereas in the English towns facilities were given for the working classes to go outside and live. They in Edinburgh had not adopted them, and did not intend to adopt them. His company did not intend to carry the workmen at a loss. He was struck with Mr. Mayne's remarks with regard to parcel carrying, and he suggested that tramway managers should institute a system of parcel carrying and delivering by messengers. In Edinburgh it brought in a gross revenue of £6,000 per annum, half of which was clear profit.

Mr. G. W. HOLFORD (Salford) foresaw a time coming for the levelling-up of fares, and also saw that they must all introduce charges for the carrying of parcels.

Mr. C. W. MALLINS (Liverpool) said the halfpenny fare was altogether a bad proposition, and would be a parasite upon the remainder of a system.

Mr. H. R. HOGG (Sunderland) pointed out the difficulties of running district tramways at a reasonable profit, and said that many companies, whilst paying the interest of their debenture holders, found it a very hard matter to get anything for the benefit of their ordinary shareholders. If they raised their fares they would incense the people in the district, whose objections might lead them to use the cars less than they did formerly, and yet the existing fares did not give an adequate return. There was no doubt that the tramways served the people in the outlying districts better than did the railways.

Alderman FRED SMITH (Liverpool) said he believed that municipal tramways should make a profit under proper conditions, and should pay their shareholders, who were the ratepayers, a reasonable dividend for the risks they ran; but he could not agree with Mr. Shepherd that municipal tramways should carry parcels. Nor should they have anything to do with workmen's fares or any of the other finicking arrangements that were intended either as class benefits or to catch votes. Let them try to give the people a good service, and let the people pay reasonable fares. In Liverpool they were not prepared to go in for halfpenny fares, free fares for the blind, school children's halfpenny fares, and the various other methods of vote-catching, because everyone was entitled to concessions if one was entitled to them. In order to be just they could not afford to be generous to any one particular class.

Mr. SAUNDERS (Maidstone) gave it as his experience that the introduction of halfpenny fares had resulted in a loss of revenue; the only concession tramway undertakings could afford was to grant weekly tickets to the workmen.

Alderman J. H. RODGERS, replying to a question put by Mr. Hammond, said that loans for cars were extended over fifteen years, for machinery over twenty years, and for track work over thirty years, and each loan was so arranged that it was paid back in equal yearly instalments over the period covered. Newcastle had put £1,175,000 into her tramways, and of that sum £488,000 had been paid off the capital in the twelve years that they had been running. The reason why they insisted upon the reserve fund figure of £100,000 was that they regarded £25,000 as one year's renewals, and they therefore always kept four years' renewals in hand. Although halfpenny fares operated successfully in Glasgow, they could never be a financial success in Newcastle.

Councillor RICHARD MAYNE replied to the discussion briefly, and thanked the congress for the manner in which they had received his paper. He agreed that halfpenny fares would be parasites upon the remainder of the system, but pointed out that the halfpenny fares in vogue in Newcastle were terminal fares.

Tramways in Brazil.

Mr. H. M. SAYERS described his experiences in tramway construction in Santos and São Vicente, in the State of São Paulo, Brazil. The supply of skilled labour was unsatisfactory, and the unskilled labourers were mostly Portuguese, Italians and Spaniards, requiring close surveillance. The author preferred the Portuguese, but Italians were particularly good at electrical work. "Lightning" strikes were not infrequent, and there was a strong tendency to violence among the men. Few subordinates were fit to undertake responsibility, so that an excessive amount of detail work was imposed upon the staff. Much trouble also resulted from the lack of experience and fixity of purpose on the part of the engineering authorities of the city, and from the fact that many of the roads were only marked out and not made up. It was necessary also to keep the existing routes operated by mules in service until in each case an electric service was ready to replace it. Great difficulties were experienced due to the unreliable nature of the subsoil, consisting of fine sand, which caused subsidences, especially where drainage operations were in progress near the track; concrete stringers gave way, and had to be replaced with wooden sleepers in many places. Expansion of the rails by heat also gave trouble through "pumping," which was remedied by grouting with pitch or "Plascom," a method worth trying in new construction. For shipment it was found advantageous to use the floor and roof of each car as the bottom and lid of a packing case, containing all the seats, posts, etc., so that each package was complete in itself, and there were no separate boxes of small parts to go astray. Perishable parts should be packed watertight, and axle journals, etc., should be painted or well greased to prevent corrosion in transit. The cars should be unpacked under cover directly they arrive, as lying packed up in the open in the tropics causes rapid deterioration. A profitable goods traffic was organised on the tramways with motor-equipped open and box wagons and trailer wagons. Care must be taken, when working an undertaking of this kind at a great distance from the source of supply, to order all stores, spare parts, etc., long before they will be wanted, as strikes and other unforeseen events may cause serious delays in delivery.

DISCUSSION.

Mr. SHEPHERD gave some experiences he had when attempting to negotiate a concession before the Turkish war broke out. One way and another they were called upon to pay as presents, in order to obtain the concession they were asking for, no less a sum than £350,000. His experience was that it was better to keep money in this country rather than to try to make new openings in foreign countries.

Mr. C. G. TEGETMEIER (London) said that if Mr. Shepherd's last remarks applied also to British dominions abroad, he could not agree with it. The Auckland Tramways were now running over 42 track miles, and taking £280,000 a year in fares, which represented nearly £3 per head per annum of the whole population. They found concrete stringers entirely inapplicable, and these had to be replaced by wooden sleepers, which were now standing most effectively.

Mr. HUMPHRIES (South Staffordshire) said his experience of concrete stringers was that they were an abomination. Transverse sleepers, running for many miles over colliery sinkings, were found to be the proper class of foundation.

Mr. SAYERS, replying to the discussion, said the tramways in the American cities paid very well. He could not tell Mr. Shepherd how much it cost to get the concession, and he himself did not know where some of the price money went to.

Standard Tramway Rails.

In a very brief paper, Mr. FRED. BLAND introduced the subject of standardisation of rail sections, a question which has been prominent during the past twelve months, and is now under the consideration of the Engineering Standards Committee. Existing British Standard sections were compared with French and German sections, showing little difference

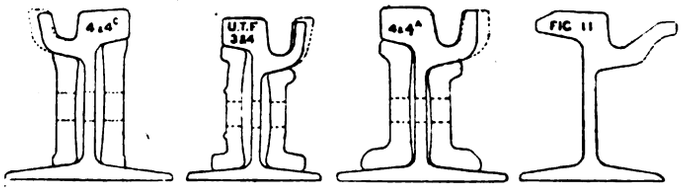

FIG. 1.—COMPARISON OF BRITISH, FRENCH AND GERMAN STANDARD RAILS, NO. 4 SECTION; AND AMERICAN PROPOSED STANDARD, FIG. 11.

except in the depth of the groove, which is ½-in. deeper on the Continent than in British practice, and the author thought would always remain a difficulty in the way of the European Standard Section. The principal section rolled in England last year was the No. 4; it was now suggested that the new sections should comprise Nos. 2, 3, and 4, retaining the old dimensions except for the bottom flange, which

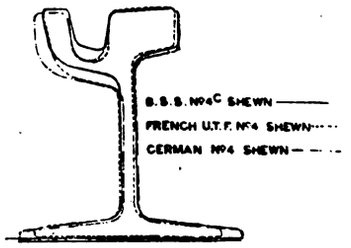

FIG. 2.—BRITISH, FRENCH AND GERMAN STANDARD RAILS, SECTION NO. 4, COMBINED.

would be reduced to a uniform width of 6½ inches. It had also been proposed that a new British Standard Section, No. 6, weighing 112 lb. per yard, should be adopted. The radius of the running trend should be made twelve inches, as all tram rails took that radius approximately, after several years' wear. American sections were useless for European conditions. It was to the interest of tramway engineers to use two rails only, either 6½ in. or 7 in., and to use Standard rails in all renewals, so as to enable manufacturers to stand-

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ardise, and to stock rails and points and crossings. The question of standardising points and crossings had been very carefully gone into, and a report containing valuable information was before the Engineering Standards Committee.

DISCUSSION.

The CHAIRMAN said this subject was of vital importance to the tramway industry, and he would like a good discussion upon it, in order that the Standardisation Committee might have the benefit of suggestions.

Mr. SHEPHERD drew attention to the difficulty his company was having with the Edinburgh municipality. Their rails were laid with old Dick Kerr joints. His company said those rails had seven or eight years' life in them yet, and contended that they were entitled to get that life out of them. What was the opinion of the congress on this point?

Mr. ROBSON (South Shields) commented upon the absence from the paper of any reference to the centre-groove rail, which had been used at Hull and Doncaster with extraordinary success. At the joints it gave complete absence of hammering.

Mr. J. W. DUGDALE (Oldham) said the rail spoken of by Mr. Robson was not a standard rail, and the idea of the paper, he took it, was to lead the congress to a consideration of standard rails.

Mr. MALLINS, referring to the point put forward by Mr. Shepherd, said certainly the company should have the seven or eight years' life out of the rails.

Mr. PICKERING said that standardisation would help the manufacturer, because he could standardise patterns, reduce the cost of output, and probably cheapen the rails.

Mr. BLAND, replying, said that during the past seven years 150,000 tons of British standard rails had been rolled as compared with 60,000 tons of the ordinary sections, and that showed the great importance of the standard sections.

THE BANQUET.

On the Thursday evening the Lord Mayor and Corporation of Newcastle entertained the members and others to a banquet at Messrs. Tilley's Rooms, New Market Street. The Lord Mayor (Mr. Johnstone Wallace) presided, and was supported by the Lady Mayoress, Alderman J. H. Rodgers, chairman of the Corporation Tramways Committee; Councillor R. Mayne, vice-chairman; Sir Joseph and Lady Ellis, the Recorder of Newcastle (Judge Atherley Jones), Mr. C. G. Tegetmeier, Mr. C. Shireff-Hilton, Mr. F. Coutts, Mr. E. H. Edwards, Mr. J. W. Dugdale, Mr. J. Cameron, and Mr. Fred Bland, members of the Council of the Association; Mr. A. De Turckheim, secretary; Alderman H. Linsley, president of the Municipal Tramways Association, and other gentlemen.

The loyal toasts having been duly honoured,

Alderman J. H. RODGERS proposed "The Tramways and Light Railways Association." He said that was the sixth annual conference that had been held by the association, and they had covered the principal towns in the United Kingdom. During the last five years the association had more than doubled its membership, which was open to anyone who was in any way connected with tramways. The association took an active part in defending the rights of all, as they were very frequently shot at by all kinds of public bodies. But they fought unitedly against those bodies much better than they could individually.

Mr. STEPHEN SELLON responded, pointing out that although that was their sixth conference, it was in the early days of the nineties that they applied for and obtained incorporation. Municipal and company alike, the association knew no politics. Under the efficient management of Mr. De Turckheim, on whom too much praise could not be bestowed, they were now, perhaps, one of the most efficient associations in the industry, and they did very important work. Alderman Rodgers, Councillor Mayne, and Mr. Hatton were at the head of one of the finest municipal undertakings in the country, and the financial results that had been presented to the association that day showed that the undertaking was carried on on proper business lines.

Councillor RICHARD MAYNE proposed "Kindred Associations," coupling with the toast the name of Alderman H. Linsley, chairman of the Salford Corporation Tramways, and president of the Municipal Tramways Association.

Alderman LINSLEY, responding, thanked the association for having invited him to their conference, and said he hoped to return their hospitality when the conference of the Municipal Tramways Association assembled at Salford. On more than one occasion the Municipal Tramways Association and the Tramways and Light Railways Association had acted jointly, and he felt that by joint action their influence was always very much greater than it would be if they acted separately.

The health of the chairman was also honoured, and briefly responded to.

During dinner a high-class musical programme was provided by Mr. H. G. Amers's orchestra, and in the interludes between the speeches the company was entertained with some delightful vocal numbers given by a concert party consisting of Madame Dorothy Forster, Miss Elsie Taylor, Mr. Maurice Pearce, and Mr. William Hendry, with Mr. Fred Jeavans acting as accompanist. Mr. Tom Hoffman gave humorous selections.

(To be concluded.)

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

BRITISH GUIANA.—The regulations under the Preferential Tariff here limit the preferential treatment of British goods to such goods as are shipped direct from the United Kingdom to the Colony. The Board of Trade are now informed that goods trans-shipped at Barbados for British Guiana on a through bill of lading from the United Kingdom are, at the present time, treated as direct shipments for the purpose of the above-mentioned regulations, and that in such cases the certificate of origin prescribed for "direct" shipments will be required to be furnished to the Customs authorities for the entry of goods at preferential rates of duty. Under the head of "Port of Ultimate Destination" in the certificate it is desirable to state in such cases "Demerara via Barbados." New preferential regulations are now awaiting the sanction of the British Guiana legislature, and when these become effective goods trans-shipped at Barbados on a through bill of lading from the United Kingdom will not be entitled to entry into the Colony under the British Preferential Tariff.

HOLLAND.—The Dutch Customs Authorities have issued the following decisions as to the treatment to be afforded to certain goods imported into Holland:—

Advertisements or show card framed even without glass	5 p.c. *ad val.*
Fusible plugs for boilers	free.
Automatic apparatus for keeping driving belts at the right tension	free.

UNITED STATES.—The American Customs Authorities have decided that celluloid in sheets which have been advanced beyond the condition of unpolished sheets by subjection to hydraulic pressure are to be dutiable at the rate of 40 p.c. *ad val.*

SOUTH AFRICA.—The Government have decided that for the purpose of estimating the amount of duty prescribed by the tariff whenever levied on goods *ad valorem*, and for the purpose of the declaration and oaths which may at any time be required by law or regulation in relation to the question of such duty, the value for duty purposes of those goods shall be taken to be the "true current value" for home consumption in the principal markets of the country from which and at the time when the goods were imported, including carriage to the port of shipment and the cost of packing and packages, provided that in no case shall the value for duty be less than the cost of the goods to the importer at the port of shipment.

CANADA.—The Canadian Customs Authorities have decided that dental switchboards shall be dutiable as electric apparatus, the rate of duty being 15 p.c. under the British preferential tariff and 27½ p.c. under the "general" tariff on foreign goods.

AUSTRALIA.—The Australian Customs Authorities have decided that a combination switch and ceiling rose for pendants shall be admitted free of duty.

Electric Motor Vehicles.—A NEW USE FOR THE KINEMATOGRAPH.—The latest use of the kinematograph is in connection with the encouragement of the use of electric motor vehicles, a film with that object having lately been produced by the Edison Storage Battery Co., of New York. The film depicts the experiences of a New York business man, in the purchase of an electric motor lorry, and while there is a distinct vein of wholesome humour throughout the "play," it is highly educational. The merchant is first shown wrestling with the problem of horse unreliability and mortality. He is confronted with a letter from the Electrical Vehicle Association, of America, and decides to inquire into the question of electric haulage. Calling up the Association on the 'phone, he secures additional data and figures, and is called upon by the local central station representative. A consulting engineer is then called in to assist in solving the technical problems. Next he is given demonstrations of different vehicles, and being finally convinced, he signs a contract for 10. The final picture shows him enjoying the savings effected in delivery by electric vehicles as against his old horse-drawn vehicles, by purchasing and using a pleasure-type electric carriage.

Scientific Research.—At the annual meeting of the Society of Chemical Industry in Nottingham last week, the presidential address of Sir William Crookes was read. He said the world was still greatly in need of able researchers, and discoveries of vast importance were awaiting their Newtons. But was not the attitude of the public towards investigators lacking in understanding and imagination, and did not the authorities treat scientific exploration in a niggardly spirit? Scientific research was being starved. The allotment of public moneys to the furtherance of scientific work, the tangible recognition of the services of scientific men, the provision of opportunities for all kinds of investigations of scientific problems without reference to their immediate commercial value—these were the benefits they looked for at the hands of the Government and of the nation.—*Times*.

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NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

16,045. "Electric switches." J. H. TUCKER. July 6th.

16,063. "Process for the manufacture of electrodes." SCHOTT & GEN. July 6th. (Addition to 17,759/13. Convention date, July 21st, 1913, Germany.) (Complete.)

16,068. "Electric clock systems." A. R. UPWARD. July 6th.

16,080. "Control systems and devices for electric current. SOC. ANON. DES ETABLISSEMENTS L. BLERIOT. July 6th. (Convention date, July 7th, 1913, Belgium.) (Complete.)

16,087. "Controlling electric motors." STOTHERT & PITT, LTD., and E. S. FRANKLIN. July 6th.

16,093. "Electric motors, or dynamos, more especially intended for use for starting or igniting the internal-combustion engines of motor road vehicles or for other purposes where light weight and compactness are required." W. H. SCOTT. July 6th.

16,094. "Electric light dimming for use with electrical prepayment meters." G. O. A. BLACKMORE. July 6th.

16,095. "Synchronous booster rotary converters." P. M. LINCOLN. July 6th. (Convention date, July 19th, 1913, United States.) (Complete.)

16,101. "Cells for electric storage batteries and the like." O. OLDHAM. July 6th

16,102. "Apparatus for cleaning out the cells of electric storage batteries and the like." O. OLDHAM. July 6th.

16,126 "Apparatus for the electric welding or soldering of thin objects by means of indirect heating." ALLGEMEINE ELEKTRICITATS GES. July 6th. (Convention date, August 12th, 1913, Germany.) (Complete.)

16,149. "Electric lamps." F. SMITH and T. J. LOACH. July 7th.

16,170. "Process for banding projectiles." S. O. COWPER-COLES. July 7th.

16,171. "Process for the removal of phosphorus from iron and steel and the like." S. O. COWPER-COLES. July 7th.

16,172. "Recovery of copper from weak copper sulphate solutions." S. O. COWPER-COLES. July 7th.

16,173. "Process for the treatment of ores containing iron and copper." S. O. COWPER-COLES. July 7th.

16,174. "Process for the manufacture of metallic strips and ribbons by electrolytic means." S. O. COWPER-COLES. July 7th.

16,175. "Electro-deposition of alloys." S. O. COWPER-COLES. July 7th.

16,176. "Process for coating metal plates and the like." S. O. COWPER-COLES. July 7th.

16,177. "Construction of pipes." S. O. COWPER-COLES. July 7th.

16,178. "Process for the recovery of copper, gold, silver and iron from sulphide ores." S. O. COWPER-COLES. July 7th.

16,203. "Central-contact electric incandescent lamp floats or foot-lights." M. CHALIER. July 7th. (Convention date, July 15th, 1913, France.) (Complete.)

16,214. "Electrical lighting and power installations and plants." R. H. GOULD. July 7th.

16,234. "Automatic selector switches." C. A. W. HULTMAN. July 7th. (Convention date, July 11th, 1913, Germany.) (Complete.)

16,251. "Recording mariners' compasses" R. KENNEDY. July 8th.

16,263. "Electric furnaces." J. L. DIXON. July 8th.

16,287. "Devices for supporting overhead trolley wires for electric railways, tramways, and the like." H. W. H. RICHARDS. July 8th.

16,308. "Spark-plugs." P. A. NEWTON. July 8th. (A. R. Mosler, United States.) (Complete.)

16,315. "Electrical device for controlling race-starting barriers." A. BURT July 8th.

16,316. "Telephone installations in which the subscribers' lines are grouped according to the frequency of the calls." SIEMENS & HALSKE AKT. GES. July 8th. (Addition to 28,751/12. Convention date, September 25th, 1913, Germany. (Complete.)

16,318. "Circuit interrupters." J. N. MAHONEY. July 8th. (Convention date, August 11th, 1913, United States.) (Complete.)

16,319. "Control systems for electric motors." A. J. HALL and L. G. RILEY. July 8th. (Convention date, July 9th, 1913, United States.) (Complete.)

16,327. "Electric circuit-controlling devices." BRITISH THOMSON-HOUSTON CO., LTD. July 8th. (General Electric Co., United States.)

16,328. "Systems for the control of moving bodies at a distance by radiant energy." J. H. HAMMOND, JUN. July 8th. (Convention date, July 14th, 1913. United States.) (Complete.)

16,340. "System of connections for telephone installations in which the work of the operators is supervised from special observation places." E. C. R. MARKS. July 8th. (Siemens & Halske Akt. Ges., Germany.) (Complete.)

16,342. "Telegraphy." E. C. R. MARKS. July 8th. (International Quadruplex Co., United States.) (Complete.)

16,343. "Telegraphy." E. C. R. MARKS. July 8th. (International Quadruplex Co., United States.) (Complete.)

16,363. "Electric lamp holders or other coupling members." G. ST. J. DAY. July 9th.

16,380. "Receiving arrangements for wireless telegraphy." R. C. GALLETTI. July 9th.

16,407. "Plug contact for use in electro-plating." S. R. BAILEY and A. H. FOLWORTHY. July 9th.

16,411. "Automatic telephone systems." BETULANDER AUTOMATIC TELEPHONE CO., LTD., G. H. BRYANT, and F. M. WARD. July 9th.

16,418. "Relays and indicators." STERLING TELEPHONE & ELECTRIC CO., LTD. July 9th. (Telephon Fabrik Akt. Ges. vorm. J. Berliner, Germany.) (Complete.)

16,424. "Apparatus for calling attendants." STERLING TELEPHONE & ELECTRIC CO., LTD., and F. G. BELL. July 9th. (Partly communicated by Telephon Fabrik Akt. Ges. vorm. J. Berliner, Germany.) (Complete.)

16,433. "Electrical heating apparatus." M. A. V. LONDON. July 9th.

16,471. "Electric relays." EASTERN TELEGRAPH CO., LTD., and B. DAVIES. July 10th.

16,485. "Conversion of alternating movements into rotary motion, the invention being applicable, for example, to winding drums." A. A. QUICK. July 10th.

16,490. "Means for obtaining high starting-torques at low speeds from electric motors and for retaining them over a wide range of speeds." A. J. LEIGH and H. J. OSBORNE. July 10th.

16,507. "Automatic transmitters for use in electric telegraphy. J. F. A. TROTTER. July 10th.

16,509. "Secondary batteries." O. OLDHAM. July 10th.

16,516. "Spark-plug tester and accumulator-terminal tester for use in all kinds of motors." W. FOSTER, A. GLASBY, and C. T. LITTLE. July 11th.

16,575. "Electrical relays." A. H. RAILING and C. C. GARRARD. July 11th.

16,578. "Electrolytic relays." W. JUDD, A. FRASER, and EASTERN TELEGRAPH CO., LTD. July 11th.

16,583. "Method of and apparatus for electrically transmitting patterns and pictures in textile machines." OESTERREICHISCHE SIEMENS-SCHUCKERTWERKE and REGAL PATENTE G.M.B.H. July 11th. (Convention date, July 12th, 1913, Austria.) (Complete.)

16,590. "Cooling arrangements for dynamo-electric machinery." SIEMENS BROS. DYNAMO WORKS, LTD., and E. O. KIEFFER. July 11th.

16,595. "Electric alarms." J. BANNEYER. July 11th. (Complete.)

16,612. "Electric hair brushes." V. SENCE. July 11th. (Complete.)

16,619. "Selectors for automatic telephone systems." G. A. BETULANDER and N. G. PALMGREN. July 11th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

14,140. APPARATUS FOR EMITTING ELECTRIC WAVES. W. P. Thompson (Compagnie Universelle de Telegraphie et de Telephonic Sans Fil.) June 18th.

14,258. DEVICES OR APPARATUS FOR REGULATING, CONTROLLING, OR LIMITING THE SPEED OF INTERNAL-COMBUSTION ENGINES. H. D. Chatfield. June 19th.

14,481. PROCESS FOR THE MANUFACTURE OF CONDENSATION-PRODUCTS FROM PHENOLS AND FORMALDEHYDE, AND OF NEW MATERIALS FORMED THEREWITH. H. Stockhausen and R. Gruhl. June 23rd.

14,518. METHOD AND APPARATUS FOR THE ELECTRICAL SOLDERING OF METALS. Allgemeine Elektricitats Ges. June 23rd. (June 21st, 1912.)

14,524. TELEPHONE SYSTEMS. W. Aitken. June 23rd. (Patent of addition not granted. Cognate application 16,859/13, 18,349/13, 19,521/13, and 19,988/13.)

14,532. DEVICE FOR CONTROLLING THE SPEED OF, OR STOPPING TRAINS AND THE LIKE BY MEANS OUT OF CONTROL OF ENGINE CREW. A. Findlay and J. D. F. Findlay. June 24th.

14,699. ELECTRIC HEATING APPARATUS. A. F. Berry. June 25th.

14,760. ELECTRIC LAMPS FOR ARTIFICIALLY PRODUCING DAYLIGHT EFFECTS. F. R. Boardman, R. V. Boardman and F. Boardman. June 26th.

14,771. ELECTRIC SIGNALS FOR RAILWAYS. A. R. Mutton. June 26th.

16,066. PROCESS OF PRODUCING FILAMENTS OR WIRE OF TUNGSTEN AND TUNGSTEN ALLOY. E. A. Kruger. July 11th.

16,078. SPARKING-PLUGS. F. A. L. Johnson. July 12th.

16,167. CONTROL OF DIRECT AND ALTERNATING CURRENT ELECTRIC MOTORS. H. H. Jowers. July 14th.

16,214. ELECTRIC HEATING APPARATUS FOR WATER AND OTHER FLUIDS. H. De Kok. July 14th. (November 30th, 1912.)

18,068. LAMP FOR VEHICLES. T. L. Griffiths. August 8th.

19,104. FUSIBLE ELECTRIC CUT-OUTS. O. L. Peard. August 22nd

19,182. PHASE TRANSFORMATION OF ELECTRIC CURRENTS. British Electric Transformer Co., and R. Crosbie-Hill. August 23rd.

20,126. COIN-FREED TELEPHONE APPARATUS. G. A. Long. September 5th.

20,800. IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. Pohl es Fiai (firm of). September 15th. (February 26th, 1913.)

22,798. ELECTRIC SWITCHES. A. V. I. Bickerstaff. October 9th.

24,850. ELECTRIC FURNACES. I. Rennerfelt. October 31st. (December 5th, 1912.)

26,570. TELEGRAPHIC TRANSMITTERS. G. Visca. November 19th.

27,744. PROCESS FOR FUSING REFRACTORY MATERIALS. Dr. E. Podszus. December 2nd. (December 2nd, 1912.)

28,802. SWITCHING APPARATUS FOR TELEPHONE SYSTEMS. Western Electric Co. (Woodward, acting for Western Electric Co.) December 13th.

1914.

38. ELECTRODES FOR ALKALINE ACCUMULATORS. Svenska Ackumulator Aktiebolaget Jungner. January 1st. (January 16th, 1913.)

2,790. WIRE-ROPE ELECTRIC INSULATOR COUPLINGS. C. C. Sunderland. February 3rd. (May 5th, 1913.)

2,849. ELECTRICAL INSULATORS. K. Von Kando. February 3rd.

3,291. SINGLE OR MULTI-PHASE ELECTRIC FURNACE FOR TREATING MOLTEN METALS. P. Lesoure. February 7th. (February 7th, 1913.)

3,478. APPARATUS FOR MEASURING DECREMENTS OF ELECTRO-MAGNETIC WAVES. F. A. Kolster. February 10th. (September 22nd, 1913.)

3,835. ELECTRIC FURNACES. Soc. Electro-Metallurgique de St. Beron. February 13th. (February 20th, 1913.)

8,146. INSTRUMENT FOR MEASURING RONTGEN RAYS. R. Grisson. March 31st. (April 25th, 1913.)

8,595. ELECTRIC WELDING MACHINES. Allgemeine Elektricitats Ges. April 4th. (April 4th, 1913.)

9,265. DIAPHRAGM FOR ELECTRO-CHEMICAL OR ELECTRO-OSMOTIC PURPOSES. Ges. Fur. Elektro-Osmose. April 14th. (April 14th, 1913.)

10,380. CAM RING FOR THE INTERRUPTOR OF ELECTRIC IGNITION DEVICES. Robert Bosch (firm of). April 27th. (March 5th, 1914.)

10,980. ELECTROLYTIC MANUFACTURE OF ALKALI METALS AND ALKALI METAL COMPOUNDS. E. A. Ashcroft. May 4th.

The Horse-Power of a Rain Storm.—After a severe rain storm, a correspondent of *Power* was interested enough to make a calculation of the energy liberated. The rainfall amounted to 4·17 in. in 10 hours, over a surface of approximately 10 square miles, and the estimated average height of the rain cloud was 5,000 ft. This represented approximately 6,000,000,000 lb. of water which had fallen during 10 hours from an elevation of 5,000 ft., or 15,000,000 H.P.-hours. Suppose man could avail himself of this energy and store it so that it could be used at pleasure; for instance, for lighting city streets with 4,000 arc lamps. Allow 500 watts per lamp, making 2,000 KW. load during the lighting period, equal to 2,680 H.P., or, including losses, say, 3,000 H.P. Allowing 12 hours in 24 as the lighting period, the daily load would amount to 36,000 H.P.-hours. The length of time this energy would last would be 425 days, or one year and two months of light from one storm. This gives some idea of the enormous energy at work in nature.

American Electric Vehicle Convention.—On the occasion of the fifth annual convention of the Electric Vehicle Association, to be held in Philadelphia on October 19th, 20th and 21st, there will be an exhibit of electric vehicles, batteries and accessories, which will form a special section of the Philadelphia Electrical Show, to be held October 19th-24th. It is expected that the electric vehicle exhibit will be the most comprehensive, interesting and instructive that the public has ever seen.—*American Electrical Review.*

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THE

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ELECTRICAL REVIEW.

Vol. LXXV.] CONTENTS: July 31, 1914. [No. 1,914.

	Page
London's Electricity Supply	161
Town Planning	162
Honour for Mr. Marconi	162
Copper	162
Tramway Rail Joints, by H. M. Sayers	163
Absolute Measurement of Electrical Resistance by Lorenz's Method (*illus.*)	164
Correspondence—	
Appointments in West Africa: A Warning	167
Mica and Micanite	167
Tubular Light Sources	167
Proposed Central Testing Institution	168
The Training of the Instrument Maker	168
Technical Errors in the Lay Press	168
Optical Signals for Aeroplanes and Ships (*illus.*)	169
Electrical Treatment of Milk (*illus.*)	169
New Electrical Devices, Fittings and Plant (*illus.*)	170
Legal	173
Parliamentary	176
Business Notes	176
Notes	183
City Notes	186
Stocks and Shares	188
Market Quotations	189
Electric Signalling and the Senghenydd Disaster	191
A Proposed Testing Institution for the Electrical Industry	193
Reviews	195
The Tramway Congress (*concluded*)	196
Rail Joints	196
Town Planning in Relation to Tramways	197
London's Electricity Supply	198
New Patents Applied For, 1914	200
Abstracts of Published Specifications	200
Contractors' Column ... Advertisement pages xxii and xxiv	

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1914 EDITION

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4, Ludgate Hill, London, E.C.

LONDON'S ELECTRICITY SUPPLY.

THE long-expected recommendations of the Special Committee on London Electricity Supply have at last taken tangible shape in the report which was submitted to the L.C.C. on Tuesday last.

We publish elsewhere in this issue a lengthy abstract of the contents of the document; the Council, however, was not asked to approve it at present, but was recommended to make such arrangements as would enable the Special Committee to bring up definite proposals, after the recess, for the promotion of the necessary legislation in connection with the matter, and to authorise the giving of public notice of the Council's intention to consider these proposals on November 10th next.

The general principle involved in the Special Committee's proposals is the combination of municipal and private enterprise in such a manner as to secure efficient management, combined with municipal control—the scheme being, in fact, based upon the report of Messrs. Merz and McLellan, of which a long abstract appeared in our issues of April 24th and May 1st.

Thus it is proposed to set up a new electricity "authority," composed mainly of representatives of the L.C.C., but also of representatives of the adjacent County Councils and County Boroughs concerned.

The authority will be empowered to erect supply stations, to acquire existing municipal and private undertakings, and generally to amalgamate them into one undertaking. The authority is to provide all the capital required for purchasing existing concerns and two-thirds of that required for new works, while the remainder will be provided by a company, which will be entrusted with the management of the undertaking for 50 years, but the authority will be empowered to resume possession at the end of the period, on repayment of the capital provided by the company.

The area of supply includes the whole of the Greater London area, together with portions of the counties of Essex, Hertford, Kent, Middlesex and Surrey, and covers nearly 1,000 sq. miles; 60 per cent. of the energy sold in this area is produced within the County of London.

The capital requirements in the first instance, it is stated, will amount to about £7,000,000, and a subsequent expenditure of from £2,000,000 to £3,000,000 per annum during the next 20 years is expected.

While the Committee favours no particular company for carrying out the work, there is a suggestion that a combination of the existing companies would be welcomed, and the scheme provides for dividends up to 8 per cent. on this company's capital expenditure, and for the appropriation of 75 per cent. of any surplus profits for the reduction of the price of electricity to the consumer.

A valuable feature of the scheme is the proposal to set up a technical Committee on a permanent basis to supervise the technical operations of the company, the authority, however, retaining its control of all financial proposals.

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This Committee, according to the *Times*, would consist of the chairman of the authority, the engineer of the authority, the financial adviser of the authority, and an outside member appointed by the Board of Trade.

It will be seen that the scheme is novel as far as this country is concerned, and that it represents a serious effort to bring together the various conflicting interests which have up to the present been unable to find sufficient ground for co-operation.

Private interests have in the past attempted to solve this problem and failed; at the present time the Borough Councils are engaged in the preliminaries of a bulk scheme on their own account, and there are rumours of both British and foreign banking groups coming forward with big schemes, if the present one fails.

It is obvious, therefore, that the present is no time for obstructive tactics, and that the L.C.C. will be well advised to seek some such solution of the knotty problem of electricity supply in its area, on the lines of mutual co-operation between municipal and private capital, as that outlined by the Special Committee.

We understand that the report was reached at the meeting of the Council on Tuesday, but its consideration was deferred until after the recess.

Town Planning.

The paper read by Mr. Brodie, City Engineer of Liverpool, at the recent Tramway Congress, raises several interesting questions, and contains some novel and stimulating ideas relating to the transportation problem. One of the most prominent features of the paper was the confidence reposed by the author in the electric surface tramway as the most suitable and efficient means of speedy transport for passengers, a confidence which, as our readers are aware, we share with him. Relieved of the wholly unjustifiable burdens under which it groans, as we hope it soon will be, and permitted to utilise the speed of which it is fully capable, the tramway will have no difficulty in proving its superiority to the motor-omnibus. Mr. Brodie, therefore, takes it for granted that electric tramways must form an essential factor in any new scheme for the improvement of existing town areas and the development of adjoining districts, and he makes due provision for them in his plans.

The principal feature of novelty is the allocation of the centre of the broad highway to the tramways, with low hedges separating the tracks from the roadway, so that high speed can be attained without risk to other traffic. The prospect, from the tramway engineer's point of view, resembles a dream rather than reality—but it appears that in at least one instance in Liverpool, Mr. Brodie has successfully carried out his proposal.

The author rightly comments on the nuisance set up by the noise of tramcars, which can be greatly diminished by suitable means. We doubt whether the adoption of rubber tires can be regarded as feasible, even with the aid of double trolley wires on the trolley omnibuses they are looked upon as a necessary evil; but much can be done to improve the gearing, as is proved by the experience of the motor-'buses, and the development of the ideal tramcar is still far from completion.

Honour for Mr. Marconi.

The appointment of Mr. Marconi as an honorary Knight Grand Cross of the Victorian Order by the King, on Friday last, will be cordially approved by the electrical fraternity, upon whose members honours are so rarely conferred. However stormy may have been the career of the companies with which his name is associated, and whatever the ill-usage to which that name has been subjected at the hands of politicians, one fact is universally admitted—that Mr. Marconi himself has come through the ordeal with honour untarnished. That the present development of wireless telegraphy has been due mainly to his efforts, and that to him hundreds of human beings in peril at sea have owed their lives, are also matters of common knowledge. We therefore cordially offer our congratulations to Mr. Marconi on the royal recognition of his distinguished services to the nation and to the world, adding the hope that in due course, when the Imperial chain is completed and the Empire linked together by ethereal waves, a further distinction will be conferred upon him.

Copper.

The position of the copper market has certainly not sustained any improvement during the past few weeks; indeed, the tendency of prices has been for the greater part weak, and considerable ground has been lost at times, though it must be admitted that the main depressing factors were centred outside of the actual position of the metal. Early this week, in view of the serious condition of Continental politics and of affairs in Ireland, the market was panicky. Under all the disappointing circumstances of the times, copper has really stood up very well, and it is not difficult to understand the moderate amount of optimism which has been expressed by leading spirits in the United States, when interrogated upon the intrinsic business position and prospects. The large absorption of refined copper by Europe this year has been the subject of general comment, and it is interesting therefore to note the expression of opinion of the head of the American Smelting and Refining Co., that the large export movement from America to Europe is due to the fact that the supply of metal other than American, which has been going into Europe for years past, has been gradually dwindling. The quantities coming to hand from Australia have been reduced owing to strikes and other economic conditions, and those from Japan have been lessened, because China and Japan are consuming more and more of the local output. It has been imperative, therefore, for Europe to look more and more to the United States, and the result has been seen in the increased importance of the shipments across the Atlantic of American refined copper. The bad political outlook, both in the United Kingdom and in Europe generally, has been the main depressing consideration, and until the position settles down, and the issue of war or peace becomes clear, it is useless hazarding conjectures as to what is likely to occur. War is always in the long run a bad feature, for it is a destroyer of commerce and of wealth, and cannot fail to work immense injury to trade everywhere in the present as in all past instances. War can only therefore accentuate the depression, whereas hopes of peace being maintained would be a "bull" factor. Turning from the main considerations calculated to sway markets at the present juncture, even though they are not directly connected with the position, it is seen that there has recently been a deterioration in the actual copper situation in so far as it is reflected in the United States statistics, which, for the month of June, showed an increase in the stocks of refined metal in first hands of close upon 10,000 tons, at 47,371 tons. The total is certainly very moderate, measured by the capacity of demand, being well below one month's supply, but it nevertheless indicates an increase of nearly 20,000 tons from the low-water mark of the year, at the end of March, and the "bears" seem to see in the increase which has taken place the beginning of an expansive movement, which will add a material tonnage to the total to be financed, and this at a time when Europe is trembling on the brink of general war. The symptoms are certainly disquieting, and, in the main, unfavourable to the maintenance even of present prices. Much, nearly everything, however, hangs upon the turn taken by international politics.

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TRAMWAY RAIL JOINTS.

By HENRY M. SAYERS.

THE problem of jointing tramway rails in a satisfactory permanent manner has exercised the ingenuity of tramway men and inventors for a long time, and whilst there has been a heavy crop of devices and methods, the progress made has been slow, and opinions are much divided. This result follows from the fact that it takes a few years to prove a jointing method, and that it is very difficult to compare experiences made under varying conditions of traffic, soil, climate, and attention to maintenance.

The objects to be fulfilled are essentially to provide a continuously smooth wheel path, and a continuity of vertical strength or rigidity, across the joints. These requirements apply generally to rail joints on railways also, but there are some important differences in the conditions, due to the fact that tramway rails are surrounded by, and embedded in, the paving of the street, and are generally supported by a continuous substructure of concrete.

The first point of difference is the more important. Whilst on a railway the joints can be inspected and adjusted without entailing further expense, on a tramway inspection and adjustment of joints involves the removal and replacement of the surrounding paving, which is not only expensive in itself, but is detrimental to the paving as a whole, and causes inconvenience to the general street traffic. Further, any movement in the joint, either as between the two rails, or as between the joint as a whole and the substructure, loosens and damages the surrounding paving, especially in the presence of water.

Hence the bolted fish-plated joint, which gives sufficiently good service on railways, has never given complete satisfaction on tramways, because the loosening which seems to be inevitable cannot be remedied by the walking platelayer with his spanner every few days; and in practice joints are left until they become audibly or visibly slack before they are attended to. Slack joints mean battered or dished rails, so that with fish-plated joints a time comes when no tightening of bolts can provide a smooth wheel path, the rail table near the joint is depressed, and either new rails or some repair method is essential.

The desideratum is a joint which will deteriorate no more rapidly than the bulk of the rail, so that the life of the joint shall equal the life of the rail. Failing that, the next best thing is a joint which shall last as long as one laying of the paving—which may vary from seven to twenty years, according to the material and the traffic conditions—so that the relaying of paving will provide sufficient opportunity for joint re-adjustment and repairs.

The fish-plate joint itself has been improved by thickening and lengthening the plates, increasing the number of bolts from four to six, using spring washers and various types of locking nuts, as well as by modifying the "fishing angles" and by making the plates embrace the lower flanges of the rail; but these improvements have not more than kept pace with the increasing stresses due to the increased axle loads and speeds of the cars, and however well made and fitted, a plated joint makes its presence heard and felt after a few months of traffic at the most, and even before any perceptible slackening of the bolts occurs.

A little consideration of a rail joint as part of a beam carrying a rolling load on its upper flange will show that there must be some relative vertical movement of the rail ends as the load passes from one to the other, accompanied by a stretching of the fish-plate bolts under the loaded end. This is one cause of the first jar and sound heard from a new joint. It will also appear that the rail ends are not firmly butted by the jointing, and are not held in contact against the effect of temperature changes, or of the tensile and compressive stresses imposed on them by the wheel loads. This longitudinal freedom is another cause of the earlier movements in a new joint, and as both provoke jumping of the wheels, hammering and progressive loosening of the joint result.

It is theoretically possible, by machining and fitting the fish-plate and rail ends, and power riveting (instead of bolting) to make a joint as good and permanent as is made in a bridge girder, but the practical conditions of track building do not favour such a solution, which also seems to demand some modification of rail sections.

Mr. Brodie, of Liverpool, described a fish-plated joint to the Newcastle Congress of the T. & L.R. Association, in which the butt ends of the rails are drawn into close contact and longitudinal compression is maintained by the use of eccentric bolts, and stated that such joints had been tried with good results in Liverpool. If further experience confirms this, the plated joint may yet survive in some such form.

The provision of an anchor-plate is intended to maintain vertical rigidity, and to prevent longitudinal movement of the rails. If well riveted to the rail flanges, and the plated joint well fitted, it may (and sometimes does) make the joint more rigid than the rest of the rail, which will show itself by hammering and the formation of a depression near the running-on rail end. This is due to the change in vertical direction of a wheel running on to and leaving a more rigid portion of its track, and is exactly analogous to the depressions formed in trolley wires just beyond rigidly suspended ears.

On the other hand a deep anchor plate penetrates the concrete substructure, with the result that the rail has a weakened support under the joints, and will eventually fracture the concrete below. Inquiry shows that a good many tracks originally built with anchored joints are being reconstructed without them, and that in other cases anchors are being placed away from the joints, so that it seems that anchoring is being abandoned as accessory to joints at least. This, however, is another subject.

Until some form of track is evolved which can be unrolled in long lengths like a carpet, it seems that welding should give the ideal joint, mechanically and electrically continuous, provided that the welding process does not prejudicially affect the rail steel, and that uniformly good welds can be relied upon.

The Falk cast welding process, in its original form, did not claim to weld the rails, or even that the metal cast on amalgamated with the rail steel. It consisted in casting on to the rail base and web, a sort of chair of cast iron, which was not brought up to the rail head. It was customary to copper bond across these joints as they could not be relied on to preserve metallic contact. In more recent works, as developed by Mr. Winslow and applied at Coventry and Norwich, great care is taken to clean the rail surfaces before running the metal, and it is stated that permanent metallic contact is secured, in fact that the cast metal amalgamates with the rail steel. It seems that such a result can only have been attained by using a mixture approximating in composition and melting point to the steel, and by running it at a much higher temperature than that of cast iron. It would be very useful to have a published account of the method, and of the results obtained at Norwich. It is, however, a burning on, rather than a welding process, and apparently no attempt is made to bring about a weld of the head. The joint is therefore a place where the upper flange of the beam is cut through, and it seems that under a rolling load such a cut is certain to have some effect upon the path of the wheel, as well as being a point of weakness. The method involves the use of a cupola and blowing plant (which has been re-

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duced to a comparatively moderate size and cost), in the street.

The electric welding process, as developed for tramway track by the Lorain company, gets very close to the continuous rail, since the rail ends properly fitted are pressed together whilst at welding heat. The butt weld is reinforced by fish-plates welded to the rail web at their centres and ends.

So far as can be ascertained this joint has given excellent results. The plant required is large and expensive, and requires a power supply approaching 200 KW. for its operation. The total cost per joint is therefore somewhat heavy, and has prevented such a wide adoption of the process as its intrinsic merits seem to justify.

The Thermit process, as first adapted to rail jointing, was essentially a development of the Falk cast welding, the melting of the metal being accomplished by the Goldschmidt alumino process of simultaneous reduction and melting of iron oxide. In respect of plant, this method has a considerable advantage over the Falk, a small crucible taking the place of a cupola and blower. In respect of result, the temperature of the fused metal is so high that it melts the web and base of the rail, and unites bodily with the steel. The composition of the metal is also under control, so that the cast-on band is in effect a steel casting. It has always been claimed that Thermit joints need no copper bonds.

In the more recent practice of this method, the rail heads are butt welded in addition to the cast welding of the web and flange, thus getting rid of the weakness of a cut-through head.

The rails are clamped in their proper alignment, the heads faced off parallel and brought into close contact by the clamp screws. The metal of the cast is sufficient in quantity to reach nearly to the rail head, and the slag (fused alumina) surrounds and covers the rail head to a considerable thickness, raising the steel in a short time to welding heat; then the clamps are screwed up, butting the heads together with a pressure which produces a very decided upsetting at the joint. This upsetting is filed off flush with the body of the rail, and the filing should reveal no line at the joints. It has been found that certain rail steels do not weld readily, and for such steels a soft steel "shim" is inserted between the faced rail-heads, which seems to have the effect of "letting down" the rail steel sufficiently to ensure a good weld.

This method of welding is very attractive in principle, and the handiness of the apparatus is a great recommendation. So far as can be ascertained, Thermit welds made on a large number of British tramways during the last six years have given excellent results in every way. It will be obvious, however, that any system involving the integral welding of fairly high carbon steel rails, needs careful and systematic operators, and that this must apply alike to the Falk, Lorain, and Thermit joints. Another observation applying to these systems is that they all involve a "heat treatment" of the rail steel which may considerably modify its structure and mechanical qualities, equivalent to insertion into the head of a softer or harder metal, bound to show up in subsequent wear. This is a matter upon which the results of independent tests, as well as the results of actual experience testified to by independent users, are much to be desired.

There are also in use joints in which the ordinary fish-plates are welded to the rail by what is in effect a "Benardos" arc welding process. In the Tudor "Quasi Arc" process special iron electrodes are used, which furnish part of the weld material. In addition a strip of new metal is welded to the rail table across the joint. This method has been used in a good deal of repair work, rectifying "dished" rails by filling up the dishes with new metal, and grinding it off flush. This process is very highly spoken of by some tramway managers who have tried it for repair work. If it has been used for new construction, the writer has failed to see the notices.

Mr. Humphries, at the Newcastle Congress of the T. & R. L. Association, described another welded fish-plate method which he has developed and used on the Birmingham and Midland Tramway Committee's lines. It is an arc welding process, using a carbon negative electrode, the rail being the positive pole of the arc. The fish-plates are welded solid to the rails, after being tightened up.

Both the Tudor and the Humphries joints are therefore fish-plated joints of the usual form, with the fish-plates welded to the rails. This gets rid of the weakness of the fish-plated joint in permitting longitudinal movement of the rail under temperature and load stresses, and interposes a much greater resistance to relative vertical movements of the rail ends than the bolted fish-plate. These methods are exceedingly promising, and they do not leave the integrity of the whole joint dependent upon a weld, a fact which will recommend them to many people.

Some precautions must be taken to avoid burning the rail steel, and to ensure that the new metal run into the welds is of suitable character, especially when such new metal is run on the rail table across the joint.

In arc welding not more than 100 volts are needed across the arc and the steadying resistances. It is therefore highly advantageous to the supply and distributing plant to interpose a motor-generator between the trolley wire and the arc, as is done by Mr. Humphries, so reducing the current taken from the trolley wire by 80 per cent., as well as giving the operator the choice of polarity, which is of considerable importance in carbon arc welding.

The repair and reconstruction of tramway tracks which have been in use for from 10 to 15 years is now in progress in many towns, and engineers in charge should be able to exchange sufficient information bearing on the comparative merits and total cost—primary and maintenance—of the various jointing methods used on the older tracks, and those of more recent introduction, to permit of the formation of definite and authoritative opinions as to the most economical forms to adopt; and, it is to be hoped, to lead to a large saving in the future maintenance of permanent way and its paving.

ABSOLUTE MEASUREMENT OF ELECTRICAL RESISTANCE BY LORENZ'S METHOD.

(*Abstract of a paper by* F. E. SMITH, *of the* NATIONAL PHYSICAL LABORATORY. *From the Philosophical Transactions of the* ROYAL SOCIETY, 1914.)

IN the method devised by Lorenz in 1873 for the absolute measurement of electrical resistance a metal disc was rotated uniformly in a magnetic field produced by a circuit in a coaxial coil. Wire brushes made contact with the disc at the edge and centre, the circuit was completed through a galvanometer and a resistance R, and the induced voltage MCN was balanced against the P.D. RC, where M was the coefficient of mutual inductance of the coil and the circle formed by the disc edge, N the revolutions per second, and C the current traversing resistance and coil. Thus when balanced $R = NM$; and M being calculated from the dimensions of the coil and disc, R was determined.

Lord Rayleigh (*Phil. Mag.*, Nov. 1882) discussed Lorenz's method in considerable detail and came to the conclusion that, in spite of certain difficulties, it was the best that had been devised. The first of these was the necessary smallness of the resistance which could be measured directly, and he showed how it could be met by the use of shunted

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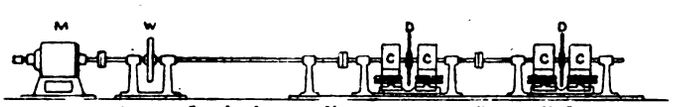
resistances, which have been utilised in part of the present work. He also pointed out the troublesome disturbances arising from thermo-electric effects at the sliding contacts, and from terrestrial magnetism. Both of these can, however, be eliminated. as is here fully shown, by taking a sufficient number of readings, with reversals of the current, provided precautions are taken to prevent sudden fluctuations in the magnitude of these effects.

The only serious difficulty remaining is the unavoidable error in determining the mean radius of the coil, which is involved in the calculation of the coefficient of mutual inductance; and Lord Rayleigh showed that, by using two coils separated to a considerable distance, it was possible so to proportion the radii and the distance apart of the coils as to reduce this error to negligible dimensions. Similar considerations apply to the discs. The apparatus was accordingly constructed with two discs, about 53 cm. in diameter, each with its pair of exciting coils, mounted on a 5-cm. copper-aluminium shaft whose magnetic permeability was indistinguishable from unity. Two shafts, one of phosphor bronze, of permeability 1.006, the other of less pure copper aluminium, of permeability 1.002, had previously been made and rejected. The whole arrangement with the driving motor is shown in Fig. 1.



M, motor; W, fly-wheel; D, D, discs; C, C, C, C, coils on cylinders.

FIG. 1.—GENERAL ARRANGEMENT OF APPARATUS.

The distance between the centres of the motor and of the nearest coil was amost exactly 4 m., at which distance the effect of the stray field on the mutual inductance was experimentally imperceptible, and a calculation by Searle of the effect of an equivalent iron sphere showed it to be no more than 1 in 10,000,000.

It was found impossible to avoid thermo-electric troubles with brushes making contact at the shaft and disc-edge, and the apparatus was therefore modified by making the discs mere carriers for ten insulated wires having their ends attached to ten segments fixed on the periphery of each disc, and passing through a central hollow in the shaft and along radial slots in the discs. The whole arrangement for a resistance measurement is shewn diagrammatically in Fig. 2, in which the current in the

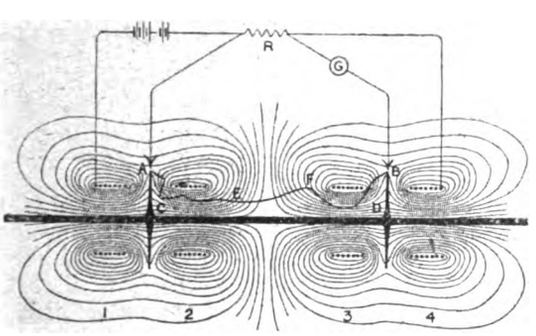


FIG. 2.—MAGNETIC FIELD AND DIAGRAM OF CONNECTIONS.

coils 1 and 2 is in the opposite direction to that in the coils 3 and 4, so that the resulting magnetic fields are opposed in direction, and the value of the fields at points in the neighbourhood of the edge of a disc is zero, or nearly so. Brushes of phosphor bronze wire, of the same alloy as that of the segments, make contact with the latter, and the P.D. between the brush contacts at the ends of a single wire, or that between five wires, is balanced against the P.D. between two points on a standard resistance, the current through which is the same as that flowing through the four coils. It should be noted that the P.D. produced between the ends of the rotating conductors, since these pass through the magnetising coils, depends, not on the shape of the conductors, but only on the positions of their ends. For example, the P.D. between A and B would be the same for either of the conductors A C D B or A E F B. The segments are insulated from the disc and from each other.

The high peripheral speed (about a mile a minute) of the discs as compared with that of the original Lorenz apparatus, largely increases the brush difficulties arising from thermo-electric effects and inconstancy in the resistance of the galvanometer cir- The brush of one to eight turns (generally three) of cuit, the latter being by far the more troublesome. fine stretched wire is shewn in Fig. 3, the wire being wound in screw cut grooves on small brass cylin-

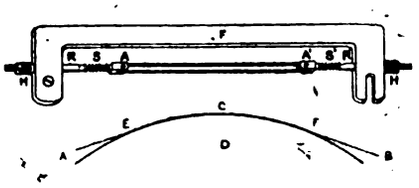


FIG. 3.—ONE OF THE BRUSHES.

ders which could turn about, or be clamped to, the axles A A¹. The ends of the wire were soldered to the cylinders, and the brush was put in tension by turning the milled heads H H. The spiral springs S S¹ were made of stout phosphor-bronze wire and were soldered to brass rods R R¹, of square section, sliding in square cut grooves in the frame F. Such a brush offers little resistance to a stream of air, and with the aid of copious petrol lubrication, its vibration could be reduced to a practically negligible amount by suitably adjusting the tension. Moreover, as shown diagrammatically in the lower part of Fig. 3, a stretched wire A B is capable of a long contact arc E F with the disc D, and the maximum pressure, and therefore. the maximum rise of temperature, with corresponding maximum thermo-electric effect, will occur close to the mid-point C, falling to zero at E and F. The brushes could be placed either all ten in series, giving an unbroken P.D. due to five rotating conductors; or in two sets of five in parallel, giving the same P.D. as from a single rotating conductor. Under the latter conditions the rapid variations in thermo-electric voltage could often be kept within 0.1 microvolt, less than a fiftieth of the variation in the case of any other form of brush experimented with.

In order to maintain the balance of the bridge over a considerable time for a series of readings, the following method of speed regulation was adopted:—A condenser placed in one arm of the bridge was charged and discharged four times per revolution by means of a commutator on the motor shaft, the other arms consisting of platinum-silver resistance coils. To ensure constancy in the arms of the bridge, the condenser and coils were kept in a constant temperature room, a small variable resistance in series with one of the arms being adjusted to secure a balance when the speed was that best suited to the measurement to be made. The speed of revolution was then maintained constant by an assistant applying a variable pressure to the flywheel in such manner as to keep the spot of light from the galvanometer in a constant position. This was essential in view of the fact that balance resulted only from a particular frequency of charge and discharge, and it was found possible, for twenty minutes' runs, to keep the maximum deflection of the spot within 2 mm. The speed was calculated from the record of a chronograph-drum capable of operating for 80 minutes, controlled through a mercury contact on the pendulum of the standard clock and a relay operated continuously by the current.

The cylinders on which the coils are supported are of "First Statuary" Carrara marble. Sixteen

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cylinders were prepared in the rough, and twelve rejected for small flaws and veins discovered after turning up from specially selected blocks. The four selected cylinders were then accurately turned, and double helical grooves cut in them to receive the coils, a process occupying about four weeks. The coils were wound under a uniform tension equivalent to a weight of about 4 kilogrammes. The mean diameters, and the pitch, respectively, of the coils were determined by a series of elaborate measurements made by specially designed measuring machines, constructed by Sir W. G. Armstrong, Whitworth and Co., who also built the heavier portions of the apparatus itself, the lighter parts being made in the National Physical Laboratory, where it is permanently installed as a memorial to the late Professor J. Viriamu Jones. The Drapers' Company of London, which had promised him the funds for the construction of such an instrument, placed £700 at the disposal of the National Physical Laboratory for the memorial, and Sir W. G. Armstrong, Whitworth and Co. were kind enough to render material assistance by executing their portion of the work at considerably less than its actual cost.

Before assembling the parts of the machine, a concrete block, built up of Keene's cement and Thames ballast, was prepared as a foundation. This block is non-magnetic, is 8 metres long, 80 cm. wide, and 120 cm. deep. Slide rails of gun-metal were bolted in position on this block, and to secure greater stability the rails were sunk 5 cm. into the concrete. The rails are in three pairs: one pair supports the motor; a second pair the fly-wheel; and the third pair, nearly 4 metres in length, supports the portions with the rotating discs. A period of twelve months was allowed for the concrete block to assume approximately constant dimensions, and at the end of that time the upper surfaces of the rails were scraped to obtain flat surfaces and to ensure these surfaces lying in the same horizontal plane.

After the alignment and running adjustment had been completed no portion of the machine gave the slightest trouble. The parts are so well balanced that the tremor of the concrete base is scarcely perceptible. The pair of reading microscopes used to determine the distance apart of two coils, are in consequence found to give readings which are reliable to within a thousandth of a millimetre, even at 1,040 revolutions per minute.

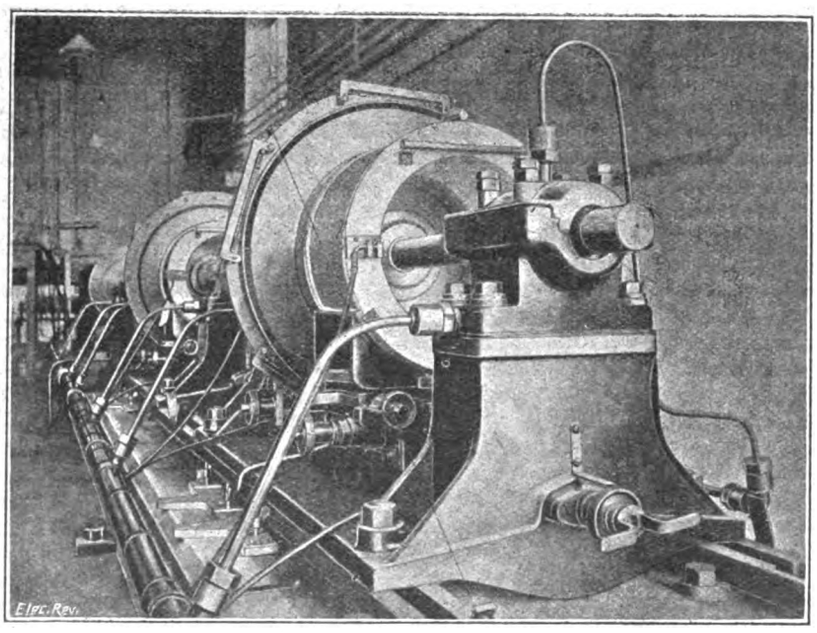
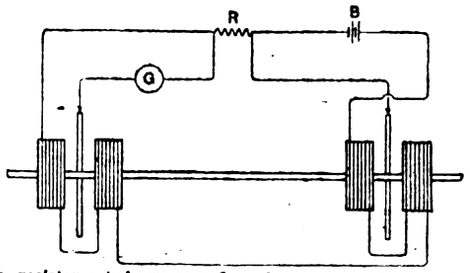


Fig. 5.—End View of Lorenz Apparatus.

The coefficient of mutual inductance of the coils was obtained in terms of elliptic integrals by means of J. Viriamu Jones's formula (Roy. Soc. Proc., vol. 63, p. 198, 1898), the values of the integrals being calculated by interpolation from Legendre's tables; and in order to check possible inaccuracies in the tables, a number of the integrals were calculated by quadric transformation. The formula used for the corresponding coefficient for coils and contact circles was one due to Rosa and Grover, which, for a long coil, is very exact and easy to use to the precision required. Corrections for conicality in the coils and for variations in pitch, which are fully discussed in the paper, were applied. They were very small in amount.

The coils were adjusted to parallelism to the shaft by the aid of micrometer readings which were found to agree within 0.01 mm., and coaxiality was obtained, originally by a mechanical method subject to an error not exceeding 0.02 mm., afterwards discarded for an electrical method fully described in the paper, which reduced the error to 0.01 mm., and an error 0.1 mm. would introduce an error into the



R, resistance to be measured; B, battery; G, galvanometer.

Fig. 4.—Diagram of Connections.

resistance measurements of about one part only in 100,000,000, which would of course be quite negligible. The coils on all of the cylinders were adjusted to the same mean distance from the contact circles by successive balancing, with reversals of the current to eliminate effects due to difference of flux through the discs, arising from the current. The error was within 0.1 mm., which gave the accuracy required.

The arrangement of the apparatus for a measurement is shown in Fig. 4, the resistances measured being of the nominal values 0.001 ohm, 0.002 ohm, and 0.01 ohm. Fig. 5 shows the apparatus as seen from one end, and fig. 6 is a side view, showing the whole of the apparatus with the exception of the motor.

The possible magnetic field due to the current in the leads was found to be negligible, as also were possible electrostatic effects. The possibility of error in the calculation of mutual inductance owing to the finite section of the wire has been investigated by Searle, who has shown the correction to be negligible. The author points out, in conclusion, that:—

"The determination of a resistance in absolute measure is subject to a number of small errors, the greatest of which is associated with the determination of the mean radius of the coils. This error is probably not greater than one part in 100,000, and if the remaining errors were all of one sign it is unlikely that their sum would exceed another one part in 100,000. We believe, therefore, that the absolute measurements of resistance which we have made are correct within 2 parts in 100,000."

The mean of the results tabulated leads to the conclusion that:—

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A resistance of one international ohm is equal to 1.00052 ± 0.00004 ohm (10^9 cm./sec.), the possible error ± 0.00004 being approximately the sum of those involved in the realisation of the ohm and the international ohm. From this it follows that:—

The ohm 10^9 cm./sec. is represented by the resistance at 0°C. of a column of mercury 14.446 ± 0.0006 gm. in mass, of a constant cross-sectional area (the same as for the international ohm) and having a length of 106.245 ± 0.004 cm. Some of the principal previous determinations are:—

1882, Rayleigh	...	106.26 cm.
1882, Glazebrook	...	106.25 ,,
1883, Rayleigh	...	106.24 ,,
1885, Wiedemann	...	106.265 ,,
1889, Dorn	...	106.243 ,,
1892 Himstedt	...	106.259 ,,

We may therefore accept Mr. F. E. Smith's claim that the instrument here described "may be used for absolute measurements of resistance with a precision satisfying all present demands whether purely scientific or technical." Moreover, as he points out, "it can be used at any time; the dimensions of all its parts can be checked when desired, the probable error associated with a single measurement is small, and the observations do not unduly tax the experimenters."

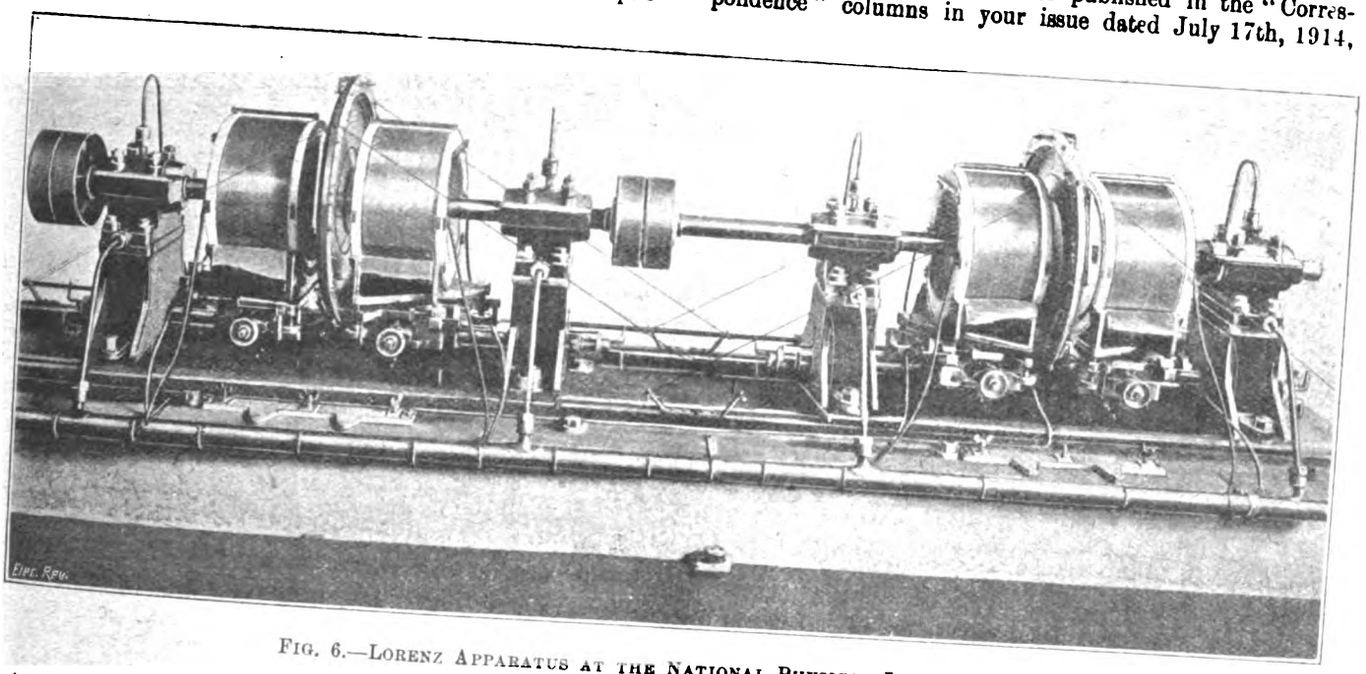

FIG. 6.—LORENZ APPARATUS AT THE NATIONAL PHYSICAL LABORATORY.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Appointments in West Africa: A Warning.

I have read with interest letters inserted at different times, warning those who apply for positions in the Far East and India, but I should like to put on their guard electricians who think of applying for positions in West Africa. No one who has had an electrical training in the workshop, or lighting station, should go out there (under the various designations of electricians, mechanicians, &c.) under a salary of £300-£350 per annum, with *first-class passage* out and home. The latter should be insisted upon, otherwise they will be made to travel second-class in the Colonies, which only those who have been out there can understand. It is enough to say that any self-respecting European would be turned sick at the sight.

I must also point out by way of comparison (as his salary is none too high for existence) that a platelayer who gets his 18s. to 25s. a week in England, out there receives £220-£250 per annum, plus a travelling allowance of 3s. per day.

Electricians, who are usually stationed only at large towns, where the cost of living is very high, do not draw any allowances, on account of not travelling, so have only their bare salary to live on and to provide an outfit which at least runs into £25, and are compelled to subscribe to various Government funds, which rob them of about £20 per annum. They are usually in debt for the first six or seven months in the colony, and longer if they make friends and wish to join in the social life of the place. I dare not venture to touch on the health point, which, I think, is only too well known, or point out how it unfits one in many cases for work at home.

A Victim.

Mica and Micanite.

I have read with much interest the remarks of Messrs. Wiggins & Sons, in their letter published in the "Correspondence" columns in your issue dated July 17th, 1914, and it is with pleasure that I take the opportunity of expressing agreement with them in their complaint about the loose way in which mica and micanite are specified and supplied. The trouble and annoyance caused by the apparent lack of accurate distinction between mica and micanite cannot be overrated, and, as a designer of apparatus in which very large quantities of both pure mica and heat-resisting micanite are used, I should be very glad to see the matter taken up by the Electrical Standards Committee or the Institution of Electrical Engineers, as, owing to the importance of mica and micanite in the electrical industry, it is surely a matter which comes within the scope of these bodies.

Instances are within my knowledge where micanite has been supplied by manufacturers when mica has been ordered. True, the micanite appeared to have been made up of virgin amber mica, yet the cement used in its construction made it quite unsatisfactory for the purpose for which it was required. The provision of the wrong article in these cases was not, I feel sure, in any way due to a wish on the part of the suppliers to provide a cheaper article, but merely to a misunderstanding of the customer's exact requirements owing to the present indiscriminate use of the terms "mica" and "micanite."

H. W. H. Warren.

Bristol, *July 25th*, 1914.

Tubular Light Sources.

In your issue of July 17th there is a paragraph, quoted from the *Electrical World*, which refers to the intensity of illumination due to tubular sources of light.

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The statement is made that the intensity from such a source varies inversely as the distance. That this is incorrect is shown by the accompanying diagram (fig. 1). P Q is the tubular source. A B C D is the illuminated area.

At twice the distance from the tubular source, the light passing through A B C D will cover the large area A_1 B_1 C_1 D_1,

FIG. 1.

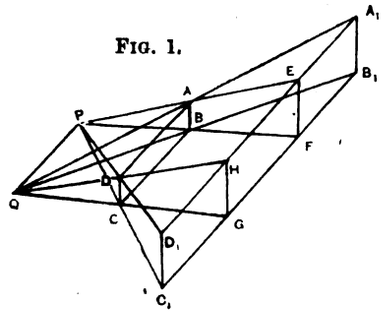

FIG. 2.

which is more than twice as large as A B C D. The intensity of illumination over A_1 B_1 C_1 D_1 will be less than half that over A B C D.

The law connecting intensity of illumination with distance from source for a line source is extremely complex. It approximates more nearly to the inverse square law than to variation inversely as the distance. This is shown by the following example.

Consider a point source of light of 9 C.P. At 1 ft. the intensity is 9 ft.-candles, at 2 ft. the intensity is 2·25 ft.-candles. Now imagine this point source replaced by nine 1-C.P. lamps placed 1½ in. apart, so as to cover a total distance of 1 ft. (fig. 2). With this arrangement the intensity over a small area placed 1 ft. away is 8·01 ft.-candles, if the area is placed 2 ft. away the intensity is 2·17 ft.-candles. The intensity is in each case less with the line source than with the point source, and the law with the line source approximates to the inverse square. It is clear that the greater the distance the closer the approximation.

H. B. Howard.

Clare College, Cambridge.
July 20th, 1914.

[If a *short* tube is considered, obviously the conditions will approximate to those obtaining in the case of a point source; but if the tube is long, as in the case of the Moore light or the Neon lamp, the statement quoted from our contemporary is practically correct. Our correspondent in fig. 1 fails to take into account the light which, emanating from P Q, reaches A_1 B_1 C_1 D_1 without passing through the area A B C D; this is the greater as the length of the tube is greater.

The subject is admittedly complex, and rather than attempt to demonstrate the truth of the note in question, we have recourse to the unimpeachable authority of Mr. A. P. Trotter:—"It may be shown mathematically that when a source of light is an indefinitely long line, the illumination produced by it on a surface facing it is inversely as the distance of the surface from the line." ("Illumination," p. 121).—EDS. ELEC. REV.]

Proposed Central Testing Institution.

The letter *re* above in your Correspondence columns is full of matter, important not only to the electrical industry, the public and commerce generally; but it has also a national and international bearing of some importance on exports and imports, as well as other points.

As the Industrial Committee of the I.E.E. is dissolved, I think the insertion of Mr. Wordingham's letter at this period is most fitting, and it is up to those whose interests are involved that the matter should be vigorously tackled in some such way as suggested.

From the aspect of national enterprise, such an institution is much to be desired. I am not surprised that the electrical industry did not support the idea when put forward, by Mr. Wordingham in his paper to the I.E.E. in 1899. "John Bull" ever was slow to take up anything in the nature of an innovation; it is only when a matter begins to have any adverse effects that "John Bull" becomes active. It is obvious that something ought to be done in the matter, and I heartily agree with Mr. Wordingham that such an institution should be British and set its own standards.

The value of such an institution would grow more and more, and if those who have not given the subject thought will now do so, I am sure they will be struck with the amount of material pointing to the need of it.

I trust that the matter will be treated with that zeal and continuity of effort it deserves, and that we shall have in our midst the finest institution of the kind at no distant date.

G. St. John Day.

Oldham, *July 27th*, 1914.

The Training of the Instrument Maker.

The matters raised in Mr. R. W. Paul's letter in your current issue are of much importance to electrical engineering. It is often forgotten that engineering is based on measurement.

I do not think that manufactories in the London district suffer to the same extent as do works in the provinces from the dearth of well-trained instrument makers and of apprentices. This is largely due to a natural preference on the part of the best trained men to remain in and about the centres of the trade.

A somewhat lengthy acquaintance with successive influxes of apprentices into electrical engineering (not confined to one or two factories only) has made it clear to me that there is an unwillingness to adopt the lighter sides of the business, such as instrument making. The glamour of large machines and power plant is too much for them.

Thus it is that some manufacturers in the provinces have found it well specially to organise their methods of manufacture, and to some extent to rearrange their designs—doing more and more of the work as machine work, and replacing, for instance, certain hitherto orthodox types of construction and finish.

This has enabled them to employ, for much commercial instrument-making at any rate, the labour procurable in the district. Obviously for much work, and especially development work, the skilled, well-trained man is essential, and any plan for attracting more apprentices and inducing them to become interested and efficient is welcome.

Mr. Paul's interest in this matter is a favourable sign. Speaking from a fairly long experience, there are many points in the design of new and special instrument work which cannot always be satisfactorily dealt with in the drawing office, and are developed on the bench. Here comes in the skilled interested man, and there "isn't enough of him."

Good and tactful foremanship is more essential in instrument making than in any other branch of electrical engineering, especially if apprentices are to be well trained and encouraged—bullying methods on the foreman's part are disastrous and should be checked early.

C. H. Wright.

Chelmsford, *July 27th*, 1914.

Technical Errors in the Lay Press.

I read your leader in the issue of May 29th with great interest, and as showing the justification of what you say, I enclose a cutting from the *Daily Telegraph* of July 4th last, confirming every word of your article.

It seems astounding that such a well-known and otherwise careful paper should print such a lot of "rubbish" without apparently taking the slightest trouble to verify technical details, which could have been done so easily.

The "Hugo" referred to is the "Hughes," which in French is pronounced with a hard "g." Submarine cables, including the Atlantic cables, have been duplexed for very many years.

What the writer really intended to refer to was the establishment of Duplex-Baudot working on the Algiers circuits. The Baudot was duplexed in England in 1910,

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but it is only this year that the French Administration has adopted Duplex-Baudot.

G.P.O., London, E.C. **A. C. Booth.**

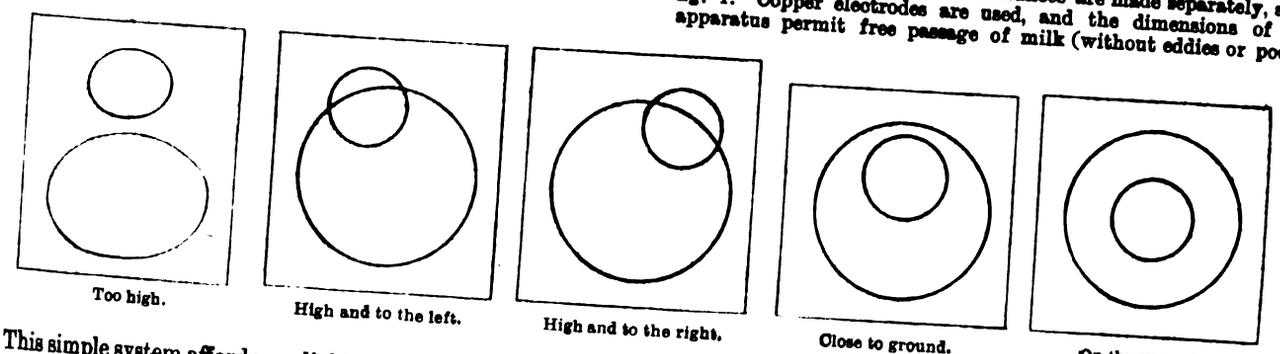
[The cutting deals with a "Striking French Discovery," "Duplex Working on Submarine Cables" (headlines), and enthusiastically describes the application of duplex working to the Marseilles-Algiers cable on the Baudot system. The writer says "at last it was announced that the secret had been found for transmitting over the same cable and simultaneously a separate dispatch from each end."—EDS. ELEC. REV.]

OPTICAL SIGNALS FOR AEROPLANES AND SHIPS.

[BY OUR BERLIN CORRESPONDENT.]

SEARCHLIGHTS have been used successfully by aeronauts and airmen for finding their way by night or in dense fogs. A Berlin architect, Edgar Hönig, has recently patented a new type of optical signal likely to prove even more useful in this connection, and which, moreover, lends itself to other applications.

This signal comprises a system of two or more circles (or similar figures) arranged behind, inside or below one another, vertically or horizontally, so that their centres will coincide. Their peripheries are, by night (or in case of fog), outlined with electric lamps.



This simple system affords a reliable means of indicating to aircraft, or vessels, their position with regard to a given point (vertically or horizontally), by their observing the variable perspective of the circles as seen at different angles. When viewed from the front they appear as circles, from the side as vertical, and from the top as horizontal, ellipses. Their intersections afford additional information as to their position with regard to the observer.

The arrangement so far chosen consists of two vertical glow-lamp circles of different diameters installed behind one another, on the ground, so that an airman will see two concentric circles at the moment when his aeroplane is on or close to the landing ground. By a proper arrangement of the luminous circles (at right angles to the landing ground and at right angles to the landing direction) it is thus possible to give the airman accurate signals as to the direction to be chosen, and as to his distance from the ground.

The airman, in landing, should so control his aeroplane that the two luminous ellipses lying above one another are seen to intersect, in order afterwards to plane down towards them, until the ellipses are slowly changed into circles and, instead of cutting one another, approach the position of concentric circles. At the moment when the small circle is seen inside the larger one, he knows his aeroplane to be only a few metres distant from the ground and may commence landing operations in the direction of the optical signal. By observing the visual angle of the latter, its distance from the observer is readily gauged.

The applications of this optical signal are many: On flying grounds, aerodromes, provisional intermediate landing grounds, &c., it should be installed permanently. During army manœuvres and in warfare, it will be readily carried by the troops, along with the tents, &c., in order, at night-fall, to be used for airmen who are expected to arrive. It will render similar services to the Navy, in connection with waterplanes, and, finally, it may prove of great use in navigation, for signalling the entrance to a harbour, the more so as there is absolutely no risk of confusion with other lights.

ELECTRICAL TREATMENT OF MILK.

TOWARDS the end of 1911 samples of milk, through which continuous current had been passed between tinned copper electrodes, were examined by the City Bacteriologist of Liverpool. It was found that profound changes had been produced in the composition of the milk, but that the only sterilising effect was that due to heating by the heavy current used in some of the tests. Further investigation showed that sterilisation could be produced by unidirectional or slowly alternating current when minute quantities of salt were added to the milk. The electrochemical sterilisation thus produced, though effective in itself, caused such profound changes that milk so treated was spoiled from the consumer's point of view, hence this method had to be abandoned. The effect of static charges of electricity across a moving film of milk formed the basis of the next series of experiments, but no appreciable sterilisation could thus be produced. The effect of a rapidly alternating current was then examined, and thence was evolved the system which has now proved successful. Even in the early stages of work with this method, it was shown that the bacterial content of milk could be reduced to a minimum without appreciable effect on the chemical constitution of the latter.

The sterilising apparatus or lethal tube, designed by Mr. F. C. Lewis (Assistant Lecturer in Bacteriological Methods, Liverpool University), and described by Dr. J. M. Beattie, City Bacteriologist, in a report to the Health Committee, consisted originally of a long tube with three bulbs accommodating copper or other electrodes. The central electrode and the two outer electrodes in parallel were connected to the terminals of a H.T. transformer. The whole apparatus was insulated by glass supports, and milk was passed through the tube from a given height at a known speed. In the latest apparatus, electrode entrances are made separately, as in fig. 1. Copper electrodes are used, and the dimensions of the apparatus permit free passage of milk (without eddies or pools), while ensuring thorough sterilisation of all milk passing through the lethal tube. The separate electrode chambers are connected by suitable lengths of glass tubing with rubber joints (fig. 2, p. 170). The flow of milk can be regulated by the operator, and the outlet connections prevent infection after treatment.

From 140 separate daily tests it appears that bacillus coli and others of this group (nearly always found in milk, and particularly

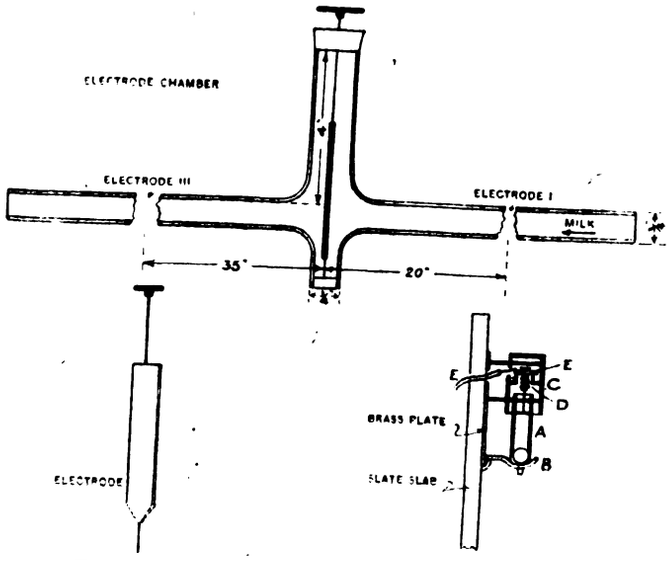


FIG. 1.—DETAILS OF TUBE AND ELECTRODES.

abundant where manurial contamination is present), are completely destroyed, and with them the bacillus of typhoid fever, if ever present. The pus, or abscess-producing bacteria (staphylococci, &c.), are also destroyed, and inoculation experiments show that milk, infected naturally or artificially with the bacillus of tuberculosis, is completely sterilised by high-tension electrical treatment. Bacteria which caused septic poisoning in inoculated animals were also destroyed, or so reduced in number as to render them harmless.

Only in rare instances was the milk rendered absolutely sterile, but it was free from dangerous or disease-producing bacteria and from ordinary milk souring bacteria, while there was over 99 pe

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cent. reduction in the number of all other forms of bacterial life. A tumbler of milk merely covered to prevent dust contamination would be quite sweet and drinkable three days after it had been treated, and samples kept absolutely free from air contamination have been found quite palatable after seven or eight days. Reports of chemical examination by Mr. W. H. Roberts, city analyst of Liverpool, show that the chemical composition of milk is unaltered by the treatment described, and that, due to the destruction of acid-forming bacteria, there is retarded increase of acidity and increased keeping power in treated milk. The lactalbumin, which is coagulated in ordinary sterilised milk, is not coagulated in electrically-treated milk, and, in addition, enzymes are not destroyed. Bacteria remaining in the electrically-treated milk have been isolated, and experiments are being conducted to find a means whereby even these can be destroyed economically. They are, however, comparatively few in number, and, as far as can be ascertained, not concerned in the production of disease, hence their presence does not affect the value of the present process for the treatment of milk for infant feeding.

Such satisfactory results were obtained with the experimental equipment (treating 6¾ gallons per hour in a single lethal tube) that a larger plant was installed at the Corporation milk depôt, Earle Road, in 1913. The whole of the milk sent out from this

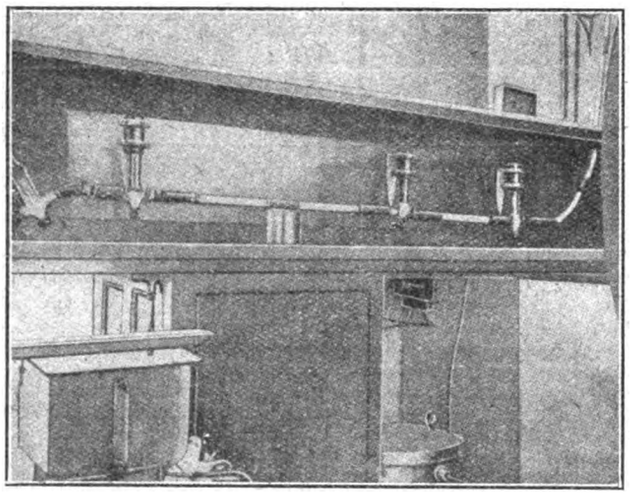

FIG. 2.—LEWIS APPARATUS FOR STERILISING MILK.

depôt and one-third of the Netherfield Road supply is now treated electrically, the transference from heat to electrical sterilisation being made without a day's interruption in the supply.

On the upper floor at Earle Road there is a tank capable of holding the full day's supply of milk and connected to a smaller ball-valve tank. The latter constant-level tank is connected to the lethal tube in the ground-floor room (fig. 2), the flow being maintained by gravity. After leaving the lethal tube (at the left of fig. 2) the milk flows into receiving tanks, whence it passes to bottling apparatus in the basement. During its passage through the lethal tube the milk is subjected to 2·0-2·3 amperes at 3,900-4,200 volts, and is exposed to a maximum temperature of 60-64° C., but for such a few seconds that heating effects can be neglected. The outlet thermometer is clearly visible to the left of fig. 2.

The electrical equipment comprises a D.C.-A.C. motor-generator set in the basement, a high-tension transformer, together with a current transformer, a pressure transformer and the usual switchgear and regulating devices. The transformers are kept in an asbestos-lined, fireproof cupboard below the lethal tube (fig. 2), the lethal tube cupboard is glass-fronted, and the switchboard is placed so as to give the operator control over the whole installa-

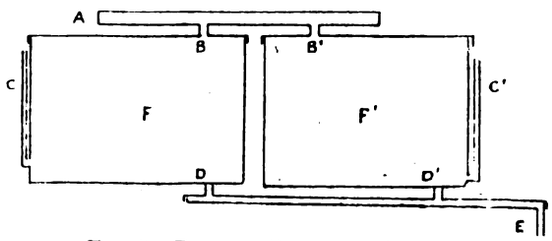

FIG. 3.—PLAN OF RECEIVING TANKS.

tion. The construction of the electrode chamber and its bracket is shown in fig. 1, in which A represents the electrode chamber, B the curved supporting claw (see also fig. 2), C a vulcanite protecting cap, D a helical spring connection, and E the high-tension cable. The vulcanite cap C fits over the chamber A, and a contact disk carried by the spring D bears on the nail head of the tube electrode (see fig. 1, left).

Before and after passing through the lethal tube, the milk passes through earthed aluminium tubes visible to right and left of the first and last electrodes in fig. 2. High-tension shock from the supply and receiving tanks is thus impossible. Switches are so placed that the system cannot be live while the cupboard-doors are open; hence, with ordinary care, there is no danger to the operator.

Soon after the Earle Road apparatus was started, difficulties were met with in "flashing" and charring of the milk. By substituting copper for the aluminium electrodes first used in the large scale plant, the difficulty was overcome. Since, however, flashing (giving a burnt taste to the milk) might occur at the end of a shift, and spoil the whole supply, two small supplementary tanks have been installed. Two small covered tanks, F F^1 (fig. 3) are fitted with gauge glasses, C C^1, and their inlets B B^1 connected by an open channel A, and their outlets D D^1 by a covered channel discharging to the main receiving tank. When tank F has been filled, the delivery tube from the lethal tube is transferred to tank F^1, a small quantity of milk being meanwhile collected in the testing trough A. This milk is tested, and if it is found that all the electrodes are working satisfactorily, and flashing not occurring, tank F can be emptied into the main tank, and so on.

The quantity of diluted milk handled daily at Earle Road is from 100 to 125 gallons, and this amount has to be distributed in about 3,000 bottles. To eliminate recontamination of sterilised milk, the shape of bottle has been altered to facilitate cleaning, and ordinary corks are now used instead of complicated spring and rubber stoppers, which were undoubtedly a source of contamination. Further to reduce opportunities for contamination, a much simpler filling apparatus has been brought into use.

The conclusions to be drawn from the work carried out at Liverpool are:—That the electrical treatment practised is a commercially practicable method of reducing the total number of bacteria in milk by 99·93 per cent., and of destroying all disease-producing bacteria originally present. No appreciable number of milk-souring bacteria escape destruction, and milk will keep perfectly sweet for three or four days after treatment (longer if protected from after-contamination). The chemical composition and taste of the milk are unaffected, so that, from this point of view, the description "raw milk" is accurately applicable. Milk treated by the Lewis process is claimed to be perfectly satisfactory as a food for infants, and as nearly sterile as appears to be necessary or advantageous.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Mazda Lamps.

THE BRITISH THOMSON-HOUSTON CO., LTD., of Mazda House 77, Upper Thames Street, E.C., have issued a new price list covering the complete range of Mazda drawn-wire automobile, battery and flashlight lamps. This list includes in the automobile

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 1.—MAZDA LAMP FOR MINERS' LANTERN.
FIG. 2.—PLAN OF "MERIDIAN" LAMP FILAMENT.
FIG. 3.—MAZDA "MERIDIAN" LAMP.

section, headlight, sidelight, tail-light and steering pillar light lamps, and domelight, festoon and tubular lamps for interior lighting. A noteworthy feature is the inclusion of a full list of specially capped headlight, sidelight, and tail-light lamps for American cars.

The list also contains particulars of a number of miscellaneous types for battery service, such as motor-'bus lamps, common battery lamps, illumination lamps and flashlight lamps. The list prices of the last-mentioned lamps have just been considerably reduced. Fig. 1 shows a miners' lamp with a special taper shell peg cap. Another type, which should have many useful applications, is the Mazda "Meridian" lamp, illustrated in fig. 3. This has the filament, of drawn tungsten wire, wound in a very close spiral, and mounted in the horizontal plane so as to throw the light downwards. A close-fitting opal reflector can be supplied which helps to concentrate the light in the downward direction. Fig. 2 shows the star-shaped filament in plan.

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Explosion-Proof Circuit-Breakers with Instruments.

In a new range of explosion-proof circuit-breakers recently introduced by the GENERAL ELECTRIC CO., of 67, Queen Victoria Street, E.C., provision is made for attaching an explosion-proof pedestal type instrument which is provided with long well-machined flanges to give the metal-to-metal joints similar to those between the circuit-breaker lid and box. The covers of these

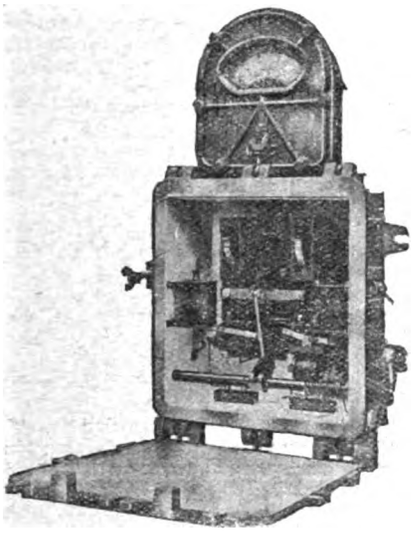

FIG. 4.—G.E.C. EXPLOSION-PROOF CIRCUIT-BREAKER (OPEN) WITH EXPLOSION-PROOF AMMETER ATTACHMENT.

attachments are strongly bolted on, in order to resist the effects of any internal explosion, and the strong plate-glass window has wire netting embedded in it, which, in addition to strengthening the glass, holds the pieces together in the event of breakage. The inclusion of such an attachment in explosion-proof circuit-breakers permits the connections between the ammeter and the circuit-breaker to be neatly arranged.

New Transformer.

We have received from the GES. FUR ELEKTRISCHE INDUSTRIE, of Vienna, particulars of some new type transformers with cooling ribs, which are manufactured by them. The construction adopted is claimed to give very effective cooling, and consists of the assembly with the coils of aluminium plates, $\frac{1}{50}$ in. thick, coated with black heat-absorbing paint.

The transformer core, built up of wrought-iron sheets, also has the cooling rib contruction at the corners.

Fig. 5 shows a 5·5-K.V.A. 110/500-volt tranformer, which, we gather, with an average temperature rise of 47·5°, developed 6·82 K.V.A. with the ribs, and 3·35 K.V.A. without them, the ratio of

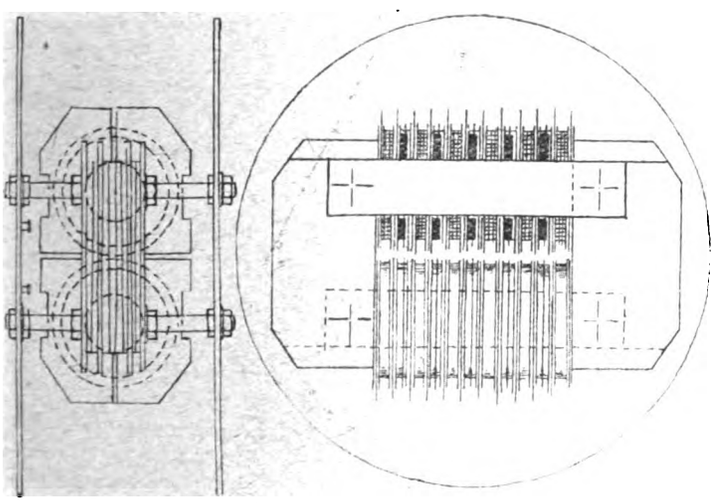

FIG. 5.—TRANSFORMER WITH COOLING RIBS.

copper and iron losses remaining constant during the two tests. The use of radiating ribs is claimed to result in uniform heating in all parts of the transformer, and to avoid cases where coils are burnt out, although the temperature at the level of the oil appears to be quite satisfactory.

B.T.H. Railway Motors.

By the courtesy of the BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, we are enabled to give the following particulars of the direct interpole ventilated railway motors which they are at present building at their Rugby works for the Central Argentine Railway. These motors are for use on an 850-volt D.C. system, and are rated at 250 H.P. each; they are arranged for tapped field control, enabling speeds up to 65 miles per hour to be obtained. Efficient ventilation is provided by a fan attached to the armature shaft, which draws air through a screened inlet over the armature and back through longitudinal ducts in the core, ensuring uniform removal of heat and the elimination of hot spots. In this way the radial ducts, which are used in the ordinary type of armature, are eliminated, making it possible to build a much tighter core and completely to protect the armature coils on the under side. The armature coils are insulated with mica, this material being used wherever possible throughout the motor. The field windings consist of copper strip insulated with asbestos and impregnated, any movement or chafing being effectually prevented by spring flanges which hold the coils in position. All the external leads

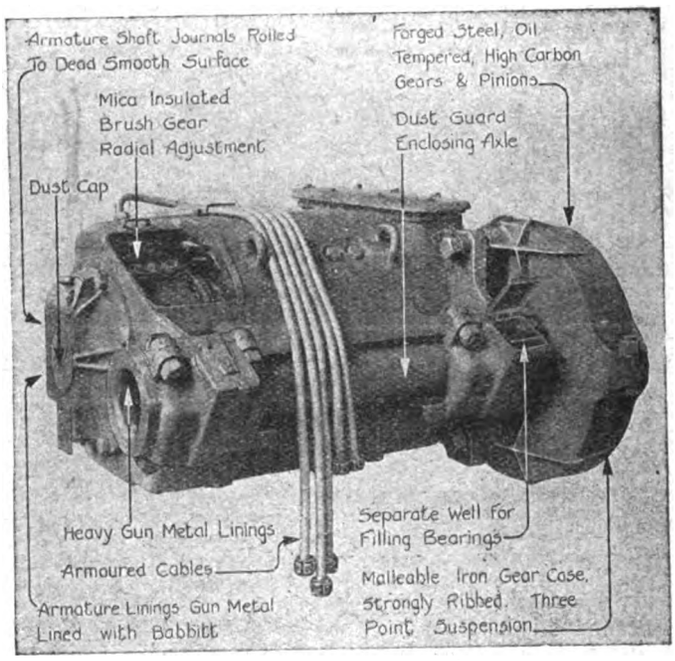

FIG. 6.—B.T.H. 250-H.P. RAILWAY MOTOR.

from the motors are encased in flexible metallic tubing, which effectively protects the insulation from injury. The axle bearings are fitted with heavy gun-metal linings, and the armature bearings are of gun-metal lined with Babbitt. That part of the axle between the bearings is enclosed by a dust-guard, a dust-cap being also fitted to the armature shaft bearing at the commutator end, so that all access of dust to the bearings is prevented. The gear case is of malleable iron, strongly ribbed to enable it to withstand heavy shocks, and arranged for three-point suspension, the gears and pinions being of high-carbon oil-tempered forged steel.

All parts of the motors are subjected to stringent tests at various stages during their manufacture, and each completed motor is

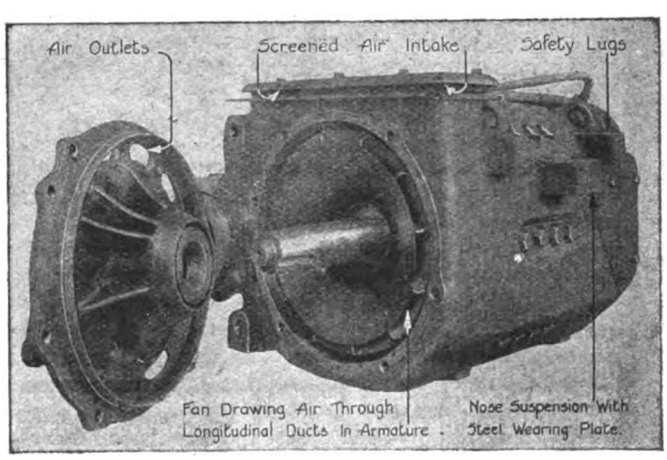

FIG. 7.—MOTOR WITH END COVER REMOVED, SHOWING FAN.

thoroughly tested to ascertain that its performance agrees with the requirements of the original design, readings being taken of efficiency, temperature rise on load, &c. The insulation is subjected to high potential tests calculated to show up the slightest defects.

"Altior" Process of Die Casting.

A novel form of automatic die-casting machine is just being perfected by NATIONAL ALLOYS, LTD., Ilford, London, E., with the object of die-casting light aluminium alloys, of specific gravity 2·85. It is also adapted for die-casting other non-ferrous alloys, such as Babbitt's metal, zinc alloys, &c.

A furnace with the necessary crucible to contain the molten metal forms the base of the machine. Bolted to this is a neck piece with a domed cover, near the centre of which is formed a

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pocket, having screwed into it a circular block of specially hard metal, bored out to form a taper nozzle, and slotted to take the sprue-cutting bar. In this pocket and around the taper nozzle is a small furnace which keeps the metal perfectly molten right up to the time of entering the die. Held in place by means of a gland and stuffing box on the under side of the nozzle is a tube of refractory material which passes down through the molten metal to within about half-an-inch from the bottom of the crucible. Through a gland in the domed cover a spindle runs down into the crucible, carrying two perforated disks, which are plunged up and down in the molten metal by means of a hand lever, thus keeping the metal well agitated. A hole and cover for same is also placed in the domed cover to allow of the crucible being filled without removing the cover. Hinged to the domed cover is a plate to which is fixed the bottom half of the die to be cast from, and having in the centre a hole to register exactly with the nozzle before mentioned in the circular block of hard metal, and also with the filling hole

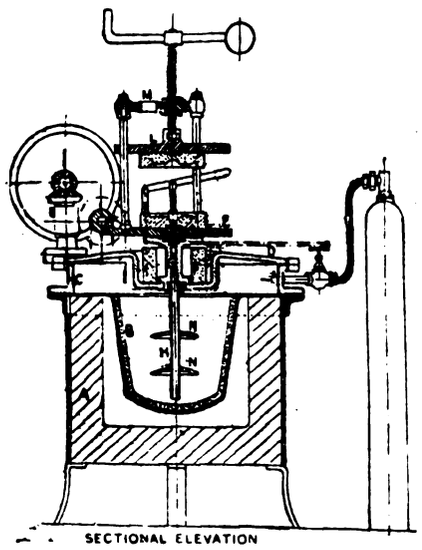
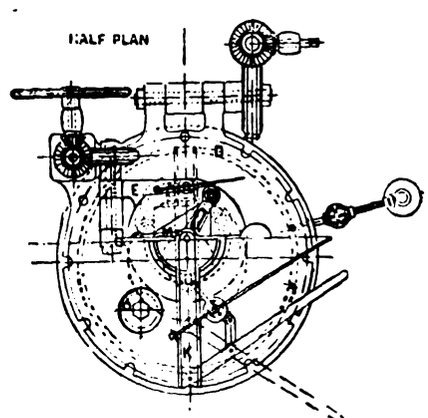


FIG. 8.—SECTIONAL VIEW, DIE-CASTING MACHINE.

in the bottom half of the die. The hinged plate referred to is tilted back into any desired position by means of a suitable bevel and worm gear. Screwed into the hinged plate are three bright mild steel pillars carrying a bridge piece, through the centre of which works a double-threaded quick-running screw, operated by a heavy hand-wheel or cross-bar at the top, and carrying at the other end a plate registering on the three bright pillars referred to. This plate carries the top half of the die. The domed cover,



A.	Furnace	H	Refractory Tube
B.	Crucible	K	Sprue Cutting Bar
C	C.I. Neck Piece	L	Top Die Plate
D	Domed Cover	M	Bridge Piece
E	Bottom Die Plate	N	Mixing Discs
F	Small Furnace	O	Filling Hole
G.	Hard Metal Nozzle		

FIG. 9.—ARRANGEMENT OF DIE-CASTING MACHINE IN PLAN.

together with the centre tube agitating disks and all the top gear, is capable of being thrown back by means of a worm gear, thus allowing the crucible to be readily got at.

The metal to be melted is placed in the crucible through the filling hole before described. The furnace is lighted, the bottom half of the die is fixed to the hinged plate, and the top half to the plate carried by the quick-running screw. This is now run down so that the top and bottom halves of the die are brought tightly together (multiple-part dies can also be used). The sprue-cutting bar is put into position so that the molten metal cannot pass through the nozzle, and the hinged plate is clamped down. Connected to the neck piece is a cylinder of liquified gas, the valve controlling which is now opened, allowing the gas to exert pressure on the top of the molten metal in the crucible. The sprue-cutting bar is then pulled back, thereby allowing the metal to be forced up into the die. The sprue-cutting bar is now pulled back again, thereby stopping any further flow of metal, the hinged plate is unclamped, and the whole of the top gear is thrown back by means of the bevel and worm gear, on to a suitable table; the top half of the die is pulled up by means of the screw, and the casting is automatically knocked out by means of three rods carried on the bridge piece. The process is then repeated It will be noticed that the dies are kept at the most suitable temperature for casting, owing to their being directly in conjunction with the small furnace, while at the same time no flames come into direct contact with the metal, thus avoiding oxidation.

The machine illustrated will take dies up to 9 in. sq., and machines to take dies considerably larger are being designed.

Comparatively few machines have been brought out to deal with alloys containing a large percentage of pure aluminium, owing to the fact that aluminium attacks wrought-iron or steel when molten, and also shrinks and cracks during the process of solidification in the die. The alloy used in this machine is Ivanium, which contains no zinc, and is guaranteed not to disintegrate; it has a tensile strength of 12 tons per sq. in., and 6 per cent. elongation in 2 in., and is not affected by sea water or atmospheric conditions. The National Alloys, Ltd., will not be in a position to use the machine for commercial purposes for some weeks, but will then be able to deal with orders for light aluminium and other non-ferrous die castings. We understand that the firm is prepared to enter into negotiations with responsible firms with a view to taking up the rights of this machine.

"Bee" Suction Cleaner.

THE ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., of 109, New Oxford Street, W.C., have recently introduced a very moderately priced electric suction cleaner—the "Bee"—model F, which we illustrate in fig. 10.

The motor is of the horizontal universal type, suited for either A.C. or D.C. circuits and rated at 75 watts only. The cleaner

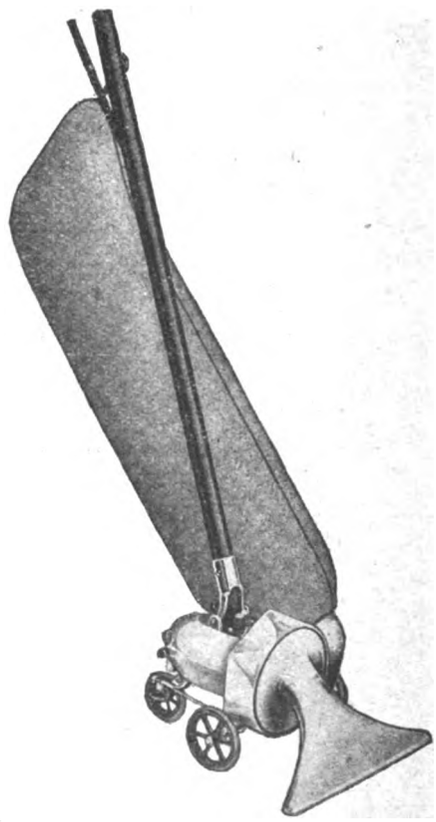


FIG. 10.—"BEE" SUCTION CLEANER.

runs on three wheels, and the rear one is adjustable to place the nozzle in its most efficient operating position; a brush attachment is provided in the nozzle for picking up threads. The dust bag is dust proof, and the usual accessories are supplied for either suction or blowing purposes.

A New Tower Ladder.

For attention to overhead tramway wires the tower ladder illustrated in fig. 11 is a great convenience. It was designed by Mr. Heathman, the tower ladder maker of Parson's Green, London,

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for use at Bexley Heath. It has the advantage of being able to travel upon ordinary roads as well as the rails, and is fitted with a connecting rod for coupling to a tramcar. The construction is well braced, and brakes are fitted to the road wheels as well as to the

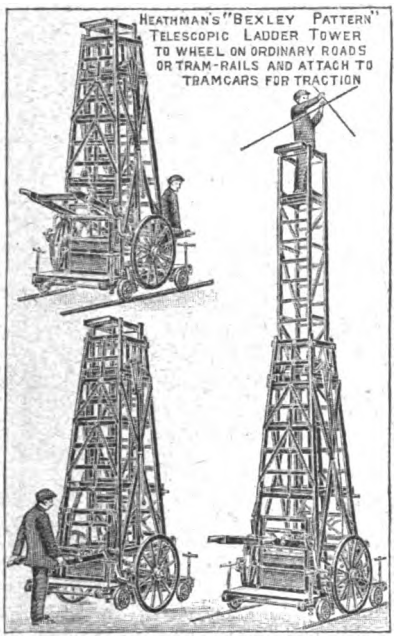

FIG. 11.—NEW TYPE TOWER LADDER.

tram wheels, with plumbing screws to raise the ladder upright when being used upon a hill. The sliding section adjusts at various heights and has a protecting guard rail, as also a tool tray.

Self-Contained Electric Fountain.

MESSRS. LAING, WHARTON, LTD., of 7, Great Newport Street, W.C., are introducing a new self-contained electric fountain—the Whardown—which is fitted with a universal motor, so that it is available for use on either A.C. or D.C. circuits of 100 to 250 volts, by connecting to lampholder or wall socket. The motor is former wound, with a two years' guarantee, and has a rating of 22 watts.

FIG. 12.—SELF-CONTAINED FOUNTAIN.

A special feature is the fitting of the upper glass basin, jet ring and filter to the fountain. The jet-ring piping connection is a push fit only, so that it can be readily removed and the basin taken off for cleaning, and the filter pulled out. The ribbed-glass basin is 13 in. in diameter, and the casing is of Sheffield electro-plate.

New Weatherproof Fuse-Box.

MESSRS. TURNERS & MANVILLE, LTD, of 5, Lloyd's Avenue, E.C., have introduced a new "Noark" weatherproof fuse-box for overhead wire protection. This device is designed to meet the demand for a small, compact and inexpensive two-pole weatherproof box for mounting on cross-arms, and to serve as a fuse between the overhead mains and house service wires, although its application is not limited to this specific purpose. The interior fittings consist of a standard "Noark" two-pole porcelain fuse block for fuses up to 60 amperes. The enclosing case is of novel construction, forming a thoroughly practical and satisfactory gasketless weatherproof box. The box, which measures $6\frac{7}{16}$ in. × $4\frac{5}{16}$ in. × $2\frac{7}{8}$ in., is cast with a deep rectangular groove extending round three sides, but open at the bottom. In the groove a heavy sliding sheet-metal cover is assembled, which is prevented from complete disengagement by a stop-screw threaded into the cover. This cover is held in a closed position by means of a spring bronze latch which engages in a slot on the cover. The total weight of the box complete, with bracket arm attachment, is $6\frac{1}{4}$ lb.

New Type Current Transformers.

In our issue of July 17th, page 117, we referred to a new type of current transformer which has been introduced by Messrs. Vedovelli, Priestley & Co., Ltd., of Paris—whose agents in this country are MESSRS. LAING, WHARTON, LTD.—and pointed out that these had been constructed for pressures up to 5,000 volts; we understand, however, that this is understating the case, as such transformers have been built for pressures of 50,000 volts, and will shortly be available for more than double that pressure.

LEGAL.

ELECTRIC COMPANY AND LOCAL AUTHORITIES IN JAMAICA.

THE Lords of the Judicial Committee of the Privy Council have given a considered judgment in an appeal by the West India Electric Co., Ltd., against an order of the Supreme Court of Jamaica, in favour of the respondents, the Mayor and Council of Kingston.

LORD SUMNER, delivering the judgment of the Board, said that on June 28th, 1912, the Corporation of Kingston, Jamaica, issued a plaint in the Kingston Court for assessment of compensation to be paid for taking a small portion of Oxford Pen, a piece of land belonging to the appellants. Thereupon the appellants began the present action, in which they claimed an injunction to restrain the respondents from acquiring the site in question, and from proceeding further with the plaint. The hearing of the summons for an interim injunction was, by consent, treated as the trial of the cause, and the action was dismissed. An appeal was unsuccessfully taken, and the case came before their Lordships on appeal from the Supreme Court of Jamaica.

The substantial question on appeal was whether the appellants had any compulsory powers of taking the site in question if they had chosen to exercise them. They were of opinion that the appellants had failed to establish this. It followed that their Lordships were of opinion that the order appealed from was right, and they would accordingly advise His Majesty that this appeal should be dismissed, with costs.

ENGAGING A FOREMAN.

IN the Marylebone County Court, on Thursday last week, before his Honour Sir W. Lucius Selfe, Albert Edward Short, an electrical engineer, sued Messrs. Watson, Marsh & Co., Ltd., of Brondesbury, for £2 10s., being a week's salary.

MR. ARMITAGE, solicitor for the plaintiff, said that, in answer to an advertisement in the ELECTRICAL REVIEW, the plaintiff got into communication with the defendants, and had an interview with them on May 23rd last. They stipulated that he should not make any advance on the salary offered, £2 10s., and, on condition that he was content to remain on at that sum, they would engage him as foreman. He agreed that he should remain at that weekly wage till September, when he would have proved his worth. He was to start on June 8th, but on May 27th he received a letter from the defendants telling him that they did not require his services.

MR. MARSH, one of the defendants, said they had selected six out of the large number of replies they had received in answer to their advertisement—plaintiff's was one of the six. They were satisfied with his testimonials, and told him to call again on the 27th. Subsequently they decided, as plaintiff would not work with satisfaction, not to engage him, and they wrote to him to that effect. In answer to this intimation they received a letter from the plaintiff, in which he acknowledged that nothing definite had been settled.

In view of this admission, his HONOUR gave judgment for the defendants, without costs.

ACCIDENT CLAIM.

AT the Halifax County Court last week, before his Honour Judge McCarthy, Thomas Braithwaite claimed £9 from the Halifax Corporation for damages due to alleged negligence.

It appeared from the evidence that on March 5th the claimant boarded a tramcar, and the vehicle set off at a high speed, and then suddenly stopped, owing to the application of the electric brake. He was thrown to the far end of the car and sustained injuries to the knee and shin, and also had his wrist injured.

The Corporation maintained that there was no negligence, as the car was proceeding at a proper speed, and the milk cart came out of a side road on the wrong side. The driver had applied the electric brake in order to save a collision.

His Honour gave judgment for the defendants with costs, stating that there did not appear to have been any negligence on the part of the driver, and the real action lay against the driver of the milk cart.

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Roberts Bros. v. Howarth.

At the Leigh County Court last week, before his Honour Judge Stanger, K.C., Roberts Bros., electricians, of Silk Street, Leigh, claimed £4 2s. 6d. from Ellis Howarth for electric fittings.

The case for the plaintiffs was that in June of 1911, the defendant entered into an agreement with a Mr. Makinson to purchase a house which was to be built in Beech Walk. When the building was being erected the defendant saw one of Roberts's workmen fitting up electric bells and lights. He told the workman he desired special plugs put in, as he might desire to have radiators attached. The workman promised to mention the matter to his employers, and the latter instructed the workman to proceed with the work. Subsequently, after the work was completed, the defendant decided not to buy the house, and denied that he ever gave the order for the electrical work.

Judgment was given for the plaintiffs, with costs.

Bourne v. South Staffordshire Tramways Co.

At Birmingham Assizes, on Friday, before Mr. Justice Scrutton, William Bourne, nut and bolt worker, of Smethwick, was awarded £175 damages against the South Staffordshire Tramways Co., for injuries received through the negligence of the defendants' servants. Plaintiff was a passenger in a tramcar from Birmingham to Smethwick. The driver applied the emergency brake to prevent a collision with another car in front; the car jerked violently, the floor-boards heaved up, and a large iron bar was forced into the car. Plaintiff sustained a fracture of the right ankle, and had not been able to work since December 13th, the date of the accident. The defence was that a defect had arisen in the suspension-bar, which had not been used for years, and which showed no signs of being defective.

Hastings Dolter Surface-Contact Tramways.

At Hastings, on July 23rd, the Hastings Tramway Co. were defendants in a summons charging them with unlawfully using the Dolter surface-contact system from January 1st to March 19th. According to the *Daily Telegraph* report Dr. Ginsburg, who appeared for the Board of Trade, said that the tramways company had notice to discontinue, but did not do so, and the Board received complaints. Further representation from the Board brought a reply that the studs were no longer alive. For the defence it was urged that another system had been utilised as quickly as possible.

The Bench imposed a fine of £5 and costs.

Underground Electric Railways v. F. W. Dunkley, Ltd.

In the Chancery Division, Mr. Justice Astbury decided this action which was brought by the Underground Electric Railways Co. of London, Ltd., against F. W. Dunkley, Ltd. (in liquidation) and the first and second mortgage debenture-holders of F. W. Dunkley, Ltd., claiming a declaration that the railway company was entitled to a first charge on the benefits conferred on Frank Wm. Dunkley, by an agreement of November 26th, 1910, in priority to the interest therein of the debenture-holders of F. W. Dunkley, Ltd. The case had reference to the buildings over the Tube Station in Leicester Square. Mr. Dunkley erected above the first floor a block of buildings, and the railway company granted him a lease of 99 years, at £500 a year. The plaintiff company, also by instalments, advanced to the lessee £7,300 at 6 per cent., the moneys to be a first charge on the interest of the lessee.

His Lordship held that, in order to postpone the plaintiff company's claim to the debenture-holders, the plaintiff company must have had notice that Dunkley had parted with his interest in the property, which he had agreed should be charged to the plaintiff company, and the defendants, on whom was the onus, had not proved that such notice was given or received prior to the plaintiff company making the last advance. The plaintiff company was, therefore, entitled to the priority it claimed, and his Lordship made an order accordingly, and gave leave to the defendants to apply for an order for the sale of the property.

Marconi's Wireless Telegraph Co., Ltd., v. Helsby Wireless Telegraph Co., Ltd.

Judgment was given by Mr. Justice Eve in the Chancery Division on July 24th in the action for alleged infringement brought by Mr. G. Marconi and Marconi's Wireless Telegraph Co., Ltd., against the Helsby Wireless Telegraph Co., Ltd., which was recently before his Lordship and an assessor (Prof. Bertram Hopkinson).

His Lordship said this action was commenced on October 18th, 1912. At that date, and down to their expiry on April 25th last, the plaintiffs were the owners of Letters Patent No. 7,777, of 1900, for an invention of "Improvements in apparatus for wireless telegraphy." They allege that the defendants infringed the said letters patent in 1911 by the construction and installation of an apparatus on board four steamships belonging to the London and North-Western Railway Co. The defendants deny that they have infringed; and they allege that the letters patent are invalid by reason of certain prior publications; and on these two issues the case has been tried. The area of conflict has been considerably curtailed, and the points in conflict greatly reduced by the fact that in 1911 the letters patent upon which the plaintiffs are suing were construed; and many of the objections raised by the defendants in their pleadings here were dealt with by Lord Parker (then Mr. Justice Parker) in an action brought by the plaintiffs against other defendants. The apparatus used by the defendants in that action was held to be an infringement of the plaintiffs' patent; and it is admitted that the apparatus complained of in this action is for electrical purposes identical with the apparatus so held to be an infringement, except for the introduction into the primary circuit of two additional spark gaps and a through charging coil—but as the presence of the coil is consequent on the introduction of the two spark gaps, there is nothing substantial in that (see Questions and Answers, Nos. 2,457 to 2,461). The short point, therefore, on the issue of infringement which I have to decide, is whether, by the introduction of the two spark gaps, the defendants have produced an apparatus which does not come within the scope of the plaintiffs' patent. The object of the two additional spark gaps is the reduction of the length of the primary wave train; and that they do bring about some reduction is, in my opinion, established by the evidence. Indeed, that such is the case is not disputed by the plaintiffs; it is mainly a question of degree. The defendants put forward and rely on the exhibit "J.S., 9" as demonstrating diagrammatically the reduced length of the primary wave train consequent on the introduction of the spark gaps; and they insist that optical experiments go to confirm the accuracy of the photographic material which form the basis of that diagram. In estimating the credibility to be attached to "J.S., 9"—that is to say, in considering how nearly it approaches to an exact representation of facts, one has to give weight not only to the obvious physical difficulties of accurately reproducing by photography phenomena, the duration of the existence of which is measured by millionths of a second, and the agencies employed in the reproduction; that is to say, such things as the sensitiveness of the photographic plate, and the actinic value of the metal constituting the spark gaps, but also the following facts admitted or proved in the course of the trial:—(1) That the defendants' installation works satisfactorily over the requisite distances; (2) that it is not wasteful of energy; (3) that the coupling of the two circuits is a loose one, in the neighbourhood of 2 per cent., and certainly not exceeding 5 per cent.; (4) that with loose coupling the transfer of energy must be in small doses, something like 3 per cent. per oscillation; and (5) that substantially the whole of the energy in the primary has been, in fact, transferred to the secondary in the defendants' apparatus when the primary has ceased to oscillate. The conclusion to which a consideration of these matters has led me, is that "J.S., 9" cannot be accepted as quantitatively reliable. The alternative of accepting it as accurate leaves one face to face with more than one problem, to which I cannot find a satisfactory answer in the defendants' evidence. For example:—(1) How can a large proportion of the energy be tranferred from primary to secondary in 3½ oscillations with a coupling of less than 5 per cent.? (2) if only that percentage of the energy which corresponds to this coupling is transferred, how can the defendants' apparatus be either efficient or non-wasteful? And (3) If the whole of the energy is not transferred, what becomes of it? But, as I have already stated, I am satisfied that the presence of the spark-gaps does substantially reduce the length of the primary wave train; and that after the primary has ceased oscillating the secondary continues to oscillate for a number of periods, and to radiate the pure wave of the aerial. The defendants claim that the result of this is to improve the working of the installation, in that the cutting off or shutting down of the primary eliminates what has been called the double-humped curve produced when surplus energy is returned from the secondary to the primary, as it can be when the primary is persistently oscillating while the secondary is radiating. I think this may be the case; but I do not think it affects the real question which I have to answer. I think that question may be thus stated. Is it an essential feature of Marconi's invention that the primary should oscillate so that as energy is radiated by the aerial the primary will persistently replenish the secondary with at least an equivalent amount of energy, and thereby maintain the radiating secondary? I do not think it is. In both the plaintiffs' and the defendants' installations, the primary oscillations die down before the secondary oscillations are finished; and in this sense the question resolves itself into one of degree, dependent largely on the character of the radiation employed. With a good radiator radiating in a single swing a very large percentage of the energy transferred, the oscillations of the secondary must die down very quickly after those of the primary have died down; and in such an installation the primary may well be said not only to build up oscillations in the secondary, but thereafter to maintain them, and to be in the true sense the reservoir on which the secondary is persistently drawing for energy to replace that which is being contemporaneously radiated. But with radiators of, what I may perhaps call, more conservative capacities, the necessity for persistent maintenance is proportionately reduced; and although when such radiators are employed, the function of the primary is perhaps rather to build up than to maintain the secondary oscillations, it nevertheless does, in fact, both build them up and maintain them. The defendants rely greatly on those passages in Lord Parker's judgment, wherein they claim that he expressly treats the maintenance of the secondary oscillations by the persistent primary oscillations as of the essence of the invention; but these passages must be read in relation to the particular infringement with which the Court was then dealing; and in my opinion they are not equivalent to a construction of the patent which would have precluded the patentee from claiming protection for installations embodying radiators in which the oscillations could be built up and maintained without the necessity of keeping the primary persistently oscillating. I think, notwithstanding the great ability which has been displayed in endeavouring to lead me to a different conclusion, that the defendants have in substance appropriated the invention described

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in the plaintiffs' letters patent; and that in the construction of their apparatus they have only introduced such modifications as are within Marconi's specification, and covered by his claim. I hold, therefore, that their apparatus was an infringement of the plaintiffs' patent. This conclusion disposes of the defendants' suggestion that their apparatus is figure 4 of Lodge's specification of 1897; but with regard to that figure, and the working of the apparatus there depicted, I am advised by the Assessor—whose valuable assistance throughout I take this opportunity of acknowledging—that Mr. Swinburne's evidence—illustrated in "J.S. 16"—is to be preferred to that of Dr. Erskine Murray. It is possible that Lodge made an invention when he suggested, in connection with figure 4, that he would charge the aerial, and would then cut it off from the charging agent as rapidly as possible, leaving it free to swing independently; and the defendants may have taken this invention; but even so, that does not mean that they have not also taken Marconi's invention, which relates to the nature of the charging agent; and can quite well be combined with Lodge's invention. I do not think it is necessary to dwell at length on that part of the case which is concerned with the alleged prior publications. In my opinion, no evidence has been adduced in this case which qualifies in any way the conclusions at which Lord Parker arrived upon the question of Tesla's alleged anticipations. Nor, as a matter of construction, do I think that the passage on page 45 of the documents referred to in the Particulars of Objections, where the use by Ducretet of the Oudin resonator is dealt with, refers to anything else than a user for the purpose of tuning transmitter and receiver; and, as Dr. Erskine Murray admits, the passage on page 51 covers the same ground only. His evidence on this alleged anticipation is well summed up on page 243 of the Notes, where on Question 2,947 he is asked: "Aye or no do you suggest this taught the world the Marconi invention"? And he replies: "I say it might teach the world—but there is always the teacher and the taught." That is not the sort of evidence on which I should be justified in holding that these passages relied on by the defendants disclose an anticipation; and I decline so to do. In my opinion the plaintiffs are right. They are entitled to a declaration that the defendants' apparatus was, at the date of the writ, and thereafter down to April 25th last continued, an infringement of the Letters Patent No. 7,777 of the year 1900; to an inquiry as to the damages sustained by them in consequence of such infringement; and to the costs of the action down to and including this judgment, to be taxed as between solicitor and client. The subsequent costs will be reserved, and there will be liberty to apply.

THE BRITISH THOMSON-HOUSTON CO., LTD., *v.* UNION ELECTRIC LIGHTING CO.

THIS patent action came before Mr. Justice Sargant, in the Chancery Division, on Monday, July 27th, on a motion for judgment in default of defence.

By the statement of claim the plaintiffs asked for the ordinary relief in a patent action, and the minutes of the order now asked for were in common form, including a direction that the defendants should within 14 days make a statement on oath as to what lamps they had in their possession manufactured in accordance with the patent.

His LORDSHIP made the order in accordance with the minutes as drawn.

THE KING *v* LANDLORD: DISTRAINT ON ELECTRICAL CONTRACTOR.

IN the Bow County Court, on Monday, before his Honour Judge Smyly, K.C., an interesting interpleader action was heard, in which the Postmaster-General had obtained judgment against Mr. Arnold, an electrical contractor, of the Midland Railway Arches, Woodgrange Road, Forest Gate. When a distress was levied, the landlords, the Tottenham and Forest Gate Railway Co., stepped in and claimed priority as landlords. The debt was for unpaid telephone calls.

MR. ALLSOPP appeared for the landlords, and Mr. Davis for the Postmaster-General, who said the whole case turned on the legal question as to who had priority, the King or the landlord. A sum of money was owing to the Postmaster-General for telephone calls, and he also believed it to be true that some £8 15s. was owing for rent.

MR. BASSETT (agent for the landlord) said they levied on June 20th.

MR. DAVIS: And we were there on the 18th.

MR. BASSETT: We were not aware of that.

JUDGE SMYLY: Was sufficient seized?

The HIGH BAILIFF: There was not sufficient to pay either; I seized all the goods and the sale realised £5 7s. 6d., which has been lodged in Court.

MR. DAVIS said his case rested on the decision in Rex *v.* Wells and Allnutt, determining a preference in favour of the King. It said that where the interests of the Crown and the subject were in conflict, the King should have the preference.

JUDGE SMYLY: I should not have the least doubt as to that, except for the late Statute, which gives the landlord priority. It is a question whether the Crown is mentioned in that, and if it is not, whether the Crown is bound by it.

MR. DAVIS: I have gone thoroughly through the Act, and can find nothing as to the Crown. I may say there has never been an attempt to limit the prerogative of the King.

JUDGE SMYLY: Except in the English Act of Bankruptcy, Sec. 150, where there is an express exception.

MR. DAVIS: And then if there is any question as to the Postmaster-General being the Crown, I have a copy of the Charter here, printed by the King's printers; also, I say it is a matter of common knowledge.

MR. ALLSOPP said he was surprised to hear the nature of the defence to his claim. He always thought the King's priority applied to taxes and dues and so on, and not to telephone calls.

JUDGE SMYLY said the authorities showed that the precedence of the King and Crown had been one unbroken line. His verdict would be for the King or Crown, as represented by the Postmaster-General.

SEIZURE OF LELIOS LAMPS.

IN the Shoreditch County Court on Tuesday, before his Honour, Judge Cluer, Geo. Argent, jun., of 133, City Road, E.C., was the claimant in a remarkable interpleader action. Messrs. Nardello and Agarzar, Ltd., of 18, Panton Street, W., agents and importers of electrical fittings and lamps, obtained judgment against Max Wineberg, of 133, City Road, E.C., agent for electrical fittings, and issued execution. Lelios inverted lamps, to the value of £31 16s. 1d., and a £5 typewriter, were seized, but Mr. Argent now claimed them, alleging that he had purchased them from Volt, Ltd., of Holland, as part of a partnership business with Mr. Wineberg. Mr. Louis Green, barrister, appeared for the claimant, and Mr. Clements was counsel for the defence.

MR. LOUIS GREEN said the question of £50 damages for dislocation of business, would arise as the case went on. The facts of the claim were that a partnership was entered into by Argent with Wineberg on February 2nd, 1914, in consequence of an advertisement in the *Daily Telegraph*. At that time the debt was due to the execution creditor, but unknown to the claimant. They traded at 133, City Road, E.C., as M. Watson & Co., ironmongers and agents for electrical goods. Formerly Wineberg had traded at the same address. Under the agreement he brought in £40 in cash to the business and £25 worth of electrical goods. The lamps seized had been purchased from Volt, Ltd., of Holland, direct, and paid for in cash to the carriers. These were in April, £28 8s. 10d. and £28 11s. 2d., and in May £27 2s. 6d., and £14 11s. 10d. He valued the 500 lamps seized at £31 16s. 1d., actual cash paid. All the lamps seized were actually in the invoices produced. The claimant gave evidence, and said that the execution creditors were the sole London agents of Messrs. Volt, Ltd. The partnership had been going along very satisfactorily, and they had been dealing in these Lelios lamps when suddenly Messrs. Nardello & Agarzar said they could have no more until Wineberg's debt was settled up. He pointed out that he had nothing to do with a previous debt of Wineberg's, and also said they were getting lamps from Volt, Ltd. Claimant was told that would be stopped, as they were the sole agents, then judgment was obtained against Wineberg and execution issued. The first he heard of the debt was when he got a letter from Volt's stopping the supplies, and he saw Nardello. In cross-examination, he agreed judgment was obtained on May 19th, execution levied on June 15th, a claim made by him on July 4th, and the partnership agreement was stamped on the 7th. It was quite true that Wineberg had been carrying on business at 133, City Road before the partnership. His bank book and cheques had always been open to inspection. He had never said that Wineberg was simply a traveller in his employ.

MR. WATERHOUSE, bank manager, gave evidence as to the opening of the partnership banking account, with the London, City and Midland bank.

For the defence MR. GRIMSDALL, the High Bailiff, gave evidence, and said Argent saw him and claimed the goods as his own personal property, never mentioning any partnership. Had he known of it, he would not have gone on, but as he did not prove his claim he went on.

JUDGE CLUER said it was clearly an honest partnership, or they would not have paid the £10 penalty stamp. The only question was, what had become of the goods? His Honour was told they were sold after notice of the partnership had been given, whereupon he said the execution creditor was liable in damages. All the books and cheques and so on could have been inspected, and the sale ought never to have taken place. It was said they would now have to pay 33 per cent. more for the lamps, and Messrs. Nardello had offered to let them have the original lamps back, as they bought them in at the sale, but how could they on one hand say they were the sole selling agents, and then offer some to the claimant to sell?

MR. AGARZAR gave evidence and said the lamps had been purchased off Volt's on the understanding they were not to be imported into England.

JUDGE CLUER: What ridiculous rubbish, when Volt's consigned them to Watson's. He was entitled to damage, owing to the serious interference with his business. He assessed the damages at £20, besides the value of the goods seized, £36 16s. 1d., and ordered the execution creditor to pay the High Bailiff's costs.

Strike.—The labour dispute at the Helsby Cable Works was settled last week, and the works were reopened on July 23rd.

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PARLIAMENTARY.

Oxford and District Tramways Bill.

ON this Bill coming up for third reading in the House of Commons, Mr. E. Harvey moved that the Bill be rejected. It was a Bill to ratify an agreement between the Oxford Electric Tramways Co. and the Oxford Corporation, and he objected to it on the ground that it conferred an entirely novel monopoly on the Tramways Company, viz., that of running an omnibus service for 37 years, while they were relieved of a very serious obligation to reconstruct the tramways under conditions which had been made difficult by changes since the Act of a few years ago.

VISCOUNT VALENTIA considered that the Bill was favourable to the City of Oxford, and gave no advantages to the Tramways Co.

MR. J. H. WHITELEY said the Bill came before him as chairman of the Unopposed Bill Committee, after the petition had been withdrawn and the City Corporation and the company had come to terms. After the proposals had been carefully examined the Committee unanimously passed the Bill.

The amendment was rejected and the Bill carried a third time.

York Corporation Bill.

ON July 22nd and 23rd a Select Committee of the House of Commons, under the chairmanship of Lord Haversham, considered the Bill promoted by the York Corporation, which, amongst other things, asked for powers to provide tramway extensions and to run trolley vehicles and motor-omnibuses. The estimates contained in the Bill were £9,800 for the provision of trolley vehicles; £8,700 for the electrical equipment of trolley vehicles; £12,000 for the provision and equipment of motor-omnibuses; and £21,700 for purchase of land for purposes of a light railway and the erection of buildings, &c.

Mr. Macassey, K.C., and Mr. Beveridge appeared for the promoters, and Mr. Talbot, K.C., Mr. Clode, K.C., and the Hon. E. Charteris represented the North-Eastern Railway Co. to oppose the Bill.

MR. MACASSEY explained that the Corporation proposed to run trolley cars on four routes commencing opposite the North-Eastern Railway Station, and the North-Eastern Co. objected to two of these routes on the ground that it was proposed that the vehicles might stop, stand or turn round in front of the station in the company's road, which was maintained by the Corporation at the cost of the company.

ALDERMAN MAYER (Chairman of the Corporation Tramways Committee), MR. BURROWS (Manager of the York Tramways), and MR. SPENCER (Manager of the Bradford Corporation Tramways) gave evidence in support of the Bill.

After hearing further evidence, the Committee passed the preamble of the Bill, but gave the North-Eastern Railway Co. power to appeal to the Board of Trade as to the matter of the turning point at the station for trolley cars and motor vehicles.

Newcastle Corporation Bill.

A SELECT Committee of the House of Lords, presided over by Lord Haversham, on Monday concluded the hearing of a Bill promoted by the Newcastle Corporation with the object of securing powers to construct and work additional tramways in the urban districts of Longbenton and Weetslade. The Corporation also sought powers under the Bill to run services of motor-omnibuses.

MR. HONORATUS LLOYD, K.C., who opened the case for the promoters, explained that it was proposed to give additional tramway facilities, particularly during the period of race-meetings at Gosforth Park. The only opposition was that of the North-Eastern Railway Co., who objected on the ground of competition.

Evidence for the Bill was given by MR. W. J. STEEL, the city engineer, and MR. ERNEST HATTON, manager of the tramways, the latter remarking that the proposed new tramways would serve a population of 25,000 people.

MR. J. B. HAMILTON, general manager of the Leeds City Tramways, also gave evidence in support of the Bill. He thought there was room both for the railway and the tramways.

Considerable evidence was given on behalf of the North-Eastern Railway Co. in opposition to the Bill, but in the end the Committee found the preamble of the Bill to have been proved.

Light Railways and the Development Bill.—In the House of Commons, Mr. Rowntree asked the President of the Board of Trade whether he was aware that the Attorney-General had advised that it was almost impossible that a light railway constructed and run by a group of private individuals could be constructed and run otherwise than as a commercial, that is a profit-making, concern, with the result that no association of persons or company formed to construct and work a light railway would in practice be found to satisfy the condition of not trading for profit within the meaning of Sec. 1 (1) of The Development and Roads Improvement Funds Act, 1909; and, if so, whether, seeing such opinion rendered the Act entirely inoperative as regarded the construction of light railways by voluntary effort with State aid, he would say what course under these circumstances the Government proposed to adopt.—Mr. Montagu replied that the Development Commission had experienced difficulties owing to the legal interpretation which they were advised must be placed on the Statute referred to, and the whole question was receiving the careful attention of the Government.

Bristol Corporation Tramways Bill.—On July 23rd the Court of Referees of the House of Commons considered the objections of the Bristol Corporation to the Bristol Ratepayers' Association, the West Gloucestershire Water Co., and several private petitioners being heard against its Tramways Bill. Mr. Fitzgerald, for the Corporation, contended that 33,000 electors had voted at the poll taken, and a majority of between 3,000 and 4,000 was in favour of the Corporation purchasing the tramways. The Court disallowed the *locus* to the Ratepayers' Association and the Water Co., but agreed that John Hare and others and Charles Bell and others should be heard before the Committee for considering the Bill.

Glasgow Corporation Bill.—On Wednesday, Thursday and Friday last week a Select Committee of the House of Commons, presided over by Sir Edwin Cornwall, had under consideration the Bill of the Glasgow Corporation under which powers were sought for a new tramway street and a bridge to carry the street over the river Kelvin. After hearing considerable evidence both for and against the proposal, the Committee passed the preamble of the Bill without alteration.

BUSINESS NOTES.

Consular Notes.—CHINA.—In a recent report on the trade of his district, the Austrian Consul at Tientsin gives some interesting advice to his countrymen as to the methods to be adopted in endeavouring to obtain trade in that market. After pointing out that competition in the class of goods in which the Chinese buyer is interested is very keen, he states that in order to do any extensive business in the country in the face of active competition from all parts of the world, it is necessary to bring to bear on the market great energy, care, sacrifice and efficiency. The popular opinion that Chinese business does not entail much exercise of care on the part of the manufacturer or merchant, but that orders can be executed with considerable latitude as to complying with conditions laid down, is far from the truth. If a manufacturer is not prepared to give of his best for the satisfaction of his customer, he had much better leave the market severely alone, otherwise he will only meet with disaster. One can only repeat that in executing business with China all requirements as to quality, packing, delivery, &c., should be carefully followed out, for the manufacturer overseas is not in a position to decide which of the details of the order are of the greatest importance to the taste and desire of the Chinese buyer. It often happens that a departure from the instructions of the buyer, even if such departure appears to the supplier to be advantageous from all points of view, only leads to considerable difficulty in the way of the buyer getting rid of the goods he has ordered, and to friction between buyer and seller. In not a few cases acceptance of delivery is declined, and when the ultimate result is an action between the supplier and customer, the former is apt to experience difficulty in avoiding a loss which a close adherence to the instructions given would have prevented. In attempting to do business in Northern China, it should be borne in mind that, whether for import or export, direct connection with the native firms should be avoided in view of the existing unsatisfactory organisation of native trade. Business must be confined to the foreign firms established on the market, who interest themselves in the importation and exportation of all kinds of goods. The chief among these are of British or German nationality, and, in lesser numbers, American, Belgian, Swiss and Russian. Almost all of these houses operate exclusively through their branches in London, Hamburg, &c. They naturally give a preference to the products of their own country when other things are equal, and are in some cases bound to these countries by agency agreements. It is not always easy, therefore, for a new firm to enter the market, offers of business being met with the reply that the firm concerned is otherwise fixed up for business in the goods concerned. The question then arises how business can be done. The Consul points out that only the best and most strongly-financed firms can hope to succeed in the market in the face of the keen competition of the existing merchants, and suggests that home firms who are strongly desirous of competing should come to an arrangement with one of the large European firms of China merchants for the purpose of establishing under its auspices a branch house in China of the manufacturer concerned. In some cases a number of firms could combine to work out such a scheme, and could, with less cost and more satisfactorily, establish an office in China which would secure enough business to warrant such a departure.

Elsewhere in his report the Consul states that electric lighting plants are to be found in the following towns in his Consular district:—Province of Chihli, Tientsin and Peking; Province of Shantung, Tsinanfu, Tsingtao; Manchuria, Harbin, Antung, Kirin, Newchwang and Dairen.

GREECE.—The Austrian Consul at Salonica reports that under Turkish rule a large number of petrol and benzine motors were in use. Since Greece has taken possession of the town, however, petrol and benzine have been subjected to a tax, so that their use will probably decline. It seems probable, therefore, that many small factories and industries will adopt electric power as an alternative.

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NORWAY.—The American Consul at Bergen reports that the Marconi company's trans-Atlantic radiotelegraph station being erected outside the city of Stavanger will be an added facility for business relations between the United States and Norway. The present cable rate from Stavanger to the zone of New York is 1s. 5½d.; the wireless rate will be 1s. per word. The construction of the radio station became assured when in June, 1913, the Norwegian Storthing (Parliament) approved the Marconi contract and appropriated £117,000 towards its erection. The station is expected to be ready for operation by January 1st, 1915. There is said to be no less than 500,000 hydroelectric H P. available for development in the Stavanger Consular district, besides the many smaller falls already utilised. Movements are now on foot for developing much of this power, the realisation of which will mean a new industrial era for this district.

Elsewhere in his report the Consul states that the installation of a new semi-automatic telephone system, with underground cable, by the Bergens Telefonselskab, is nearing completion, and, when finished, will give to Bergen the most modern and up-to-date system of any city in Scandinavia. The system is American, installed by an American company, which secured the contract after tendering according to plans and specifications furnished by this Consulate. The annual report shows that the receipts from subscribers aggregate £12,750, number of subscribers 4,121. Length of line, 11,905 miles, of which 9,673 miles are cable. The length of ducts for underground cables is 39·5 miles. The new exchange will cost £22,500, and will have a capacity for 15,000 subscribers. The original capital stock of £33,500 has been increased to £67,000.

The project of constructing a railway from the heart of the city of Bergen to the summit of Mount Floien (1,000 ft. high) has been discussed for years, but the great cost of construction and its uncertainty as a business venture have, so far, made it impossible of realisation. Since the building of the Bergen-Christiania mountain railway and the establishment of the Norske-Amerikalinie, the passenger and tourist traffic has increased to such an extent that the plan has become feasible, and, with a view to ensuring its construction, the City Council of Bergen, on December 29th, 1913, appropriated £5,600 to aid in the construction of an electric railway to the summit. A tunnel will be made through Mount Floien, at its base, to connect the new railway terminal with the harbour; the estimated length of the tunnel is 1·86 miles.

The Consul in Christiania has recently endeavoured to ascertain the cost of water-power plants per H P. in Norway. No statistical data are available, but an interview with the Department of Waterfalls elicited the following information:—The construction cost of water-power plants varies from £5 12s. to £11 2s. per H.P. for large water plants, and from £5 12s. to £28 per H.P. for small plants. The rate at which the power is sold to customers varies from 35s. 4d. for large enterprises up to £2 16s. for small ones per H P. per year, 24 hours per day service. A small book, published in Norwegian, by Aschehoug & Co., 45, Karl Johansgate, Christiania, giving information on the subject, and entitled "Veilygning i Udbygning af Vandfeld, 1913," can be procured at a cost of 2·10 kroner (about 2s. 4d.), which includes postage.

ARGENTINA.—The American Consul at Rosario reports that electric motors are used in Rosario to a considerable extent, those for industrial purposes being chiefly in small plants and workshops. The Sociedad de Electricidad (light and power plant) states that there are 1,200 electric motors in use at Rosario ranging up to 45 H.P. The greatest demand is for small motors of 5 to 7 H.P.

Conditions with respect to voltage, current, prices, &c., are as follows:—Main part of the city, continuous current, 440 volts for motors over 5 H P. and 220 volts for smaller motors; outer districts, three-phase alternating current, 200 volts for motors over 5 H.P. and 110 volts for smaller motors. Rates for motors are as follows:—9·7 cents per KW.-hr. for first 30 KW.-hrs. consumed per month for each horse-power installed; 5.8 cents per KW.-hr. for remainder up to 1,000, and 4.3 cents per KW.-hr. for consumption in excess of 1,000 KW.-hr. per month. The company grants special rates to large consumers, and endeavours through advertising to increase the use of electric motors. It neither owns nor rents motors except those used in its own plant.

While electric motors are used to a considerable extent, it will not be easy to introduce a new line here, as the field is already well worked. Four of the leading manufacturers of electrical appliances, including motors, two American and two German, are represented here or in Buenos Ayres, and have a good hold on the market.

It is hardly likely, in view of the strong competition, that new motors can be introduced here through mere correspondence. Goods which are finding a demand here have been placed on the market through personal efforts of travelling salesmen and agents. Where two articles are in competition, that which is backed by personal effort interested in its success has every advantage over the article which has to depend on catalogue advertising. In case reports from other Consulates in South America lead to the conclusion that it would not be worth while to send out a personal representative to work the field, it might be found advisable to make sales through some New York commission house.

Experience in this territory shows that the distribution of catalogues produces very meagre results, and that goods are seldom ordered from catalogues except where the catalogue has been solicited.

Bankruptcy Proceedings.—TRUBIE MOORE, electrical engineer, Headingley, Leeds.—Receiving order, July 24th, on creditors' petition. First meeting, August 7th, at Official Receiver's office, 24, Bond Street, Leeds; public examination, September 8th, at County Court House, Albion Place, Leeds.

Catalogues and Lists.—MESSRS. CROMPTON & CO., LTD., Arc Works, Chelmsford.—Publication No. P29 (36 pages) in their uniform size and style, giving illustrations and very fully-detailed particulars of the Crompton-Blondel open type flame arc lamps. An advance copy of leaflet No. 538, describing several patterns of enclosed arc lamps, has also been received.

MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—20-page booklet, entitled "A Few Words to Electrical Contractors on Signs." A number of outdoor and indoor shop electric signs are very neatly illustrated, also some indicator and special signs and illuminated letters. Prices are given, as well as some interesting notes designed to persuade the contractor to push the sign business in his own town.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, London, S.E.—New catalogue of 96 pages (No. 535) containing excellent illustrations and clear price indications, with some brief descriptive particulars, of a considerable range of telephone apparatus. The largest individual section (between 40 and 50 pages) is devoted to telephones and accessories—intercommunication battery telephones, magneto wall and table telephones, central-battery telephones, portable telephones, high-tension telephones, watertight and gastight magneto telephones, cables and wires, cells, &c. In the second section various telephone switchboards are included—battery or magneto, magneto, central-battery, &c. Automatic systems, numerous protective devices, condensers, and fire-alarm systems follow, and a telegraphic code completes the catalogue.

MR. GEORGE ELLISON, Victoria Works, Warstone Lane, Birmingham.—Sheets 131/1 to 131/14, illustrating and describing totally enclosed ironclad auto-transformer starting panels for squirrel-cage induction motors. Tabulated particulars are given at great length in regard to the switch ratings under various conditions, prices and code words for telegrams, of the various types, together with accessories and extras, also approximate weights and dimensions.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, E.C.—Handsome brochure with many illustrations, showing their fan works at Witton, which are wholly devoted to the manufacture of "Freezor" fans.

THE STERLING TELEPHONE AND ELECTRIC CO., LTD., Telephone House, Tottenham Court Road, W.—Two-page leaflet, No. 229, giving particulars and prices of enamelled-wire telephone cables for interphone systems.

THE ARMORDUCT MANUFACTURING CO., LTD., Farringdon Avenue, E.C.—Leaflet and sample of Armorduct "H.B." cable, which is claimed to occupy a leading position outside Association cable.

MESSRS. KRUPKA & JACOBY, LTD., 39, Victoria Street, S.W.—Leaflet H.C. A1 dealing with heating and cooking apparatus, including electric coffee, tea and water cans, hot-plates, travelling outfits for universal voltage, sterilising apparatus, cookers, cigar lighters, &c.

Welding Plant.—THE SIRIUS AUTOGENOUS WORKS CO., of 85 and 87, High Street, Stratford, E., have secured an order from the Schmidt's Superheating Co., Ltd., for a complete oxy-acetylene welding plant for their new works at Trafford Park, Manchester. The generating plant is of the same capacity as that recently supplied by the company to the British Westinghouse Electric and Manufacturing Co., Ltd., of Manchester, and these will be the two largest automatic acetylene generators in this country.

Holidays.—The OSRAM LAMP WORKS, LTD., Hammersmith, announce the closing of their works from to-morrow, Saturday, August 1st, until Monday morning, August 10th, for the annual holidays. Matters of urgency only will be dealt with.

The works of MESSRS. BELLING & CO. will be closed from August 3rd to 8th inclusive. Correspondence will receive attention.

The ELECTRICAL APPARATUS CO., LTD., notify the closing of their works from August 3rd to 9th inclusive. Matters of urgency will be attended to.

The works of the RUGBY LAMP CO., LTD., will be closed from to-day, July 31st, until August 10th. Urgent matters will receive attention.

RECORD ELECTRICAL CO., LTD.—The Broadheath Works will be closed from 5.30 p.m., on Friday, July 31st, until 7.30 a.m. on Monday, August 10th, 1914. Letters of extreme urgency will receive attention.

EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD.—The Ediswan Works, Ponder's End, and offices will close on Saturday, August 1st, and will re-open on Monday, August 10th. An adequate staff will deal with urgent business during the holidays.

MESSRS. BROWETT, LINDLEY & CO., LTD.—The works will be closed from Saturday, August 1st to Saturday, August 8th, both days inclusive. A small staff will be in attendance to deal with urgent correspondence.

MESSRS. CROMPTON & CO., LTD.—The works will be closed from Friday night, July 31st, until Monday, August 10th. The general offices will be closed for the Bank Holiday, August 3rd, only.

MESSRS. WILLANS & ROBINSON, LTD.—The works will be closed from Friday, July 31st, to Monday, August 10th. The general offices will be closed for the Bank Holiday, August 3rd, only. The staff in attendance in the offices will deal with current contract correspondence and the supply of replace parts, &c.

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For Sale.—The Eastbourne Electricity Department have for disposal an engine, alternator, &c. Particulars are given in our advertisement pages to-day.

Annual Outing.—The employés of Messrs. E. P. Allam and Co. held their annual outing on Saturday last. The party went by train to Gravesend, and thence by brakes to Gads' Hill. Delightful weather was experienced, and, after the luncheon, at which Mr. E. P. Allam presided, a cricket match was played and rambles made in the charming Dickens country. The arrangements were ably carried out by the stewards, Messrs. Waklen and Dalgarno.

Book Notices.—"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIII, No. 1. July. New York: The Society. Price $1.

"Annual Report of the Rand Water Board, for the Year Ended March 31st, 1914." Johannesburg: Chief Engineer's Office, Rand Water Board.

Liquidations and Dissolutions.—The Electromotor Equipment Co., Ltd.—A meeting will be held at 21, Old Broad Street, E.C., on August 26th, to hear an account of the winding up from the liquidator, Mr. O. Steiner.

No Cell, Ltd.—A meeting will be held at the offices of Messrs. Moore, Partridge & Co., 2, Gresham Buildings, E.C., on August 31st, to hear an account of the winding up from the liquidator, Mr. A. H. Partridge.

Midland Ignition Co.—A meeting will be held at 35, Newhall Street, Birmingham, on August 26th, to hear an account of the winding up from the liquidator, Mr. C. H. McPherson.

Adams & Fox, electrical engineers, 178, High Street, Notting Hill Gate, and 23, Ladbroke Terrace Mews, W.—Messrs. W. J. Adams and W. H. Fox have dissolved partnership. Mr. W. H. Fox will attend to debts.

Trade Announcements.—The British Thomson-Houston Co. have had two additional lines installed in their private telephone exchange at Mazda House, 77, Upper Thames Street, London, E.C. The telephone number has also been changed, and, instead of Bank 5561/2/3 as heretofore, all future calls must be made to one or other of the following numbers: Central 10434, 10435, 10436, 10437, 10438.

Mr. F. Bickford, late with Messrs. H. R. Williams & Co., has commenced business as an electrical engineer and contractor at Bontport Street, Barnstaple.

LIGHTING and POWER NOTES.

Atherton.—Proposed Loan.—The Clerk to the D.C. and the electrical engineer have been instructed to furnish particulars to the L.G.B in regard to an application for permission to borrow £2,100 for E.L. purposes.

The Howe Bridge Spinning Co. has decided to take a supply of electricity from the D.C. for driving its No. 2 mill.

Australia.—The Sydney Council has been recommended to borrow £500,000 for the extension of the electricity undertaking in the western and northern suburbs, and to meet the overdraft.—*Australian Mining Standard.*

The Brunswick (Vic.) Council has decided to borrow £10,000 to extend its E.L. system. A further £10,000 will be required to complete the scheme.

Barnes (Surrey).—Mains Extension.—The U.D.C. has sanctioned the extension of the E.L. mains to the Priory Lodge Estate, and in Sheen Common Drive.

Blackburn.—Referring to our note last week, Mr. P. P. Wheelwright, engineer and manager of the electricity department, writes to point out that the statement that a scheme in connection with the department has been held up, owing to the consideration of reorganisation of the gas works, and that both matters are being referred to the full Council, is quite incorrect as far as his department is concerned, and the only question that has been referred to the General Purposes Committee is the report of Sir Corbet Woodall, on the reorganisation and reconstruction of the gas works. The special report mentioned in our paragraph was one that Mr. Wheelwright made in connection with a new generating station, which was accepted by the Council some months ago, and will in the near future be put in hand.

Bolton.—Annual Accounts.—The accounts of the Corporation electricity department for the year ended March 31st, 1914, have just been issued, and show that the revenue from the sale of energy amounted to £69,737, against £65,514 in the previous year, and the total income, less discounts, &c., was £78,333, against £74,296. Interest, depreciation and other expenses amounted to £28,224. There was a surplus of £2,365, of which £2,000 was allocated to the relief of the rates. The capital expenditure during the year amounted to £52,619. The units sold numbered 13,727,819, against 12,605,940. This total includes power, 7,445,580; tramways, 4,396,543; and private lighting, 1,885,696. Works costs per unit were 0·537d., against 0·538d., and the inclusive cost per unit was 1·144d., against 1·202d. The average price obtained for energy was 1·13d. per unit, against 1·15d. It is anticipated that when the new power station is running the generating costs will be considerably reduced. The renewals fund now stands at £33,534.

Bradford.—The Electricity Committee has authorised the Chairman, Deputy-Chairman and the Electrical Engineer to purchase about 50 tons of copper for cable making.

Brighton.—Municipal Wiring.—The L.G.B. has forwarded to the B. of G. a copy of a letter received from the Electrical Contractors' Association (Inc), relative to the installation of E.L. by the Guardians at the Poor Law Institution. The House Committee recommended that the L.G.B. should be given details of the work done, and pointed out that, when the work had been done by the staff, the materials had been purchased locally, and that as the special terms upon which the T.C. supplied electricity enabled the Guardians to light the buildings more economically than by gas, the Committee was of opinion that by employing its own staff it had not exceeded its powers.

Bristol.—Annual Report.—In his report on the working of the Corporation electricity department for the year ended March 25th, 1914, Mr. Faraday Proctor, the general manager, states that the gross receipts amounted to £105,940, and the gross expenditure to £48,105. After paying capital charges there was a net profit of £8,516, and a disposable surplus of £10,927. After meeting sundry expenses and transferring £6,000 to the reserve fund, £2,314 has been carried forward. The units sold totalled 15,488,638, against 13,067,231 in the previous year. During the year the charge for street lighting was reduced by £2,000, and 608 incandescent street lamps, out of 1,158 to be installed, were equipped free of charge. The load factor was 21·16 per cent., against 20·71 per cent. in the previous year. The works costs per unit amounted to 0·518d., against 0·512d., and the total costs per unit were 1·45d., against 1·6d. The average revenue per unit from the sale of current amounted to 1·534d., against 1·683d.

Proposed Loan.—The Electricity Committee has recommended the T.C. to apply to the L.G.B. for sanction to a loan of £42,000, for expenditure on mains, sub-stations, and services during the next three years.

Buckie.—E.L. Scheme.—A large scheme of E.L. and power, derived from the river Spey, for the adjacent district, was referred to at a meeting of the T.C. The Lighting Committee had recommended that a report on the E.L. of Buckie be got from an engineer, but it was agreed to delay the matter for a year or two, in order to see if the larger scheme was taken up.

Burton.—A Gas Loan.—At a recent L.G.B. inquiry as to an application to borrow £25,000 for the gas undertaking, the inspector pointed out the growing competition of electricity, and said he did not see his way to recommend the granting of more than £7,000 for immediate requirements.

Bury.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £40,720 for extensions at the Chamber Hall power station.

The Electricity Committee has given permission to the Lancashire E.P. Co. to supply electricity to the Robinson Kay Home.

Carlisle.—Annual Report.—The accounts of the Corporation electricity department for the year ended March 31st, 1914, show that the total revenue was £21,229, against £19,067 in the previous year, and the generating and distribution cost was £14,068, against £10,330. There was a net deficit on the year of £209, against a profit of £1,510 in the previous year. The units sold numbered 3,140,457, against 2,531,545. The works costs per unit amounted to 0·5d., as against 0·42d., and the total costs per unit were 1·64d., as against 1·66d. The average revenue per unit was 1·62d., against 1.8d. The load factor was 18·45 per cent., against 18·87 per cent. During the year £6,181 was expended on plant, £4,953 on mains, services, &c., and £2,212 on buildings. Coal increased in cost by £1,426. In his report, Mr. F. W. Purse, the electrical engineer, states that during the past year there was an unprecedented combination of circumstances which can hardly occur again, and although there was a slight deficiency, the output and revenue were the largest on record. A three-phase H.T. system was introduced during the year.

Chobham.—Proposed E.L.—The Chertsey R.D.C. has received a letter from the Woking E.L. Co. stating that the company had been petitioned by residents at Chobham and Mimbridge for a supply of electricity, and that as the district lay within the area of the Ascot Gas and Electricity Co., whose mains were a long distance from Chobham, it intended applying to the B. of T. for consent to supply. The Council was asked to agree to this course, but decided to submit the matter to the Chobham P.C.

Continental Notes.—Sweden.—As previously reported in this journal, a Danish company has entered into an agreement with a Swedish company for the purchase of electrical energy, which will be transmitted by submarine cables across the Sound from Sweden to Denmark. The first step towards the realisation of this scheme has now been made, the work of laying the first cable having been commenced. The energy will be supplied from the Lagan power station in the neighbourhood of Helsingborg, which already has 25,000 H.P. at disposal, and will be doubled in size. At Helsingborg, where the current leaves its native country, the pressure will be reduced to 25,000 volts, and after having passed through the cable to Elsinore, a distance of 5,400 metres, the voltage will be increased to 50,000. From this point the

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energy will be distributed in the usual way to various places in Zealand, as far as the town of Roskilde, to the south of Copenhagen. To the power cable itself will be attached another cable, which will serve as a protection for it against ships' anchors. In the first instance only one cable will be laid, as the whole scheme may be considered to be in the experimental stage. But if this first experiment succeeds, it is the intention to lay two additional cables. The scheme will be completed towards the autumn.

NORWAY.—The municipal authorities of Norvik, in the north, have acquired a water-course, from which an additional supply of energy to the town will be derived. There are two lakes to be dammed, which will serve as reservoirs.

It is reported from Mandal, in the south of Norway, that preparations are being made to erect a large factory at Lyngdal for the manufacture of nitrates. At the same time a large power station will be built on the River Kvina. The power available amounts to 100,000 H.P. at least, which will be transmitted to the factory. Lyngdal is situated close to the sea, and there is an excellent port, which will facilitate the shipping of the goods. The enterprise is controlled by a large company at Christiania.

RUSSIA.—The Municipality of Piotigorsk has been authorised to raise a loan of £105,000 for, among other things, an electric power station.

GERMANY.—Twenty-seven Kreise of Silesia, with the co-operation of the Provincial Council, have formed an "Upper Silesia Communal Power-Station" company, to build a power-station and distributing network for the supply of electricity in the district. The capital is 733,000 marks.

Cuddington (Surrey).—PROPOSED E.L.—The South Metropolitan E.L. Co. has informed the P.C. that it is prepared to go into the matter of a supply of electricity for the parish, and if the Council consents, will apply to the B. of T. for its permission. A Committee has been appointed to discuss the matter with the general manager of the company.

Dalkeith.—STREET LIGHTING.—As its agreement with the Electric Supply Corporation shortly expires, the T.C. is experimenting with the latest types of illuminants, with a view of improving the street lighting in Dalkeith and Eskbank.

Doncaster.—YEAR'S WORKING.—The income from the Corporation electricity undertaking for the year ended March 31st last was £14,344, and the expenditure £13,329, leaving a surplus of £1,015, against £1,114 in the previous year.

Farnworth.—L.G.B. INQUIRY.—Mr. H. R. Hooper held an inquiry on July 17th into the application of the U.D.C. for sanction to loans of £1,900 for plant, and £1,500 for prospective expenditure, in connection with the electricity works.

Grimsby.—NEW PLANT.—The Lighting Committee has approved of the expenditure of £4,975 on the extension of the electricity undertaking, as follows:—Buildings, £1,700; battery, £2,400; booster and switchgear, £800; cables, £75.

Halifax.—ANNUAL ACCOUNTS.—The accounts of the Corporation electricity department for the year ended March 31st last state that 9,670,008 units were sold, against 7,488,255 in the previous year. The total income was £55,654, against £48,025, and the working expenditure was £28,706, against £25,107. After paying interest, sinking fund and other charges, there was a surplus of £4,109, against £2,408, of which £3,893, against £3,545, was placed to the relief of the rates.

Hawkhurst.—E.L. SCHEME REJECTED.—A poll on the E.L. scheme submitted by a London firm has resulted in 102 votes in favour and 119 against. Only 221 voters polled out of 700.

Iceland.—It is reported that Mr. Pull J. Torfason, one of the most prominent business men on the island, has succeeded in obtaining a concession for the utilisation and harnessing of some waterfalls. The electrical energy derived from these will be employed for the manufacture of salt, of which large quantities are consumed every year in Iceland, and for which there is a great demand. The present price is about 37s. per ton, but it is proposed to extract the salt from sea-water by means of a special process which can be worked at a moderate cost, leaving a good margin of profit on the basis of the selling price quoted above. The scheme will require a considerable amount of capital, which the promoter is trying to get in Iceland and Denmark, although he has several offers from Germany, where the new enterprise has aroused much interest.

Ilfracombe.—DUST DESTRUCTOR.—The U.D.C. has decided to erect a dust destructor, to cost between £1,000 and £2,000, at Bowdon Farm.

Ilkley.—LOAN SANCTION.—The L.G.B. has informed the U.D.C. that it is willing to sanction the loan of £18,000 for E.L. purposes directly the B. of T. approves of the site for the generating station. The B. of T. has now consented to a site.

India.—According to *Indian Engineering*, the Amritsar municipality has applied to the local Government for a loan of Rs.4,50,000, for the purposes of the city electrification.

Knowle.—According to the *Daily Graphic*, a wooden post, erected to carry electric lighting wires in this Devon village, has taken root, and is making a vigorous growth of greenery!

Leeds.—NEW PLANT.—The Tramways and Electricity Committee has decided to recommend the Council to approve a tender for a 13,000-KW. turbo-alternator and condensing plant, at £34,160, subject to the L.G.B. granting sanction to the borrowing of that amount.

Llandyssul.—PROPOSED E.L.—Efforts are being made to provide a supply of electricity for the town, and it is understood that the project meets with much favour.

London.—L.C.C.—The Finance Committee has recommended the L.C.C. to sanction the following loans for electricity purposes:—Battersea B.C., £3,275, for plant; St. Pancras B.C., £22,530, for boilers; Stepney B.C., £3,000, for services. The Stepney B.C. has applied for £35,000, being part of a loan of £70,000, for plant, sanctioned in December, 1912, and the Committee recommends that this also be granted.

HAMMERSMITH.—YEAR'S WORKING.—A gross profit of £28,629 was made on the B.C.'s electricity undertaking for 1913-14, and the net profit was £6,386; of this sum £3,380 has been allocated to the relief of the rates, and the Finance Committee recommends that £3,000 should be carried to the reserve fund.

Loughton.—PROV. ORDER.—The County of London E.S. Co. has notified the U.D.C. of its intention to apply for a prov. order for electric supply in the Council's area.

Ormskirk.—PROV. ORDER.—The Ormskirk E.S. Co. has notified the W. Lancashire R.D.C. of its intention to apply for an order to supply electricity within the Council's area.

Newcastle (Co. Down).—E.L. INAUGURATED.—Last week the new E.L. installation was switched on by Countess Annesley.

Redditch.—EXTENSION SCHEME.—The U.D.C. has appointed Messrs. Handcock & Dykes as consulting engineers, and Mr. Mayne, the works manager, as resident engineer, to the scheme for the re-organisation of the electricity undertaking.

South Africa.—According to the *Financial News* the Portuguese Government is contracting with an English firm to supply electric power to Lourenco Marques, for three years.

Southampton.—EXPERTS' REPORT.—In a report which they have prepared on the Corporation electricity undertaking, Sir John Snell and Mr. Ernest Edmonds state that the plant and mains were generally of good type and were maintained in good condition, and that the undertaking was perfectly solvent, there being an excess of assets over liabilities of £14,000. The report states that, if desired, the charges to the Tramways Committee could be reduced. There was no necessity to reduce the rates for private lighting from 3½d. to 3d. per unit, especially as further economies in the current consumption of metallic-filament lamps were quite probable. The heating and cooking rate of ½d. per unit, if taken alone, could not be justified, but when its effect on other departments was considered, the general increase in the profits justified the policy, and even if, instead of the limited number in 1912-13, every consumer took a supply for heating and cooking at ½d. per unit, the profit of the undertaking would increase. Notwithstanding the satisfactory results of the charges now in force, the report recommends the adoption of a rateable value, or KW. charge, for domestic supply.

Southend-on-Sea.—PIER LIGHTING.—Owing to the saving made by utilising electricity in place of gas, the T.C. has decided to continue to substitute electricity for gas on the pier premises in cases where it is considered that the change will be in the interests of the pier undertaking.

Taunton.—ANNUAL ACCOUNTS.—The accounts of the Corporation electricity undertaking for the past year, show a gross profit of £5,814, of which £1,455 has been devoted to interest, £3,032 to redemption of loans, £304 to renewals account, £139 to the purchase of meters, and £173 has been carried to net revenue account.

Tunbridge Wells.—EXTENSION OF AREA.—The T.C. is to apply to the B. of T. for permission to supply electricity at Langton and Pembury, outside the Council's area of supply.

Walthamstow.—LOAN SANCTION.—The U.D.C. has received sanction to borrow the following sums for electricity purposes:—£7,247, including boiler house plant £6,726, and transformers and switchgear £521; £1,534 for H.T. cable; £1,159 for mains; and £1,162 for services.

Wombwell.—E.L. SCHEME.—The Yorkshire E.P. Co. is putting into operation its powers for supplying electricity at Wombwell, and is connecting the town to its mains.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—YEAR'S WORKING.—The report of the Corporation tramways department for the year ended March 31st, 1914, shows that the total revenue was £85,266, against £80,166, and the working expenditure was £47,036, against £43,206. Capital charges, renewals and depreciation, amounted to £24,169, against £24,435; and the net profit was £14,062, against £12,525.

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The energy consumption worked out at 1·184 units per car-mile, a decrease of 0·29 unit. The reserve fund now stands at £29,508, the renewals fund at £140,480, and the sinking fund at £46,802.

The T.C. has decided to extend the P.A.Y.E. system, and 16 cars are to be altered, and six new cars constructed, on this principle. Thirty-four of these cars will shortly be in operation.

Continental Notes.—RUSSIA.—During the recent strikes, the tramway services in St. Petersburg, Moscow and Tiflis, were affected, and according to the daily Press, 150 tramcars were smashed in St. Petersburg by the strikers.

GERMANY.—ELECTRIC WATERING CARTS.—The asphalted streets of the City of Berlin itself are cleaned and watered by 60 electrically-propelled watering carts, each with rotary squeegees. The other roads are watered by 265 horse-drawn carts, but trials are being made with electric fore-carriages, with a view to the conversion of these vehicles.

Croydon.—ELECTRIC VEHICLE.—The B.C. has obtained an electric motor-car from Edison Accumulators, Ltd., at £516, for the use of the lighting department.

Dewsbury.—LABOUR DISPUTE—The dispute between the Yorkshire (Woollen District) Electric Tramways Co. and its employés has been settled, the men having accepted the offer of the company, which embodies an increased rate of wages.

Doncaster.—YEAR'S WORKING.—There was a surplus of £1,225 on the working of the Corporation tramways for the year ended March 31st last, against £1,290 in the previous year. The income was £23,224 and the expenditure £21,998.

Edinburgh.—ELECTRIC VEHICLES.—The engineer has been instructed to report on the advisability of providing one or two electrically-driven vehicles for the use of the E.L. department.

Leith.—YEAR'S WORKING.—The revenue of the Corporation tramways department for the past year amounted to £37,967, an increase of £2,002 on the previous year, and the expenditure to £36,001, and there was a credit balance of £1,966.

London.—The Highways Committee has recommended the L.C.C. to approve the expenditure of £88,000 in respect of two 8,000 KW. steam turbo-generators for the Greenwich generating station. The present load on the station is 32,500 KW., and energy to the extent of 4,000 KW. is purchased.

In order to expedite the construction of the Lee Green-Eltham tramways, the Committee recommends that, as the Bill authorising the construction of the extension may be passed during the summer recess of the Council, the expenditure of £57,025 on the scheme be sanctioned, and that the chairman and vice-chairman of the Committee be authorised to open any tenders that may be received for the work.

The Committee also recommends that the tramway track in Burdett Road and Grove Road, E., be reconstructed, at a cost of £63,000.

In consequence of the increasing car services, the Committee recommends that the sub-stations and sub-station plant be rearranged, at a cost not exceeding £23,850.

In connection with the construction of tramways in High Street and East Hill, Wandsworth, and from London Road to Park Road, Forest Hill, the Committee recommends that the expenditure of £18,500, for cables, &c., be sanctioned.

The Committee recommends that the Council approve the agreement arrived at on June 24th by the Traffic Conciliation Board with regard to the conditions of labour of the tramwaymen, and also the supplementary estimate of £15,000, involved by the same.

The Committee also states that the question of issuing season tickets on the tramways has been considered several times, but it has come to the conclusion that the experiment should not be tried.

The Works Committee of the Westminster City Council reports that it considers the scheme of the L.C.C. Highways Committee, for the linking-up of the tramways from Victoria to Westminster Bridge, to be extremely undesirable, apart from the fact that the streets on the suggested route would not be wide enough to allow of the construction of tramways. The Committee considers that no good purpose would be served by the suggested conference, or by the City Council deferring the expression of its opposition to the scheme.

Two tramcars collided at the south side of Blackfriars Bridge on Saturday afternoon last, resulting in considerable damage to the cars and injury to two men.

The City and South London Railway Co. proposes to improve the access to Clapham Common Station, and to provide a moving stairway to the platforms.

Owing to the employment of boy conductors on the L.C.C. tramways there is a possibility that the men may strike. The men's Union has taken the matter up. The Executive Council of the Union waited upon the L.C.C. on Tuesday. It is understood the deputation urged the Council to withdraw the boys, and stated that unless this was done the men would probably cease work.

Newcastle-on-Tyne.—The threatened strike of the employés of the Corporation tramways system has been settled, and although the offers of the Tramways Committee did not meet the men's demands, they have been accepted. Increases in pay, estimated to cost £2,955, have been granted.

South Africa.—The Boksburg railless traction system apparently is not turning out to be a financial success. Councillor Malman at a recent meeting declared that the town was going to lose £5,000 a year over it. The total cost was about £10,532 per annum, whilst the revenue would not reach £6,000.

TELEGRAPH and TELEPHONE NOTES.

China.—The Chinese Government has decided to establish telephonic communication between Shanghai and Nanking.

A new wireless station, constructed for the Chinese Government by Messrs. Siemens, at Woosung, has just been completed; it forms one of a chain of six Telefunken stations.

Denmark.—The telephone cable between the three largest of the Faroe Islands has for some years been nearly useless, and the authorities have submitted a petition to the Danish Government for the establishment of a wireless service between the islands instead. It is possible that this will lead to the establishment of a wireless service between the Faroe Islands and Iceland also.

London Ambulance Service.—In the report of a Special Committee to the L.C.C. on Tuesday, it was stated that instead of providing call posts, the Committee wished to find 3,500 telephone subscribers who would allow their telephones to be used by policemen in uniform for calling the ambulances, a metal tablet being fixed on the front of the premises to indicate the fact. Those who are willing to assist in this way are requested to send their names and addresses to the Clerk of the Council.

Long-Distance Wireless Telegraphy.—During the voyage of Prince Henry of Prussia to South America last spring, news was sent twice daily from the wireless station at Nauen to the steamship *Cap Trafalgar*, the tuned-spark system and the Arco high-frequency machine being used alternately, in each instance with an expenditure of 100 KW. in the aerial. The opportunity was taken to investigate the best wave length to employ. In view of the decreased absorption by night and the less loss experienced by long waves, longer wave lengths were employed by day than by night (when advantage was taken of the high efficiency with which shorter wave lengths could be radiated from Nauen). By night 4,500-m. waves were sent from the tuned quenched-spark apparatus, and at 5 p.m. (in March) 4,500-m. tuned-spark waves, and 9,400-m. waves from the Arco high-frequency machine, were used alternately. The same receiving apparatus was used for both damped and undamped radiations. Probably the longer wave would be more suitable for use at noon on a summer's day, but, under the circumstances actually existing during these tests, the shorter wave proved the better, and quite capable of transmitting messages over 5,000 km. (3,100 miles) by day. The *Cap Trafalgar* being then S.S.W. of the Canary Isles, waves received travelled in this direction across Germany, France and Spain. This distance of transmission exceeds those attained during the *Salem* trials (when, moreover, mere measuring signals, and not news, were transmitted). Transmission by day from land to ship had not previously been accomplished over so great a distance. On resuming the service during the return voyage of the *Cap Trafalgar*, the large Nauen tower having been meanwhile completed, 4,500-m. wave signals were heard at 9,000 km. (5,600 miles) by night (across Germany, Switzerland, France, the Spanish coast on the Mediterranean, and the N.W. of Africa), while at 7,000 km. (4,400 miles), the land route being even longer than before, the whole text could be picked up save for occasional interruptions by coastal and ship stations. These night distances also constituted a record for land to ship communication.

Sterilisation of Water.—It is reported that a new method of sterilising water has been devised by Prof. J. de Kowalski, who has found a way of producing very intense ultra-violet rays more economically than with quartz mercury-vapour lamps. The rays are derived from high-frequency sparks between electrodes of invar.

The Postal Service.—The Postmaster-General has appointed Sir George S. Gibb, Sir A. F. King, Mr. G. H. Stuart, Mr. R. F. Wilkins, and Mr. H. R. Young to be a committee to examine, from the point of view of the Department and its employés, the issues with regard to the wages and conditions of employment of Post Office servants, raised by the report of the Holt Committee. Sir George Gibb will be chairman.

Sweden.—The question of laying a telephone cable between Sweden and Germany has been under discussion for a considerable time, and the plan has now been approved by the authorities on both sides. The total expenditure in connection with the project is estimated at £36,000, of which sum each State, according to the agreement, will pay half.

Wireless on Board Ship.—The Merchant Shipping (Convention) Bill was again considered in a Committee of the House of Commons, on Thursday last week. Strong objections were raised to the draft agreement between the Board of Trade and the Marconi Co., in view of the recent expiration of the 7,777 patent, and it was contended that the agreement, so far from benefiting shipowners, would tend towards the creation of a

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monopoly. It was stated that seven independent companies in this country were supplying apparatus suitable for use on board ship. In the end Mr. John Burns agreed to drop the negotiations with the Marconi Co., and accepted a suggestion that the installation of wireless telegraphy on board ship should not be compulsory until six months after the Board of Trade had published rules under the Act. The Bill was reported to the House.

In reply to questions in the House of Commons regarding the draft agreement between the Board of Trade and the Marconi Co., Mr. Burns stated that the shipowners, being apprehensive about monopoly terms, requested the Board of Trade to open up communication with the Marconi Co. in the interests of the shipowners, but the latter were now satisfied that they did not require any protection that the agreement was supposed to give them.

Wireless Telegraphy and the Solar Eclipse.—The Committee for Radiotelegraphic Investigation of the British Association informs us that on the occasion of the total solar eclipse on August 21st next, five high-power wireless telegraph stations in Europe will each make a series of special emissions to provide facilities for the observation of strays, and for the measurement of the strength of signals. The Committee has sent us copies of the programme and of each Form, A, B and C, which it is issuing for use during the eclipse. Experimenters in wireless telegraphy possessing such apparatus of precision as will enable them to make accurate measurements should communicate with Mr. W. Duddell, F.R.S., 56, Victoria Street, London, S.W., and prospective observers willing to make aural estimates of signal strength or to make observations on strays (either by the graphic record method, or by the method of registering the number heard during every 30 seconds) should send an intimation to that effect, with a notification of which portion of the observations they could undertake, to the honorary secretary, B.A. Radiotelegraphic Committee, 88, Gower Street, London, W.C. They should also give the names of those of the five sending stations with which they could work.

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—August 4th. U.D.C. One natural-draught chimney-type cooling tower. See "Official Notices" July 10th.

Australia.—SYDNEY.—August 31st. Sydney Harbour Trust. Four electrically-operated semi-portable travelling cranes. Forms of tender from Mr. H. F. Norrie, Secretary to the Trust, Sydney.

September 14th. Municipal Council. 22,500 yd. of 33,000-volt, three core, paper-insulated, lead-covered cable. Deposit £200. Specification, 10s. 6d., from the City Electrical Engineer; a copy may be seen at the B. of T. Commercial Intelligence Dept., London.

RICHMOND.—Nov. 30th. Refuse destructor and auxiliary plant. Specification, &c., from Mr. C. C. Blazey, Town Clerk, Richmond, Victoria.

BRISBANE.—September 2nd. Measuring instruments, protectors and parts, telephone and telegraph instruments, for the Postmaster-General. See "Official Notices" to-day.

ADELAIDE.—Sept. 9th and 23rd. Telephone material, microphones, protectors, &c., bells and cells, for the Postmaster-General. See "Official Notices" to-day.

Adelaide Tramways Trust.—September 1st. One booster set, with cables and spares.—*Australian Mining Standard.*

MELBOURNE.—August 18th. Electricity recording meters and carbon brushes, for the Melbourne City Council. See "Official Notices" to-day.

Victorian Railways Department.—October 7th. Motors and switchgear, and motor-driven air compressors for the Ballarat and Bendigo workshops.

Austria.—August 13th. Machine tools for Prague railway workshops, including 10-ton electric lifting screws, two electric hand-boring machines, one electric quick-boring table machine, one electric motor, &c. Particulars, enclosing postage from the K.k. Staatsbahndirektion, Prague.

Belfast.—August 24th. Corporation. One electric motor tower-wagon. See "Official Notices" to-day.

Birkenhead.—August 10th. Corporation. Cooling tower. See "Official Notices" July 24th.

Blackburn.—August 1st. Twelve months' supply of steam coal for the Electricity Department. Mr. P. P. Wheelwright, Engineer and Manager.

Bradford.—Corporation. Electric installation at the Technical College Hall. Particulars from the Technical Education Sub-Committee.

Bulgaria.—August 13th. Electrical installation in the harbour of Burgas; estimated cost 248 000 fr. Guarantee, 5 per cent. Particulars of the Finance Commission, Sofia.

China.—TIENTSIN.—August 4th. Boilers, turbines, electrical power plant and coining machines, for the Government Mint. Specifications, &c. (two at 5s. each), from Sir Douglas Fox and Partners, 56, Moorgate Street, E.C.

Croydon.—The B.C. has decided to obtain tenders for a motor tower-wagon, for the Tramways Department.

Eastbourne.—August 18th. Corporation. Main machine and feeder switchboard for the electricity works. See "Official Notices" July 24th.

Electric light installation at the parish church. Sir Aston Webb, architect, London.

Halifax.—July 31st. 12 months' supply of coal for the Electricity Committee. Mr. W. M. Rogerson, Borough Electrical Engineer, Foundry Street.

Kingston-upon-Hull.—August 22nd. Corporation. Electrical fittings for the Guildhall Council Chamber, &c. See "Official Notices" July 24th.

London.—L.C.C. The Fire Brigades Committee recommends that tenders be invited for the supply of two petrol electric chassis and mounting Magirus ladders thereon.

The Highways Committee recommends that tenders be invited for laying of cable ducts, fixing of feeder pillars, reconstruction of various motor generators, and supply of trolley wire, in connection with the Council's tramways.

August 12th. Office of Works. Supply of electric clocks on a rental basis in the London districts, for the Commissioners of His Majesty's Works. Particulars from the Controller of Supplies, H.M. Office of Works, 18, Queen Anne's Gate, S.W.

Matlock.—August 8th. U.D.C. For the supply of 1967 yards of patent steel wire tramway cable. Specifications, &c., from C. P. Foster, Esq., Tramway Manager, Town Hall.

Newport (Mon.).—August 17th. Corporation. Converting plant, &c. See "Official Notices" to-day.

Nuneaton.—August 11th. Corporation. Underground cables. See "Official Notices" to-day.

Oldham.—August 16th. Corporation. D.C. motor-generator and extension to E.H.T. switchboard. See "Official Notices" July 24th.

August 24th. Corporation. Three economisers and three induced-draught fans and motors. See "Official Notices" to-day.

Rochdale.—August 5th. Paper-insulated cables for 12 months. Particulars (£2 2s. returnable) from Mr. C. C. Atchisor, Engineer and Manager, Dane Street.

Southampton.—August 6th. Installation of lighting plant, cables, &c., at the Farm Institute, Sparsholt. See "Official Notices" July 17th.

Sunderland.—August 18th. Corporation. Two 1,500-KW. machines. See "Official Notices" to-day.

Swinton and Pendlebury.—August 19th. U.D.C. Cables, fittings, &c. See "Official Notices" to-day.

Tonbridge.—August 4th. U.D.C. Steam coal for the year, for the Urban Council's electricity works. Mr. M. P. Plunkett, Electricity Works.

Walsall.—August 11th. Corporation. Coal conveyer and measuring apparatus, jib coaling crane, ash-handling plant, travelling crane. See "Official Notices" July 17th.

West Hartlepool.—August 17th. Corporation. Machine tools for tramways depôt workshops. See "Official Notices" to-day.

CLOSED.

Australia.—The following tenders have been accepted:

P.M.G.'s Department, Victoria:—
20,000 pattern A porcelain insulators, £500.—Warburton, Franki (Melbourne), Ltd.
289 cable boxes, £433; 843 ditto, £1,897; 198 ditto, £1,089.—Western Electric Co. (Australia), Ltd.
100 miles rubber-insulated, tinned copper wire, £282.—B.I. and Helsby Cables, Ltd.

P.M.G.'s Department, New South Wales:—
3,500 galvanised stay rods, £512.—Siemens Bros. Dynamo Works, Ltd.
17,500 galvanised tunnel brackets, £310.—Barratt & Co.

South Australia Tender Board:—
10 tons g.i. telegraph wire, £11 7s. per ton.—Geo. Wills & Co., Ltd.

Sydney Municipal Council:—
Testing transformers, £1,603; 33,000-volt switchgear, £6,293.—Australian General Electric Co.
33,000-volt transformers, £5,653.—Siemens Bros.

Home Affairs Department, Geelong:—
Green type economiser, for Woollen Mills generating station, £1,059.—Fraser, Ramsey Pty., Ltd.

—*Australian Mining Standard.*

Barrow.—The T.C. has approved of the Electricity Committee purchasing a balancer from the Phœnix Dynamo Co., at £99; switch gear from the British Thomson-Houston Co., at £1,400; and a mechanical stoker from the Underfeed Stoker Co., at £192.

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Bexhill-on-Sea.—The T.C. has accepted the tender of Messrs. Siemens Bros. & Co. for a booster, at £265; and that of Messrs. Myers, Rose & Co., for 1,000 tons of Shipley or Tibshelf peas for the electricity works.

Bradford.—The tender of Messrs. Wheeler Condenser and Engineering Co. has been accepted by the Technical Education Sub-Committee for a surface condenser, at £79, and that of Messrs. Ballias & Morcom, Ltd., for a high-speed engine to specification, for £367 13s. net.

The Electricity Committee has accepted the following tenders:

Cox-Walker's, Ltd.—One voltage regulator.
S. Parsons & Co.—Steel building for housing induced draught plant.
Sturtevant Engineering Co., Ltd.—One wet air filter for 5,000-KW. turbo-alternator.
Ferguson, Pallin & Co.—Three switchgear cubicles for transformer chambers.

The Corporation Tramways Committee has accepted the tender of the British Insulated & Helsby Cables, Ltd., for 25 miles of 0000 grooved copper trolley wire, at 8½d. per lb., and of Messrs. F. C. Booth & Co. for 800 conductors' ticket boxes, at 3s. 9d. each.

Cape Town.—The tender of Messrs. Koch & Dixie has been accepted for the wiring for lights and motors for Messrs. Hermann & Canard's new tobacco factory, also for the supply and erection of a main switchboard and distribution board for the same factory.

Coventry.—The Tramways Committee has recommended the acceptance of the tender of the Daimler Motor Co., Ltd., amounting to £1,626, for two motor-omnibuses.

Croydon.—The Education Committee has accepted the tender of Mr. E. C. Price, of Croydon, for an electric light installation at Princess Road Schools, at £78.

The Lighting Committee has accepted the tender of Messrs. Wm. Cory & Sons, Ltd., for "Muirfield peas" at 16s. 3d. per ton, and "Hill House washed peas" at 15s. 11d. per ton.

Dublin.—The Electricity Committee recommends the acceptance of the tender of the General Electric Co., for the supply of Aron type meters in such numbers and sizes as required during the next two years.

Keighley. — The T.C. has accepted tenders for the supply of a 750-KW. rotary converter and transformer for the sum of £1,595; and for two water-tube boilers for the sum of £5,076, subject to the necessary borrowing powers being granted by the Local Government Board.

Kirkcaldy.—The T.C. has accepted the tender of the Pendreich Electrical Firm, Edinburgh, for 15,000 pairs of carbons (open type).

London.—L.C.C.—The Fire Brigade Committee reports having received the following tenders for the supply of electrically-driven chassis for the conversion of three horse-drawn turntable ladders to motor traction:—

	One chassis.	Two chassis.	Three chassis.
Heinrich Scheele	£725	£1,400	£2,025
Henry Simonis & Co.	780	1,450	2,160
Do. do. (alternative tender)	825	1,640	2,445
Do. do. do.	880	1,750	2,610
Mossay & Co., Ltd.	807	1,584	2,196
"Cedes" Electric Traction, Ltd.	840	1,640	2,400
British N.A.G. Motor Co., Ltd.	1,020	1,998	2,967

The Committee recommends the acceptance of the tender of Messrs. Mossay & Co., Ltd., for the supply of one electrically-driven chassis to carry a turntable ladder, for £807, on the condition that the company shall, if so required, within three months of the acceptance of the chassis, supply one additional chassis for £727, or two additional for £1,389, and that they be allowed to sub-let to the Hansa Lloyd Works A.G. the construction of the chassis (without battery).

The Fire Brigade Committee recommends that during the summer recess of 1914 the chairman and the vice-chairman of the Fire Brigade Committee be severally authorised to open any tenders received for the supply of two electrical chassis and the mounting of Magirus ladders thereon, and to accept the lowest satisfactory tender.

The Highways Committee has received the following tenders for the supply of rotary converters, static transformers, and overhead crane required in connection with the rearrangement of tramway sub-stations and sub-station plant:—

ROTARY CONVERTERS.

Dick, Kerr & Co., Ltd. (recommended)	£13,065
Bruce Peebles & Co., Ltd.	13,092
British Westinghouse E. and M. Co., Ltd.	14,196
The General Electric Co., Ltd.	14,261
The British Thomson-Houston Co., Ltd.	14,377
Siemens Brothers Dynamo Works, Ltd.	16,274

STATIC TRANSFORMERS.

The British Electric Transformer Co., Ltd. (recommended)	£5,695
The British Thomson-Houston Co., Ltd.	5,916
The British Westinghouse E. and M. Co., Ltd.	6,166
Do. do. (alternative tender)	6,011
Johnson & Phillips, Ltd.	6,420
Bruce Peebles & Co., Ltd.	7,005
Siemens Brothers Dynamo Works, Ltd.	8,420

ONE 20-TON OVERHEAD TRAVELLING CRANE.

Carrick & Ritchie, Ltd. (recommended)	£265
John Smith (Keighley), Ltd.	295
Alexander Jack & Co.	310

The Highways Committee recommends that the chairman and the vice-chairman of the Highways Committee be authorised during the summer recess of 1914 to open any tenders that may be received for the laying of cable ducts, fixing of feeder pillars, reconstruction of motor-generators, and supply of trolley wire required in connection with the Council's tramways, and to accept the most favourable tender.

The Highways Committee also recommends that the necessary repairs to the storage battery at the electrical meter testing station at Hungerford House be carried out, and that the tender of the Electric Power Storage Co., Ltd., of £165 12s., be accepted, subject to an allowance of £11 12s. per ton in respect of old lead.

MARYLEBONE.—The tender of the British Thomson-Houston Co., Ltd., has been accepted by the Borough Council for the supply and fixing of a voltage regulator for the new turbo-generator, for £150.

PADDINGTON.—The Guardians are recommended to accept the tender of the General Electric Co., Ltd., to thoroughly overhaul and repair the intercommunication telephones at the Guardians' offices and maintain the same for 12 months, at £20 7s. 6d. The following quotations have been received for the installation of internal telephones at the infirmary, and also for the improvement of the fire-alarm indicator system:—

Carr & Parr	£96 6 0	C. Mickleburgh	£107 0 0
General Electric Co., Ltd.	99 10 0	Smith & Son	114 0 0
		White & Co., Ltd., £155 2s. 6d.	

The tender of the General Electric Co. is recommended, at £78 10s., for installing telephones and maintaining the same for a period of 12 months. The Committee is of opinion that there is no necessity for alterations to the fire-alarms.

WOOLWICH.—The tender of the Brush Electrical Engineering Co., Ltd., has been accepted by the Borough Council for the supply of two three-phase 100-K.V.A. transformers, for £155.

HAMMERSMITH.—The B.C. Electricity Committee recommends that the tender of the Main Colliery Co., Ltd., be accepted for the supply of so much Graigola and Victoria coal, at 16s. 10d. per ton, as may be required during the year ending July, 1915.

In connection with the conversion of 70 street lamps to electric lighting, the following tenders have been received for the supply of lanterns and fittings required:—

	Complete lanterns.	Fittings only.
Electric Street Lighting Apparatus Co.	£1 12 0 each	£0 16 6 each
" " alternative	£1 9 0 "	—
Lucy & Co., Ltd.	£1 18 6 "	£0 12 9 each
Resson Mfg. Co., Ltd.	£1 19 0 "	£0 10 6 "
W. Edgar	£2 17 0 "	£1 12 6 "
General Electric Co., Ltd.	£2 17 0 "	£0 9 0 "
Veritys, Ltd.	£3 16 9 "	£0 12 3 "

The Committee recommends that the tender of Messrs. Lucy & Co., Ltd., be accepted for the supply of lanterns, and that, subject to certain modifications in regard to materials used, the tender of the G.E. Co., Ltd., be accepted for the supply of fittings.

For the supply of cable, &c., required in lighting the public footpath from Bloemfontein Road to Ducane Road, the following tenders have been received:—

British Insulated and Helsby Cables, Ltd. (recommended)	£56
Siemens Bros. & Co., Ltd.	£66
Johnson & Phillips, Ltd.	£69

For the supply of 24 fuse handles with fuses, &c., and 24 fuse handles, complete with extra lighting blades for low-tension distribution boards in sub-stations, the following tenders have been received:—

Universal Elec. Mfg. Co., Ltd. (recommended)	11s. 9d. each and 13s. 6d. each.
Spagnoletti, Ltd.	17s. 6d. " 16s. 8d. "
Turners & Manville, Ltd.	18s. 9d. " 22s. 6d. "

For the installation of two internal inspection pipes for the pump suction of the coal reception tanks, the under-mentioned tenders have been received:—

Westwood & Wrights, Ltd. (recommended)	£56
John Bellamy, Ltd.	64
Aiton & Co., Ltd.	66

Lindley.—Messrs. J. H. Taylor & Co. have secured the contract for electrical work at the new Adult Schools.

Pelton (Co. Durham).—The Parish Council has accepted the tender of Messrs. S. Stobart & Co., of Newcastle-on-Tyne, for the supply of electric light poles and fittings for Grange Villa Road.

Salford.—Messrs. Chamberlain & Hookham have received a contract for meters from the Corporation.

Southampton.—The T.C. has accepted the following tenders:—

B. I. & H. Cables, Ltd., for one mile of trolley wire at 8 7/16d. per lb.
Lankester & Co., for installation of electric light and heating at 101, High Street, £11 18s. 6d.
Walton & Clough, Ltd., for the erection of coal conveyors at the Electricity Works.

Stoke-on-Trent.—The T.C. has accepted the following tenders for coal for the electricity works for the ensuing year:—

Sneyd Colliery Co.—Cockshead slack, for Burslem works.
Shelton Iron, Steel and Coal Co.—Great Row slack, for Hanley works.
Florence Coal and Iron Co.—Washed slack, for Stoke works.
Moorfield Colliery Co.—Coal for Longton works.

Tenders for fuel for the central power-house have been deferred.

The Bastian Meter Co., Ltd., have again received an order from the Council for the supply of their 3 and 5-ampere meters to its various branches.

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Tramway Contracts.—Messrs. Clough, Smith & Co., Ltd., have recently secured the following overhead equipment contracts:—Northampton Corporation Tramways, Far Cotton extension; Merthyr Tramways, Cefn extension; overhead construction of Hove experimental route, for the Cedes Electric Traction, Ltd.

Tunbridge Wells.—The Town Council has provisionally accepted the tender of Messrs. S. E. Haward & Co., Ltd., at £12 5s. 3d., for wiring the cemetery lodge.

West Bromwich.—The T.C. is recommended to accept the tender of Messrs. Babcock & Wilcox, for a boiler, brickwork, and extension to galleries at the electricity works; also the tender of the Rees Roturbo Co., Ltd., for a feed pump.

West Ham.—The following is a list of the tenders submitted for installing electric light at Rosetta Road School, Custom House, for the Education Committee of the county borough (Mr. William Jacques, A.R.I.B.A., architect):—

Bristow Brothers	£1,014	Malcolm & Allen	£682
Flower & Co.	898	John Biggs	681
West Ham Electric	889	Dickinson & Co.	655
McMillan & Co.	848	Weston & Sons, Ltd.	641
Smeeton & Page	844	Vaughan & Co.	639
Cathcart & Co.	835	Steel & Co.	635
Stegmann & Co.	798	Defries & Goldman	630
Prockter & Co.	795	Lund Brothers & Co.	611
Arthur Newman, Ltd.	750	J. T. Halsey, Stratford, E. (accepted)	518
Nicholls & Son	707		

Whitstable.—The U.D.C. has accepted the tender of the Pulsometer Engineering Co. for electric motors and other plant for the pumping station, at £1,210 10s.

Yarmouth.—The T.C. has accepted the following tenders for coal for the Electricity Works:—

Myers, Rose & Co.—5,500 tons Shipley or butterfly slack.
Cory & Sons.—1,500 tons Clifton or Woolerton hard steam.
Wm. Cory & Sons.—1,500 tons Nixon's smokeless Welsh steam.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION.)

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued:—

Headquarters will be opened daily for the transaction of regimental business from 10 a.m. till 4 p.m., except Saturdays, on which days the opening will be from 10 a.m. till 12 noon. Headquarters will be closed for all purposes on August 3rd and 4th, 1914.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

NOTES.

London Electricians' Strike.—The situation arising out of the dispute in the electrical trades of London was discussed at a meeting of representatives of the Electrical Trades Union and Electrical Contractors' Association on Thursday last week. The proceedings were private, but it was afterwards stated that no settlement was arrived at.

Fatalities.—SOUTH AFRICA.—A South African newspaper reports that on June 22nd, at an hotel at King William's Town, a native servant girl, while cleaning the third storey window, dropped her cloth, and in the attempt to regain it slipped from the verandah roof on which she was standing, and grasped a live 220-volt wire which runs close to the edge of the roof. For a time she was in a precarious position, with one foot on the roof and the other dangling in space. The current was switched off, and the girl fell to the ground, sustaining injuries from which she died shortly afterwards.

SUNDERLAND.—An inquiry was held by Coroner Buinicle, at Sunderland, on July 22nd, into the death of Peter Cornforth, who was killed electrically on July 20th, while working at the North-Eastern Marine Engineering Co.'s works at the South Dock, Sunderland. John Kirkpatrick said Cornforth was "striking" for him in the blacksmith's shop. Witness wanted to use a big hammer, which was worked by electricity, and he asked an apprentice blacksmith to start it. The apprentice was on his way to the switch when Cornforth rushed up to put the switch handle over. Witness waited for the hammer to start, and as it did not he looked to see the cause and saw Cornforth against the switchboard. Witness tried to pull Cornforth off, but the current "flung him off." There were live terminals on the switchboard, and there was no cover over them. In reply to Mr. W. B. Lauder, Inspector of Factories, witness said he did not know that the proper hammer boy had had shocks at the switch in question. He knew of one workman who had a shock, and witness had had a shock himself through his hand slipping on to a wire.

William Birbeck, an apprentice blacksmith, said he was asked to start the hammer, but before he could get to the switch the deceased reached it. Witness saw Cornforth's right hand slip off the handle and held there. Witness had had two shocks during the year and a half he had worked there. Mr. Joseph James said he was engineer in charge of the electrical plant, and had held that position for eight years. He was not present when the accident occurred, but tried to resuscitate Cornforth. The voltage was about 240. In reply to the Coroner, witness said he knew the live wires were unprotected, and knew that under the regulations they should have been protected. The switchboard was as supplied by the makers more than eight years ago. In answer to the Factory Inspector, witness said he did not know exactly when the electrical regulations came in, but he knew of them. There was a copy of the regulations posted up, and he was told to read them over and to mention to his superiors the alterations necessary to meet the regulations. Asked if he made mention of the switch in question, witness said he did not remember; he did not think so. Rule 3, which refers to the protection of switches, &c., was put in, and witness was asked if the switch complied with that rule. Witness answered in the negative. Asked whether, if the rules had been complied with, there would have been this fatality, witness again replied in the negative.

The Coroner said there was no doubt as to the cause of death, and the grave part of the matter was, apart from the unfortunate man's death, the negligence in not carrying out the regulation which provided that there should not be left uncovered or unprotected any dangerous part. In this case the live terminals were left unprotected. There was no dispute upon that point, and the engineer had admitted that if the regulations had been complied with, the accident would not have occurred.

A verdict was returned that "Death was due to an electric shock accidentally received."

CARDIFF.—George Gale, a Corporation electrician, was killed at Cardiff, on Thursday last week, while attending to fuses at a sub-station. He was leaning over an iron casement to reach the fuses, when he accidentally touched the terminal carrying a pressure of 2,500 volts, and was killed instantaneously. He had been used to this class of work for 12 years.

While repairing wires in a transformer tank, George Rich, an electrical engineer employed by the Cardiff Corporation, was killed on Wednesday, having apparently touched a live wire. Only last week another man lost his life by a similar accident in the same tank.—*Standard.*

GOVAN.—David Callander Morton (31), of Govan, was killed while working at Bull's metal and melloid works, Yoker, on Thursday last week. While engaged in painting the roof he fell, and, in his descent, caught hold of two electric power wires supplying energy to an overhead crane, and subsequently fell to the ground, fracturing his skull. A doctor gave it as his opinion that death took place before the man reached the ground.

BIRMINGHAM.—Mr. A. H. Hebbert (Deputy Coroner) held an inquest, on July 22nd, concerning the death of Albert William Cooper Harris (53), an electrician, who was killed on the 18th at the works of the Eyelet Co., Nechells, where he was employed. Mr. Ram, Electrical Inspector of Factories, and Mr. A. C. Lowe, Inspector of Factories, were present, and Mr. Baker (Shakespeare and Co.) appeared on behalf of the employers.

W. E. C. Jennings, assistant electric mains engineer to the Corporation, said that electrical apparatus was installed at the Eyelet Works in November, 1912, and the voltage was 5,000. Deceased had been warned of the danger. After the accident witness went to the works and found the main switch closed. The two transformer switches had been taken off, and the current was going to one side of the control panel. Before deceased touched that panel he should have switched off the current on the panel belonging to the Corporation. The Corporation strongly advised electricians before making any alterations to communicate with them and have the current switched off altogether. Witness had been told that deceased was unscrewing the bottom switch when the accident occurred. He should not have done that unless the current was off. Replying to a question, witness said he did not recommend india-rubber gloves for plant with high voltage.

Horace Bassett, the manager of the works, said deceased had charge of the electric plant, and witness considered he was an efficient workman. Deceased said he wanted to brush the transformers and refill them with oil, and witness gave him the panel key.

Albert Hammond said he accompanied deceased to the transformer room. After the transformers had been brushed and refilled with oil, deceased opened the panel door and unscrewed two screws from underneath the panel. He then touched the top of the panel, and immediately there was a flash and deceased was hurled backwards, knocking witness over. Before deceased opened the panel witness asked whether everything was safe, and an affirmative reply was received.

Dr. Winfield said that death was due to heart failure caused by an electric shock. He did not think that artificial respiration would have had any effect upon the deceased.

Mr. Ram said men who had come into contact with a voltage of 5,000 and upwards had been restored by the application of artificial respiration. He knew of one man who had recovered from a shock of 10,000 volts. Mr. Ram quoted medical opinion to the effect that it was possible to restore a victim if artificial respiration was resorted to at once.

The jury returned a verdict of "Accidental death," and added that they were of opinion that in future the Corporation should be communicated with before the panel was opened.—*Birmingham Daily Post.*

Life of Mercury Rectifier Bulbs.—Mercury rectifier bulbs used on constant-current arc lighting circuits are guaranteed for an average life of 500 hours, but this guarantee is being generally exceeded, and in some instances an average life as high as from eight to fifteen times the guarantee has been obtained. The report of the People's Gas and Electric Co., of Savanna, Illinois, recently issued, showed an average bulb life for the last three years of 8,398 hours.—*Journal of Electricity, Power and Gas.*

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The Parsons 25,000-kw. Turbo-Alternator. — The *Electrical World* states that the 25,000-KW. Parsons turbo-alternator set, the installation of which has just been completed by the Commonwealth Edison Co., Chicago, was received in the United States late last summer shortly before the new tariff law went into effect. To gain the saving in Customs duties possible under the new tariff, the turbine was therefore held in bond for about a month until the date when the Act went into force. Upon unpacking the set at the end of this period it was found, however, that the insulation of the machine had absorbed considerable salt moisture during its sea voyage across the Atlantic, so that the armature end-turns had to be reinsulated before the turbo-generator could be made ready for use.

Fire Due to a Candle.—At St. James's Parish Church, Accrington, on July 22nd, an electric light installation was being put in, and two electricians were engaged running wire in the ceiling by the light of a candle. It is thought that during their temporary absence the candle fell over and ignited the woodwork, as an outbreak of fire occurred. Members of the choir were assembled for practice, and gave the alarm, and fortunately the fire was quickly suppressed. The incident is noteworthy as a warning; the use of candles should never be permitted under such circumstances.

Under the Round Table Again.—Just as certain odours are said to possess remarkable powers to recall to our memories scenes of by-gone days, so certain familiar words appear to influence a writer in one of our contemporaries with even more realistic effects, as we have noticed on more than one occasion. Last week, for instance, after naming with remarkable and suggestive fluency a variety of alcoholic liquors, he referred to "the annual meeting of the Electro-Harmonic Society on the 27th inst." The meeting took place on the 22nd.

Illuminated Proof Table.—For aligning the margins of proofs of book pages which are to be printed on both sides of the sheet, a Philadelphia printing house now saves much time by the use of a novel glass-topped proof table, beneath which are mounted several tungsten lamps. When the proof sheet, printed on both sides, is laid on this illuminated table the transmitted light shows at a glance where the page formes fail to register, and the time required to align proofs is 8 minutes instead of 20.—*Electrical World.*

Municipal Trading.—One of the subjects on which the American Municipal Executives and civic leaders at present in London are anxious to obtain information is municipal trading, which is not carried on to any great extent in the United States. This subject was set down for discussion at a sitting of the International Municipal Congress at the Anglo-American Exposition, Shepherd's Bush, last week.

The Mayor of Lambeth, who opened the discussion, said his borough did not go in for municipal trading. He believed that on the whole the feeling was against municipal trading, because it interfered with private enterprise.

Dr. Haddon (Professor of Political Science, Western Reserve University, Ohio) said there was a strong movement in America in the direction of municipalisation. The reason the idea had not gained ground in that country was because of the strong sentiment of individualism, and because the country was still largely rural in thought. Besides, under their present powers the cities were unable to finance municipal undertakings. Another drawback was that politics entered into the administrative side of their cities. He anticipated that within the next 10 years municipal trading would have a tremendous spurt in America.

The Mayor of Scarborough thought that it was extremely doubtful whether, from the points of view of price and quality, the municipality could improve upon the gas and electricity supplied by private companies.

Mr. Croot, of the West Ham Council, said their electric light undertaking yielded a net profit of £750 after meeting capital charges and interest. There was a loss on the tramway of £14,000, due to unfair competition by the omnibuses.

The Lord Mayor of York, speaking for himself, argued that better value was obtained at less money from a private company than from the municipality. The municipalisation of public utilities was fraught with danger at election times. He was strongly of opinion that the province of a city was to rule and govern and not to trade. It was a significant fact that, generally speaking, the rates were higher in those cities where the profits from municipal undertakings were large.

So much interest was shown by the American delegates in the subject that it was suggested it should be revived at a later meeting.—*Morning Post.*

Motor-Buses and Roads.—The Joint Committee promised by Mr. Samuel to inquire into questions affecting the liability of motor-buses, &c., to contribute to the upkeep of roads, is practically complete. Lord Balfour of Burleigh is chairman, and other members include Lord Derby, Lord Barnard, Lord Gorell, Lord Ashton of Hyde, Sir J. Barran and Captain Weigall. Although the reference is restricted to motor-buses, there is a desire to extend it to other heavy motors.

Inquiry.—A correspondent asks for particulars of a successful adaptation of electricity for tolling church bells of considerable size—leaving them free to be hand-rung in the peal when desired.

Educational Notes.—CITY AND GUILDS OF LONDON INSTITUTE.—The report of the Council for 1913 has been published, and shows that the number of students attending the City and Guilds (Engineering) College in electrical engineering in 1912-13 was 75, compared with 78 in the preceding year; in 1904-5 the number was 160—the maximum recorded. In the civil and mechanical engineering course there were 285 students, as compared with 145 in 1904-5; 61 students took special courses, and there were 124 students in applied electricity from the Royal College of Science. At the Technical College, Finsbury, there were 71 day students taking the electrical engineering course, compared with 107 in 1904-5. The Department of Technology held examinations in 74 subjects, for which 21,878 candidates entered in the United Kingdom. The total expenditure of the Institute for all purposes was £29,539.

On the report of the delegacy of the City and Guilds (Engineering) College, the Council of the City and Guilds of London Institute has awarded the diploma of Associate of the Institute to the following matriculated third year students who have completed a full course of instruction in electrical engineering as prescribed by the Council:—R. Burleigh, S. Neville, A. T. Hitch, E. V. Wolff, S. L. Smith, A. H. Pullan, R. Gray, K. G. Marconi, T. C. C. de Moura, B. M. Gillett, J. G. D. de Grandpre, S. E. T. Pryce, J. H. D. Sheppard, P. M. Hailey, A. W. Adams, A. Morales, B. S. S. Rockey.

SOUTH-WESTERN POLYTECHNIC, Manresa Road, Chelsea.—The Polytechnic will re-open on September 28th for day classes, and on September 21st for evening classes. Courses are provided in electrical engineering, and students are prepared for the B.Sc. degree in Engineering of the University of London, as well as for the examinations for admission to the various Engineering Societies and the examinations of the City and Guilds of London Institute. The evening courses include, besides the Engineering Courses, also classes in Electrical Wiring and other trade subjects. In the Electrical Wiring Department an advanced course has been arranged for the preparation of candidates for the Final Wiremen's Examination of the City and Guilds of London Institute. Arrangements have been made for placing students who have passed satisfactorily through the three years' Day Course in positions with large engineering firms, and hitherto such firms have offered more vacancies than the Institute has been able to fill with its students. The prospectus may be obtained at the Institute, or by post for 4d.

UNIVERSITY OF LEEDS (ENGINEERING DEPARTMENT).—The next session begins on October 5th. Particulars of the departments and names of lecturers in civil, mechanical and electrical engineering, coal gas, fuel and metallurgy, and mining are given in our advertisement pages to-day.

UNIVERSITY COLLEGE, NOTTINGHAM.—The next session opens on September 28th. Particulars of the Electrical Engineering Courses, &c., appear in our advertisements to-day.

NORTHAMPTON INSTITUTE.—The arrangements of the courses for next session are announced in our advertisement pages to-day.

CITY AND GUILDS TECHNICAL COLLEGE, FINSBURY.—The Executive Committee of the City and Guilds of London Institute has appointed Mr. Alfred J. Margetson, B.Sc. (Lond.), M.Sc., at present Assistant Professor at the City and Guilds (Engineering) College, Kensington, to the Professorship of Civil and Mechanical Engineering at the Technical College, Finsbury, vacated by Prof. E. G. Coker on his appointment to the Chair at University College.

UNIVERSITY OF LONDON, KING'S COLLEGE.—Special facilities are given at this College for research work in Civil, Mechanical and Electrical Engineering. Special courses of Advanced Lectures have been arranged on "Advanced Railway Engineering," "Factory Administration and Accounts," "The Commercial Aspect of Electrical Engineering," "Central Station Practice and its Relation to Legislative Enactments," &c. The courses of instruction in Civil, Mechanical and Electrical Engineering prepare students for the Diploma of King's College and the B.Sc. Engineering degree of the University of London. The entrance examination begins on Monday, September 21st, 1914. Full information may be obtained from the secretary.

A 25,000-KW. Turbo-Alternator.—The Kommunale Elektrizitätswerk Mark A.G., in Hagen, have installed a Brown-Boveri turbo-alternator, working with steam at 350° C. and 13·5 atmospheres, and delivering, at 1,000 R.P.M., a maximum output of 25,000 KW. ($\cos \phi = 0.8$) three-phase, 50-cycle current at 11,000 volts. Guaranteed steam consumptions are:—5·2 kg. per KW.-hour at normal full load, 5·43 kg. at three quarters, and 5·85 kg. at half full load. With boilers of 83 per cent. efficiency these consumptions correspond to 0·612 kg. of coal per KW.-hour, or 0·435 kg. per H.P.H.-hour, and an overall thermal efficiency of 22 per cent. The surface condenser has 5,200 tubes, its external dimensions being 7·6 m. × 3·5 m. diameter, and its total cooling surface 2,500 sq. m. Approximately 5,200 cb. metres of cooling water at 12° C. is circulated per hour, this duty and the removal of air and condensate being performed by two turbo-driven pumps, either of which is capable in emergency of maintaining full-load output with little deterioration of vacuum. The turbo-pumps exhaust to the mid-stage of the main turbine, or directly to the condenser, according to load. The condenser, having two-part water chambers, can be cleaned out without interrupting the supply. The floor space occupied by the turbo-generator is 16 × 4·2 metres; the height of the set is 3·5 m. overall. The condenser and auxiliaries pit is 16·8 × 5·5 m. × 7·5 metres deep. Including the condensing equipment, the total weight of the set is 385 tons, *i.e.*, about 42·5 lb. per KW.

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Appointments Vacant.—Assistant telegraph engineer for postal and telegraph department of the East African and Uganda Protectorates, £350 per annum; assistant electrical engineer (£300+) for Public Works Department, Nigeria: improver, to act as switchboard attendant (15s. per week), for Kendal Corporation; canvassing engineer (£2 2s. per week), for Walsall Corporation. Particulars are given in our advertisement pages.

Municipal Tramways Conference.—The preliminary announcement with regard to this conference, which is to be held at Salford on September 23rd—25th next, shows that the following papers will be read and discussed:—

"Some Notes on Transit Facilities for Passenger Transportation in Large Cities." By Mr. J. M. McElroy, Manchester.

"Trailer and Coupled Cars." By Mr. A. L. C. Fell, London.

"The Utilisation of Tramways for Goods Traffic." By Mr. W. Clough, Bury, and Mr. G. W. Holford, Salford.

The Midland Hotel, Manchester, will be the headquarters, and a preliminary reception will be held there on the evening of September 22nd. Both the Salford and Manchester Tramways Committees are entertaining the visitors, and an excursion to Chatsworth is proposed for September 25th.

Institution and Lecture Notes.—Victorian Institute of Engineers.—At a meeting on June 10th it was resolved that the Institute should take steps towards obtaining incorporation under the title "Australian Institution of Engineers," and should seek closer union with the Institutes in other States of the Commonwealth.

North of England Institute of Mining and Mechanical Engineers.—We have received the programme for the excursion to the Home Office Experimental Station at Eskmeals, on Saturday, August 29th. A number of experiments on the ignition of coal-dust and fire-damp will be carried out.

Institution of Electrical Engineers (Newcastle Local Section).—Mr. H. W. Clothier, who has been Hon. Secretary to the Section for many years, is retiring from that office, his successor being Mr. J. R. Andrews, 6, Sanderson Road, Newcastle-on-Tyne.

Association of Electrical Station Engineers.—During the last few weeks very few meetings of the Association have been held owing to the holiday season, but meetings will start again at the end of August. The annual conference of the Association has been arranged for the first week in October; at this Conference the future action of the Association will be decided upon, taking into consideration recent events.

No meeting has yet taken place between the A.E.S.E. and the Associated Municipal Electrical Engineers (Greater London) as suggested by the A.E.S.E. in a circular letter of February 9th last, owing to the impossibility of the A.M.E.E. finding a date convenient to their members, but the A.E.S.E. has been given to understand that every endeavour is being made to fix a convenient date for the meeting as early as possible.

With regard to the recent discharge of a member of the A.E.S.E. from the Corporation electricity generating station at Coventry, a meeting was arranged on Monday last between the secretary of the Association and the chief engineer and chairman of the Electricity Committee; unfortunately, the chief engineer was taken ill, and was unable to attend. The chairman stated that the act of appealing to the Committee by the man who was discharged, over the head of the chief engineer, was rank insubordination, and that the Committee must support the engineer. At a meeting of the Coventry Town Council, on Tuesday last, the matter was brought up, but the Council decided to let it drop. There is a possibility of further negotiations when the chief engineer has recovered from his illness.

G.E.C. Sports.—On Saturday, July 18th, the Witton Athletic Club held their annual sports at Witton. These sports are open to the whole of the G.E.C. organisation, and large contingents of competitors and visitors travelled from the G.E.C. branches and works in all parts of the country in order to compete. Over 50 came from Cardiff, and Osram Lamp Works contributed a strong team of picked athletes. Amongst the valuable prizes were the Hallgarth cup for the 100 yards race, the Byng cup for the best relay team, the Directors' cup for the department showing the best athletic prowess, and a magnificent trophy, the Hirst cup, for the finest G.E.C. athlete. For the purpose of the last two cups the Witton Works were divided into 10 sections, each other branch and works constituting a section. Points were allotted to the first, second and third in each event, as well as to heat winners for the purpose of deciding the winners. The competition for the cups was very keen, although two sections—Osram Lamp Works, and Section 5 of Witton Works (switchgear department, arc lamp department, export department, and publication department)—soon gained a clear lead of all the others, and Section 5 ultimately gained the victory by 46 points to 39, mainly as a result of organisation, the men running entirely for their section by giving up the prospects of more valuable prizes in one race in order to make sure of points in other races. Not only did Section 5 win the Directors' cup, but one of their number carried off the Hirst cup. The Byng cup was gained by Osram Lamp Works, and the tug-of-war by the Witton engineering department. At the conclusion of the sports, Mrs. Railing presented the prizes.

Westinghouse Strike Ended.—The striking employés of the Westinghouse Companies at East Pittsburgh, Pa., voted on July 9th to go back to work. The works are now running full time.—*Electrical Review and W. Electrician.*

Electrolytic Disinfecting Fluid.—In his report for the year 1913, Dr. F. W. Alexander, medical officer of health to the Borough of Poplar, states that 66,740 gallons of the electrolytic fluid were produced, at a cost of £71 for electricity (1½d. per unit) and £56 (or £62—there is a discrepancy.—Eds.) for material. Since the installation of the plant in 1906, when the output was 17,000 gallons, the total production has amounted to 312,999 gallons, at a cost of £613 (under ½d. per gallon). The fluid is supplied to the Public Health Department, the Sick Asylums, the Board of Guardians, the Works Department, four L.C.C. schools, and to the swimming baths.

Similar plants have been supplied to the War Office and the Admiralty, to Finland, Buenos Ayres and Rangoon; Gateshead Corporation has ordered one, and a large installation is being carried out for Portsmouth Corporation, to use ordinary sea water. A new double cell has recently been constructed, of slate, in such a form that electric leakage from one cell to another is prevented; this cell is cheap, and can be made in a few days. Current is taken directly from the Council's mains.

Fire Prevention.—The British Fire Prevention Committee concluded its summer session last week with a series of tests relating to wired glazing. Having regard to the number of applications for interesting tests with fire-resisting materials and systems of construction, the Committee has decided this year to have a vacation session, and there will thus be tests during August and September. The Russian Government proposes to make a substantial grant of £5,000 or more to the Russian Fire Society for the erection of a testing station in St. Petersburg on the London model.

Edison & Swan New Showrooms.—Yesterday morning the new City headquarters of the Edison & Swan Co., at 123-125, Queen Victoria Street, E.C., were thrown open to inspection by the Press. The premises include a spacious ground-floor showroom occupying an area of some 83 ft. × 53 ft., with a gallery on either side, a trade entrance, with counter, &c., in Upper Thames Street, and upper floors for stores. The showroom is one of the finest we have seen, and it is almost needless to add that a very complete display is being made of electric fittings of all kinds, cooking and heating apparatus, switchgear, lamps, bells, &c., and the various apparatus with which the Edison & Swan Co.'s name is associated. We hope to give further particulars at a later date.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Lancaster T.C. has increased the salary of Mr. E. C. Milnes, electrical engineer, by £25, to £250.

Mr. A. M. Kissack has resigned his position as charge engineer at the central power house of the Stoke-on-Trent Corporation, and Mr. A. T. Gilbride has been appointed in his place, at a commencing salary of £120 per annum. Mr. H. V. C. Cotton, charge engineer at the Burslem Works, has been appointed charge engineer at the Longton Works, at a commencing salary of £2 per week. Mr. J. Bickenton, switchboard attendant, has been appointed charge engineer at the Burslem Works at a salary of £1 12s. 6d. per week.

Mr. C. Barton has been appointed chief shift engineer at the Bexhill Corporation electricity works, and a second shift engineer is to be engaged.

Pressure of business has led to the resignation of his commission in the Territorials by Mr. H. Richardson, the city electrical engineer of Dundee. Mr. Richardson has been associated with the Volunteers and Territorials for 11 years.

The salary of Mr. W. Scott, acting charge engineer at the Woolwich Electricity Works, is to be increased from £2 6s. to £2 10s. per week as from October 1st next.

Mr. E. G. Boissier, mains superintendent, having resigned, the Derby T.C. has appointed Mr. G. D. Arden, assistant mains superintendent, as his successor, at a salary of £200 per annum.

General.—With reference to the illness of Mr. Barralet, mentioned in this column three weeks ago, that gentleman, who we are pleased to learn is now convalescent, desires to thank the large number of friends who have been so kind as to make inquiries.

The wedding of Mr. R. P. Yates, of Messrs. Gillespie & Beales, with Miss D. Lidbetter, took place at Halifax on July 23rd. As a memento of the occasion a presentation was made at the offices of the firm, consisting of a handsome canteen of cutlery and table silver, on behalf of the staff of Messrs. Gillespie & Beales and the British Electric Equipment Co., Ltd.

At the works of Messrs. C. A. Vandervell & Co. a presentation was made on July 23rd to Mr. S. F. H. Parsons, chief draughtsman in the Commercial Drawing Office, on the occasion of his marriage. The present consists of a fine case of cutlery from the management and staff of the company. The presentation was made by Mr. A. G. Goodwin, general manager, on behalf of the subscribers.

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DR. W. G. RHODES has resigned from the position of chief lecturer in the electrical engineering department at the Salford Technical Institute, and the Salford Education Committee has appointed MR. EDWARD H. DIXON, B.Sc., of Southampton, to fill the vacancy.

MR. G. MURRAY, of the British Thomson-Houston Co., has been appointed electrical engineer to the Afghan Government.—*Indian Textile Journal.*

The King received MR. MARCONI at Buckingham Palace on Friday last week, and conferred on him the Honorary Grand Cross of the Victorian Order.

The marriage took place, on July 24th, of MR. HENRY SKELLERN JACKSON, late of Burnley, and now of Johannesburg, Transvaal, to Miss Barbara Muir, late of Kilmarnock, and now of Frosburg, South Africa. For some years after the war, Mr. Jackson was electrical engineer at Robinson Gold Mine, and he is now with the Witwatersrand Deep G.M. Co. in a similar capacity.

MR. R. W. DAVIES, of Frodsham, who is leaving the British Insulated and Helsby Cables, Ltd., to take up new duties at Warrington, has received a present from his colleagues.

COL. JOHN E. BROADBENT, C.B., R.E., has been appointed to succeed the late Mr. Henry Collins, as a director of the Reading Electric Supply Co.

MR. G. BRANCH has joined the staff of Messrs. H. R. Williams and Co., of Barnstaple, as electrical engineer.

MR. G. R. DRUMMOND, late electrical engineer to the Bikanir Government, has been appointed State electrical and mechanical engineer to the Jodhpur Durbar.—*Indian Textile Journal.*

MR. and MRS. MARK ROBINSON celebrated their golden wedding on Monday last, the entertainment taking the form of a trip up the Thames in the steam launch *Formosa*, starting from Hampton Wick. A golden-covered cake was cut on board.

On the 22nd inst., at Longsight, Manchester, MR. H. L. AINSWORTH, head traveller of Messrs. J. & H. Grevener, was married to Miss Eva Beckett, of Manchester; he was presented by the firm with a handsome barometer, and by the staff with a salad bowl and gold-mounted cigarette-holder.

ALDERMAN DAVID SHANKS, a well-known manufacturer of electric light fittings in Birmingham and the founder of David Shanks & Co., Ltd., Aston, has been added to the local bench of magistrates.

NEW COMPANIES REGISTERED.

F. Parks, Ltd. (137,096).—This company was registered on July 21st, with a capital of £10,000 in £1 shares, to carry on the business of wholesale and retail manufacturers, importers and exporters of, and dealers in, lamps and lampshades for electric and other lamps and component parts thereof, electric and other fittings, lamp stands, &c., and to adopt an agreement with F. G. Parks. The subscribers (with one share each) are:—F. G. Parks, 21, Berners Street, W., lamp shade manufacturer; Mrs. A. S. Parks, 45, Sotheby Road, Highbury Park, N. Private company. The number of directors is not to be less than two or more than five; F. G. Parks is the first director; qualification, £100; remuneration (except managing director) as fixed by the company; solicitors, Cooper, Bake, Roche and Fettes, 6-7, Portman Street, Portman Square, W.

Morris, Warden & Co., Ltd.—This company was registered in Edinburgh on July 16th, with capital £6,000 in £1 shares. To acquire and carry on the business of Morris, Warden & Co., engineers, manufacturers of and dealers in electrical and engineering appliances. The subscribers (with one share each) are:—Willoughby O. Warden, 69, Gordon Street, Elmsford, metal merchant; Andrew B. Morris, 68, Gordon Street, Elmsford, metal merchant; Ernest George Tidd, 64, Gordon Street, Elmsford, engineer; Kenneth W. Warden, 69, Gordon Street, Elmsford, engineer. The first directors (to number not less than two or more than six) are W. C. Warden, A. B. Morris, E. G. Tidd and K. W. Warden; qualification, £100.

Aluminium Foil Co., Ltd. (137,133).—This company was registered on July 23rd, with a capital of £5,000 in £1 shares (1,200 "A" and 3,800 ordinary), to carry on the business of rollers and workers of aluminium and other metals, electricians, electrical engineers, &c. The subscribers (with one share each) are:—N. G. Paterson, 83, Mayhill Road, Charlton, S.E., accountant; J. H. Andrews, 8, Lyndhurst Road, Higham's Park, cashier. Private company. The first directors are K. M. Clark, E. C. Gates, and H. J. Jack (managing director). Remuneration (except managing director) as fixed by the company. Registered office, 52, Coleman Street, E.C.

Self-Protector, Ltd. (137,155).—This company was registered on July 23rd, with a capital of £5,000 in 3,000 first preference and 1,500 second preference shares of £1 each, and 4,000 ordinary shares of 2s. 6d. each, to acquire from A. Jonckheere, of 9 and 10, King Street, Cheapside, E.C., the benefit of certain existing inventions relating to electromagnetic apparatus and cable connections for burglar alarms and like systems, &c. The subscribers (with one second preference share each) are:—W. Durrant, 9-10, King Street, E.C., secretary; H. W. Bird, 41, Endymion Road, Finsbury Park, N., engineer. Private company. The number of directors is not to be less than two or more than seven; the first are R. W. Wright, A. E. Brown and A. Jonckheere. Remuneration (excepting managing director, if any), £150 each per annum. Registered office, 9-10, King Street, E.C.

Electro-Magneto Motors, Ltd. (137,168).—This company was registered on July 24th, with a capital of £10,000 in 1s. shares, to carry on the business indicated by the title. The subscribers (with one share each) are:—F. B. Spencer, 10 Versailles Road, Anerley, S.E., clerk; J. Connor, Crosby Buildings, Crosby Square, E.C., clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first, who shall be permanent; remuneration as fixed by the company. Registered office, Crosby Buildings, Crosby Square, E.C.

Health Humidifier Co. (Blackburn), Ltd. (137,173).—This company was registered on July 24th, with a capital of £1,000 in £1 shares, to take over the business of engineers and patented process manufacturers carried on at Blackburn, as "Thomas Forrest Smith," to acquire from T. F. Smith, W. Scales and F. Scales, all their respective interests in Patent No. 13,624 of 1912, granted to the said T. F. Smith, and to carry on the business of suppliers of light, heat and motive power, electrical, mechanical and general engineers, &c. The subscribers (with one share each) are:—Thos. Forrest Smith, Langho, Blackburn, engineer; Wm. Scales, Eastlee, Ramsgreave Blackburn, funeral undertaker; Fred. Scales, 22, Audley Lane, Blackburn, funeral undertaker. Private company. The first directors are Thos. Forrest Smith, Wm. Scales and Fred. Scales; qualification, £40. Registered office, Central Works, Eagle Court, Darwen Street, Blackburn.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electro-Flex Steel Co., Ltd.—Issue on July 10th, 1914, of £3,000 debentures, part of a series of which particulars have already been filed.

Premier Electric and Hardware Co., Ltd.—Second mortgage debenture dated July 14th, 1914, to secure £637 10s., charged on the company's undertaking and property, present and future, including uncalled capital subject to first debenture. Holder: E. H. Hawkins, 4, Charterhouse Square, E.C.

Underground Electric Railways Co. of London, Ltd.—Charge of 45,000 additional shares of £10 each in the London General Omnibus Co., Ltd., dated June 29th, 1914, supplemental to indenture dated April 1st, 1912, to secure £1,400,000 6 per cent. first cumulative income debenture stock. Holders: Union of London & Smith's Bank, 2, Princes Street, E.C. Also indenture of even date (supplemental to charges dated July 30th, 1908, and April 1st, 1912, securing £6,500,000 income bonds), charged on above-mentioned property, as collateral security and subject to above-mentioned charge. Holders: London County and Westminster Bank, Ltd., 41, Lothbury, E.C.

Tilney Manufacturing and Testing Co., Ltd.—Particulars of £1,000 debs., created April 8th, 1914, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

St. Austell and District Electric Lighting and Power Co., Ltd.—Agreement dated June 30th, 1914, extending time for payment of first and second debs., each for £2,000, and increasing rate of interest upon the former, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: First Debenture-holders.

Fardon & Carpenter, Ltd.—Debenture dated July 17th, 1914, to secure £250, charged on the company's undertaking and property, present and future. Holder: R. H. Mills, 179, Maida Vale, W.

Birkdale District Electric Supply Co., Ltd. (70,259).—Capital, £50,000 in £5 shares; return dated April 28th, 1914. 9,200 shares taken up, £5 per share called up on 6,000, and £3 per share on 3,200 shares, £36,400 paid. Mortgages and charges: £3,000.

Anchor Cable Co., Ltd. (69,073).—Capital, £250,000 in £10 shares; return dated May 28th, 1914: 6,500 shares taken up, £10 per share called up on 6,100, £61,000 paid, £4,000 considered as paid on 400 shares. Mortgages and charges: £50,000.

Trafford Power and Light Supply Co., Ltd. (72,601).—Capital, £30,920 in £1 shares (23,120 pref. and 57,800 ord.) Return dated July 14th, 1914; all shares taken up; £30,920 paid. Mortgages and charges: £60,500.

Urban Electric Supply Co., Ltd. (57,986).—Capital, £640,000 in 80,000 ord. shares of £3 each, 50,000 pref. shares of £5 each, and 150,000 shares of £1 each. Return dated April 15th, 1914: 80,000 ord. and 50,000 pref. shares taken up; £3 per share called up on the ord and £5 per share on the pref.; £490,000 paid. Mortgages and charges: £411,951.

CITY NOTES.

City of Carlisle Electric Tramways Co., Ltd.

THE directors' report for 1913 shows that after providing for debenture and loan interest and writing off the sum of £529 from the suspense account, there is a balance at the credit of profit and loss account amounting to £33, which will be carried forward to next year's accounts. Included in the working expenses for the year is the cost of a reversible booster installed in the Carlisle Corporation's power station. The directors recommend that an issue of £20,000 6 per cent. second debentures be made by the company, the proceeds of which can be utilised to pay for the outstanding portion of the cost of the reconstruction of the system.

The ordinary general meeting was held on Wednesday, at the offices, 66, Queen Street, E.C., Mr. Wm. Shearer presiding. The proceedings were private, but we were informed that the report and the resolution authorising the issue of £20,000 6 per cent. second debentures were carried unanimously.

Electrolytic Co. (Spain and Portugal).—The annual meeting was held on Tuesday at the offices, 18, Eldon Street, Finsbury. We are unable to give a report of the proceedings as a representative of the ELECTRICAL REVIEW, who attended for that purpose, was informed that the meeting was private.

County of London Electric Supply Co., Ltd.—The directors have declared an interim dividend on the ordinary shares for the half-year to June 30th last at the rate of 5 per cent. per annum, less income-tax.

Vickers, Ltd.—Interim dividends for the half-year to June 30th last will be paid as follows:—2½ per cent. (less tax) on preferred 5 per cent. stock, and 5 per cent. preference shares; 1s. per share (free of tax) on ordinary shares, including the 1,110,000 recently issued, on which £1 has been paid. Dividends will be posted on August 26th.

Northampton Electric Light and Power Co., Ltd.—The directors have declared interim dividends at the rate of 5 per cent. per annum on both the ordinary and preference shares.

Chelsea Electricity Supply Co., Ltd.—An interim dividend at the rate of 4 per cent. per annum, less income-tax, has been declared on the ordinary shares for the past half-year.

Blackpool and Fleetwood Tramroad Co.—The directors have declared an interim dividend at the rate of 4 per cent. per annum.

National Gas Engine Co., Ltd.—An interim dividend at the rate of 7½ per cent. per annum has been declared.

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German Electrical Companies.

THE accounts of the *Elektra A.G., of Dresden*, show gross profits of £22,900 for 1913 as compared with £22,700 in the preceding year. After setting aside £4,300 for depreciation and reserve funds as against £4,200 in 1912, the balance permits of the payment of a dividend of 6 per cent., being the same rate as in the previous year.

The *Kabelwerk Wilhelmineschof, of Berlin*, records an increased turnover in 1913, so that all branches of the company's works were fully occupied. Including the balance brought forward the accounts exhibit net profits of £13,600 as compared with £11,900 in 1912, and a dividend of 15 per cent. has been declared on share capital of £50,000, being the same rate as in the preceding year.

The *Elektro Treuhand A.G.*, which is a financial bank, jointly owned by the A.E.G. and the Siemens-Schuckert Works, reports interest receipts amounting to £16,900 for 1913 as compared with £15,600 in 1912, and £41,250 as dividend on shares held in the Hamburg Elevated railway, being the same amount as in 1912. After defraying the interest charges on loans the accounts indicate net profits of £25,100 as against £23,100 on a paid-up share capital of £375,000.

The *Hochfrequenz Maschinen A.G.*, which owns the Goldschmidt patents for high-frequency generators in Germany and which is interested in the Compagnie Universelle de Télégraphie et de Téléphonie sans Fil of Paris, now proposes to distribute the profits which had been placed to a suspense account and which arose from the patent transfer transactions concluded with the French company about two years ago. The amount in question is £46,900, which is to be divided by the payment of 24 per cent. on the £80,000 of A shares and 57.6 per cent. on the B shares of £25,000.

The report of *Hartmann & Braun A.G., of Frankfort-on-Main*, states that the turnover in 1913 experienced a considerable increase as compared with the preceding year. As gross profits the accounts indicate the sum of £100,000 as against £93,500 in 1912, and the general expenses and taxes were £50,000 as contrasted with £46,000. After setting aside £11,000 for depreciation as against £9,700 in 1912 and making other appropriations, the net profits and balance forward are returned at £27,800 as compared with £29,000. The directors recommend a dividend of 10 per cent. on ordinary share capital of £85,000, being the same rate as in each of the three preceding years.

The *Korting & Mathiesen Bogen Lampenfabrik, of Leutzsch*, reports net profits of £20,000 for 1913 as contrasted with £30,000 in the previous year, and the payment of 10 per cent. as against 20 per cent. The report attributes the less satisfactory results to the general unfavourable situation. At the recent meeting it was stated that good hopes were entertained in regard to the arc lamp business, which was expected to revive in the autumn. The position of the arc lamp in relation to the glow lamp had in part already been cleared up as, for instance, municipal authorities, the railways and large establishments had unreservedly decided in favour of the former, whilst numerous cases existed where the arc lamp had supplanted the glow lamp.

The C. Lorenz A.G. (Telephon und Telegraphenwerke), of Berlin, reports that the year 1913 was exceptionally favourable as the plant was fully employed and the turnover reached record figures, but sale prices in general were very low both in the business with government authorities and with private customers. After devoting £16,000 to depreciation as against £12,000 in 1912, the accounts show net profits of £29,000 as compared with £19,700, and a dividend of 20 per cent. has been declared on share capital of £70,000 as in the previous year, and a bonus of 5 per cent. has also been paid out of the profits arising from the company's association with the High Frequency Machine Co. Although the stock of orders brought over from 1913 was greater than a year previously, a slackening in new orders has taken place in the current year.

The directors of the *Felten & Guilleaume Carlswerk A.G., of Mulheim*, reporting on the past year, state that the volume and value of the turnover in 1913 exceeded the record figures for 1912. Satisfactory results were also yielded by the company's investments. A decline in the proceeds from the Norddeutsche Seekabelwerke, owing to inadequate orders was more than counterbalanced by greater proceeds in the case of the Land und Seekabelwerke, Escher Wyss & Co., and the Treuhand Bank fur die Elektrische Industrie. The collection of the debts and the settlement of other matters in connection with the winding-up of the former Frankfort works continued their naturally slow course. The proposed construction of steel works in Luxemburg for an annual production of 200,000 tons in order to supply the requirements in semi-finished steel was definitely resolved upon in December, 1913, after the company had secured further government iron ore concessions and the undertaking had consequently been placed upon a wider basis. After further reference to the iron and steel department and the wire trade, the report mentions that the copper works, the cable factory and the factory for insulated wires were satisfactorily employed at good prices. The manufacture of high-pressure cables for over 50,000 volts was successfully advanced, and special attention was devoted to the development of telephone cables, whilst the production of special articles was undertaken in the rubber factory for technical goods and in the metal works. The systematic transformation of the works, plant and equipment was continued by the expenditure of considerable money, and the improvements introduced enabled the increased output to be effected with approximately the same officials and workmen, who numbered 6,851 as compared with 6,846 in 1912. The accounts exhibit the following figures for the two years:—

	1913.	1912.
Share capital	£2,750,000	£2,750,000
Loan capital	1,193,500	1,218,000
Gross profits	603,000	547,000
Depreciation	86,000	83,000
Net profits and balance forward	321,000	278,000
Dividend, per cent.	8	8

The *Continentale Gesellschaft fur Elektrische Unternehmungen, of Nuremburg*, reports that the unfavourable economic conditions prevailing in 1913 had but little effect upon the company's interests in lighting and tramway undertakings. The gross profits are returned at £157,000, as against £146,000 in 1912, and the net profits at £108,000 as compared with £99,000. It is intended to distribute 6 per cent. on the preference capital of £1,556,000, as compared with 5½ per cent., the ordinary shares of £44,000 again receiving no dividend. In addition to undertakings administered by the company and representing a total of £1,152,000, the securities in portfolio comprise £880,000, apart from syndicate investments for £409,000.

The *Elektrizitats A. G. vorm, Lahmeyer & Co., of Frankfort-on-Main*, which is now essentially an investment company, reports that the undertakings in which the company is interested experienced a favourable development in 1913, thus permitting of an improvement in the dividend. The gross profits amount to £184,000, as compared with £156,000 in 1912. After defraying general expenses and interest on the loans of £1,500,000, the accounts show net profits and balance forward of £100,000 as against £84,000 in the previous year. It is proposed to pay a dividend of 7 per cent. on paid-up capital of £1,312,000, as contrasted with 6 per cent. in 1912 and 5 per cent. in 1911. The company holds shares of £600,000 in the Felten & Guilleaume Co., and exchanged shares of £1,050,000 with the Zurich Bank for Electrical Enterprises three years ago. Apart from investments the company owns supply works which are valued at £84,000, the former being put at £2,387,000.

Underground Electric Railways Co.—The Underground Electric Railways Co. of London, Ltd., has now, with the sanction of the Court, become a share and securities holding company. The revenue receipts of the company in respect of the first six months of the current year remaining after paying or providing for all revenue outgoings in respect of the same period would, in the opinion of the board, justify the distribution of approximately £60,000 by way of interim dividend on the shares, according to their respective rights. The board, however, have decided to defer the question of the payment of a dividend until the next annual meeting of the company, when it can be dealt with on the audited accounts for the complete year. It is announced that interest on the 6 per cent. first cumulative income debenture stock will be paid on September 1st next, less income-tax, at the rate of 6 per cent. per annum, and coupon No. 13 off 6 per cent. income bonds of this company will be paid, free of income-tax, at the rate of 6 per cent. per annum on the same date.—*Financial Times.*

Metropolitan Railway Co.—The figures for the past half-year, including the receipts and expenditure of the Great Northern and City line, show an increase in gross receipts of £42,452, and an increase in expenses, including debenture interest and other fixed charges, of £41,700. This will admit of the payment of 1½ per cent. per annum on the ordinary stock, the same as last year, after making similar provision for depreciation, &c., and leaving a corresponding balance to that carried forward in June, 1913. The Surplus Lands Committee announces that the balance for the half-year ended June 30th, 1914, including the sum brought forward from 1913 available for payment of an interim dividend on the Surplus Lands stock, amounts approximately to £39,000. The interim dividend at the rate of 2½ per cent. per annum absorbs about £36,000, leaving to be carried forward £3,000.—*Financial Times.*

Continental.— SWITZERLAND.— The balance-sheet of the Société Electro-Métallurgique, Procédés Paul Girod, for the last financial year, shows a net profit of only £4,708, as compared with £17,046 in 1912. Including the amount brought forward, there is an available balance of £20.926, which, in view of the unsatisfactory position, the directors recommend shall be carried forward to the current year.

NORWAY.—Under the name of the Tysse Elektrometallurgiske Aktieselskap, a new company has been formed at Kristiania for the purpose of taking over some works at Hardanger, which will be altered to suit the manufacture of ferro-alloys and similar products. The capital of the new company is £44,400 fully paid, and operations will be commenced in the near future. The buildings to be taken over are presumably those which previously belonged to the Hardanger Electrical Iron Works.

Mather & Platt, Ltd.—An interim dividend on ordinary shares of 5 per cent., free of tax, for the half-year to June 30th, being at the rate of 10 per cent. per annum, has been declared.

Paisley District Tramways Co., Ltd.—An interim dividend at the rate of 5 per cent. per annum has been declared on the 5 per cent. cumulative preference shares for the half-year to June 30th last.

City of Buenos Aires Tramways (1904), Ltd.—For the quarter to June 30th last, the usual dividend of 1¼ per cent. has been declared, payable August 17th.

Bank Rate.—The Bank Rate was yesterday raised from 3 to 4 per cent.

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Chatham and District Light Railways Co.

THE directors' report for the half-year ended June 30th, 1914, shows as follows:—Revenue, £23,548; expenses, £13,756, leaving £9,793; less rent of Rochester Corporation lines, £1,872; interest on debentures, £934; interest account, £508 = £3,314, leaving £6,479; plus £819 brought forward, making the balance £7,298. £2,940 is to be applied to dividend at the rate of 5 per cent. per annum for the half-year on the preference share capital, £1,590 to dividend at the rate of 3 per cent. per annum for the half-year on the ordinary share capital, and £2,768 is to be carried to revenue new account. The traffic receipts show an increase of £501, and the expenses an increase of £688 as compared with the receipts and expenses for the corresponding half-year of 1913. A further £2,000 debentures of the company were purchased and redeemed on 30th ult. Three additional cars have been ordered and will be put into service shortly. The directors will, as usual, provide for depreciation when the final accounts are made up at the end of the year.

Half-year ended.	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
Dec. 31st, 1912 ..	14·98	4,850,973	£23,634	1·17d.	567,202	47
June 30th, 1913 ..	14·98	4,669,151	£22,713	1·17d.	540,192	47
Dec. 31st, 1913 ..	14·98	5,210,822	£25,519	1·17d.	567,634	47
June 30th, 1914 ..	14·98	4,880,135	£23,214	1·14d.	573,213	47

Lanarkshire Tramways Co.

THE directors report for the half-year ended June 30th, 1914, that there was a revenue of £50,595, and the expenses were £32,650, leaving £17,945, less contributions payable to local authorities £1,433, interest on debentures £911, interest account £857, interest account—Lanark County Council Tramways £799 = £4,000, plus £1,991 brought forward, leaving a balance of £15,935. Out of this the dividend at the rate of 6 per cent. per annum for the half-year on the issued share capital absorbs £10,290, and £5,645 is carried to revenue new account. The revenue for the half-year shows an increase of £7,145 and the expenses an increase of £7,995 as compared with the revenue and expenses for the corresponding half-year of 1913. The increase in expenses was partly due to operating the lines leased from the Lanark County Council and partly to increased wages to the staff and heavier maintenance charges for the permanent way. The Lanark County Council Tramways were completed on February 10th last and are now in full operation. The directors will, as usual, provide for depreciation in the accounts to December 31st next.

Half-year ended.	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No of cars.
June 30th, 1912 ..	23·32	7,062,726	£36,570	1·24d.	893,927	64
Dec. 31st, 1912 ..	23·32	8,202,018	£41,867	1·21d.	955,164	64
*June 30th, 1913..	24·62	8,579,876	£42,884	1·20d.	979,621	66
*Dec. 31st, 1913..	34·29	9,471,832	£47,760	1·21d.	1,074,440	78
*June 30th, 1914..	136·47	9,926,810	£49,948	1·21d.	1,169,837	78

* Includes motor-omnibus service. † Includes motor-omnibus service 8·04 miles.

Monterey Railway, Light and Power Co.—Owing to the continuance of the disturbed political conditions in Mexico, arrangements with the Government of the State of Nuevo Leon for a settlement of the claim of the Monterey Waterworks and Sewer Co. under the Government's guarantee of 10 per cent. on the capital expenditure have not yet been completed. Notwithstanding this, it would have been possible to provide the interest on the debenture stock but for the low rate of exchange prevailing, and on this account the directors regret that they are compelled to postpone the payment of the interest on the 5 per cent. first mortgage debenture stock, due on August 2nd next, until such time as it is possible to transfer the money on reasonable terms. If settled Government be restored the rate of exchange may be expected to become normal again with the return of normal trade conditions, enabling the company in due course to resume regular payment of the interest on its debenture stock.

Bristol Tramways and Carriage Co., Ltd.—The directors have declared an interim dividend at the rate of 4 per cent. per annum for the half-year ended June 30th. The dividend warrants will be posted to-day.

Yorkshire Electric Power Co.—The directors have declared an interim dividend for the six months payable on August 1st next at the rate of 6 per cent. per annum on the preference shares, and at the rate of 2 per cent. per annum on the ordinary shares.

Japan.—The Yokohama Electric Car Co.'s report for the last financial half-year shows that £1,730 is being placed to reserve, £15,000 distributed to the shareholders in the form of a dividend at the rate of 8 per cent. per annum, and £500 accorded to the directors, leaving a small balance to be carried forward.

Kalgoorlie Electric Tramways, Ltd.—The accounts show, after providing for interest and sinking fund on the "A" debenture stock, a balance of £6,520 at debit of profit and loss account for 1913.

Westminster Electric Supply Corporation, Ltd.—For the half-year to June 30th, an interim dividend at the rate of 10 per cent. per annum, has been declared, payable September 1st.

STOCKS AND SHARES.

Tuesday Evening.

THE Stock Exchange this week has swept nearer to the verge of positive panic than it has done during the present century. In fact, members in many markets declare that they have to retrace their memories for nearly a quarter of a century to match conditions so disastrous as those which have been prevailing just lately. Two crises—one in Austria and the other in Ulster—combined to precipitate a slump in Consols which flung down the price by half points at a time. Berlin and Paris joined in with selling orders of their favourite securities. Merits have counted for nothing; the only anxiety was to sell, and not infrequently this was impossible.

Imagination is so prone to exaggerate on occasions so disturbed and agitated as the present, that those in the thick of the scrum can scarcely trust themselves to obtain a calm view of what is actually occurring under their eyes. It would not be difficult to write a heated, even an interesting, account of the wild excitement witnessed in the Stock Exchange during the past few days, but though demoralisation upset the markets, it would be hardly fair to say that actual panic conditions have ruled. The Stock Exchange itself stopped them to some extent by the simple process of declining to deal at all, so that the mild-eyed proprietor of insurance shares, for example—than which, as a rule, there are few more stable stocks—discovered to his astonishment that he was unable to sell at any price during the height of the excitement, although, had he wanted to buy, he would have found almost as much difficulty in obtaining really cheap stock. The violence of the depression was accentuated by the unexpectedness of the rapidity with which the war clouds gathered between Austria and Servia. International bonds fell like rubber shares do in a synthetic scare; and such inter-bourse issues as Brazilian Tractions moved by points within the space of a few minutes.

These Brazilian Tractions, by the way, have proved one of the storm centres of the week. The making-up price on Monday of 65, compared with 78½ at the previous settlement, a fall of 13½ within 19 days; while another perpendicular drop took them since then to 59. Carried over with readiness, as a rule, Brazilian Tractions on Monday encountered refusals that were certainly not looked for on the part of those who generally lend money on the shares. This conduced to necessary forced selling for cash, and for a time the bottom seemed to fall out of the market. The actual declaration of war led to violent relapses in other markets, and fortunate indeed were those securities that escaped being affected by the action of Austria.

Home Railway stocks have had one or two disappointing dividends to contend against, but had the announcements been twice as favourable as anybody expected, it is doubtful whether prices would have been any the better for them. The market has been caught in the swirl of the slump, and Undergrounds have gone down with the rest. Metropolitans, Districts and Underground Electrics show heavy falls, the dividend statements in each case hardly being a factor in the situation.

The London County Council Electric Supply Committee have published their report this week, in which the official effort is made to grapple with the problem that has hitherto seemed insoluble. The recommendations of the Committee are of great interest to many others besides the proprietors of electric lighting shares, while to the latter they will be a reminder of the hints thrown out here of recent weeks as to the likelihood of the next scheme being patterned pretty closely upon that produced by Mr. H. B. Renwick not long ago. The companies are invited to come into co-operation with each other, and we take it that this will be the rock around which most of the difficulties will cluster. The market effect of the scheme would probably have been favourable had other conditions warranted it; but, of course, with everything else flat, the proposals failed to attract buyers for the time being.

On the whole, however, the share market is good, with several small rises to its credit. Cities are 10s. lower, there being still a small "bull" account in the shares; but the three issues of the St. James' Company, for instance, are all higher. Chelseas hardened on the declaration of the regular interim dividend; Charing Cross Preferences are rather lower, while Westminster Preference improved.

Mexican issues are extremely weak. The quite satisfactory news from Mexico concerning the pacification of the country has gone by the board in the pressure to realise any stocks and shares that were saleable at all. Mexico Trams show a drop of nine points; the bonds are two to three points down. In Mexican Light and Power descriptions the falls range from two to five. Latin-Canadians, as a whole, have suffered with the rest of the markets. Manila Electric bonds are one higher, thanks to a very satisfactory report.

In the Telegraph group, the dire necessity for obtaining cash has led to sales of purely investment shares. The declines are small, on the whole. American Telephone and Telegraph stock went back upon the declaration of war. Marconis again developed flatness, the Ordinary falling 5s. to 1¾, and the Preference to 1½. The manufacturing group has held its ground with firmness, and General Electric Preference at 10¾ are ⅛ higher on the week. Babcock & Wilcox receded, and India-Rubber shares gave way. The Rubber market itself has been weak on a further drooping of the raw material.

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SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations July 28th.	Rise + or Fall —	Present Yield £ s. d.
Bath Trams, Pref. Ord.	1	NH	..	—	..	Nil
Do. 5 % Pref.	1	5	5	—	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	16½ — 18½	— ½	..
Do. Do. Deferred	100	..	..	10 — 12	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	85 — 89	..	6 11 2
Do. 7 % Non-Cum. Pr'f.	100	8	8½	54 — 57	..	6 2 10
Do. 5 % Perp. Deb.	100	5	5	91 — 93	..	5 7 5
Do. 4½ % 2nd Deb.	100	4½	4½	75 — 78	—1	5 15 5
Central London Railway, Ord.	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 8
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	84 — 86	..	4 18 0
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	80 — 82	..	4 17 7
Do. 4 % Deb.	100	4	4	95 — 97	..	4 2 6
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	91 — 94	..	5 6 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1908	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	86 — 88	..	4 11 0
Hastings Trams, 6 % Pref.	1	6	6†	—	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	84½ — 86½	..	5 15 4
London and Suburban, Ord.	1	..	1	—	..	3 10 10
Do. Do. 5 % Cum. Pref.	1	..	5†	—	—	8 0 0
Do. Do. 4½ % 1st Deb.	100	4½	4½	78 — 78	..	5 15 5

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations July 28th.	Rise + or Fall —	Present Yield £ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	88 — 90	..	4 9 0
London United Trams, 4 % Deb.	100	4	4	53 — 57	..	7 0 4
Metropolitan Railway Consol.	100	18	18	34½ — 35	—6	4 12 10
Do. Surplus Lands	100	2½	2½	60 — 62	—2	4 8 9
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	79 — 81	..	4 6 4
Metropolitan District Ord.	100	Nil	..	20½ — 20¾	—½	Nil
Do. 6 % Deb.	100	6	6	186 — 189	..	4 6 0
Do. 4 % Deb.	100	4	4	91 — 93	..	4 6 0
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	82 — 85	—1	5 6 0
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
Do. 5 % Deb.	100	5	5	85½ — 88½	..	5 13 0
Potteries, Ord.	1	3½	3½	—	..	8 12 10
Do. 5 % Pref.	1	5	5	—	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	81¾ — 84¾	..	5 6 2
South Metro. Trams, 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Underground Elec. Railways	10	..	..	2½ — 2⅝	— ⅛	Nil
Do. "A"	1/-	..	..	—	—	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	113 — 115	—¼	5 4 4
Do. 4½ % Bonds	100	4½	4½	98 — 100	—1	4 10 0
Do. 6 % Income	100	6	6	87 — 88	—3½	6 16 4
Yorkshire (West Riding), Ord.	5	Nil	Nil	—	..	Nil
Do. 6 % Pref.	5	3	4	4½ — 4⅝	..	4 6 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4¼ — 4⅝	—⅛	5 17 4
Do. 2nd Pref.	5	5½	5½	4⅜ — 4¾	..	6 5 9
Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Do. 4½ % Deb.	100	4½	4½	97 — 100 xd	+1	4 10 0
Do. 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Auckland Trams, 5 % Deb.	100	5	5	101 — 104	..	4 16 8
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11¾	..	5 2 2
Do. 4½ % Deb.	100	4½	4½	96 — 97	..	4 12 9
Do. 5 % 2nd Deb.	100	5	5	99 — 101	..	4 19 0
Brazilian Traction, Light and Power	$100	6	6†	59 — 61	—15	9 16 8
Brisbane Trams Invt., Ord.	5	3	3	7½ — 7¾	..	5 3 3
Do. 5 % Pref.	5	5	5	4¾ — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 — 103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	3	3†	104 — 108	—1	7 3 2
Do. Pref. Ord.	100	6	6	108 — 107	..	5 12 1
Do. 5 % Pref.	100	5	5	101 — 104	—1½	4 16 2
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 — 101	..	4 9 0
Do. 4½ % Vancouver Deb.	100	4½	4½	92 — 96	..	4 13 9
Do. 4½ % Con. Deb.	100	4½	4½	96 — 97	—1	4 7 9
Calcutta Trams, Ord.	5	7½	7½	7 — 7¼	— ⅛	6 6 9
Do. 5 % Pref.	5	5	5	4¼ — 5⅛	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	98 — 101	..	4 9 0
Cape Electric Trams	1	5	5	3 — 3	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5⅜ — 5⅝	..	4 9 0
Do. 4 % Deb.	100	4	4	96 — 100	..	4 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 3 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	91 — 95	..	5 5 3
Kalgoorlie El. Trams 5% A Deb.	100	5	5	82 — 87	..	5 15 0
Do. 6% B Deb.	100	3	..	10 — 20	..	Nil

La Plata Elec. Trams, Ord.	1	..	..	—	..	..
Do. Pref.	1	4½d.	6	—	..	6 5 0
Lisbon Elec. Trams, Ord.	1	6	6	1⅝ — 1¾	..	4 9 3
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 15 0
Do. 5 % Deb.	100	5	5	92½ — 97½	..	5 2 6
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4¾ — 5¼	..	5 14 3
" Elec. Tr. (1904), Deb.	100	5	5	99 — 101	..	4 19 0
Manaos Trams & Lt., 1st Deb.	100	5	5	75½ — 78½	..	6 7 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100 — 102	+1	4 18 0
Mexico Trams Com	$100	7	7	63 — 67	—9	..
Do. Gen. Con. 5 % Bonds	..	5	5	92 — 96	—2	5 16 3
Do. 6 % Bonds	..	6	6	74 — 78	—3	7 18 10
Para Elec. Rlys. & Lt., Ord.	5	10	10	4 — 4¼	..	11 2 2
Do. 6 % Pref.	5	6	6	4 — 4¼	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	88 — 91	..	5 10
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5¼	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	94 — 96	..	4 18 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	96 — 98	—1	5 1 0
Do. 5 % Mort. Bonds	100	5	5	89½ — 90½	..	5 10 6
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	97 — 101	..	4 19 0
Singapore Trams, 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	99 — 102	+1½	4 18 0
Un. Elec. Trams Monte Video	5	7	7	4½ — 4¾	..	7 7 4
Do. 6 % Pref.	5	6	6	4¾ — 5¼	..	5 17 3
Do. 5 % 1st Deb.	100	5	5	96 — 97	..	5 3 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9½ — 10½	..	4 5 9
Do. Second 6 % Pref.	10	6	6	10½ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96	..	4 13 9
Brompton & Kensington, Ord.	5	10	10	8⅞ — 9⅜	..	5 6 8
Do. 7 % Cum. Pref.	5	7	7	8⅜ — 8⅞	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91 — 94	..	4 5 1
Charing Cross, West End & City	5	5	6	5 — 5⅛	..	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	— ⅛	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4½ — 4½	—1/16	5 0 0
Do. Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Chelsea, Ord.	5	5	5	4⅝ — 5⅛	+ ⅛	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	95 — 98	..	4 11 0
City of London, Ord.	10	9	10	15½ — 16½	— ½	6 1 4
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	115 — 118	..	4 4 9
Do. 4½ % Second Deb.	100	4½	4½	99 — 102	..	4 8 1
County of London, Ord.	10	6	7	11⅜ — 12⅛	..	5 14 3
Do. 6 % Pref.	10	6	6	11⅜ — 12⅛	— ⅛	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	101 — 104	..	4 6 7
Do. 4½ % Second Deb.	Stock	4½	4½	99 — 102	..	4 8 1
Edmundson's, Ord.	£8	..	..	—	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞ — 4 xd	..	7 10 0
Do. 6 % Non-Cum. Pref.	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	82 — 85	..	5 6 0
Folkestone	5	6	6	5 — 5⅛	..	5 9 1
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9

Hove	5	8	9	8¾ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7½ — 7¾	..	5 16 3
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	74 — 78	..	5 15
London Electric, Ord.	8	2½	3	1⅛ — 1⅜	..	5 10
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	4½	4½	8¼ — 8¾	..	6 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 7/16 — 4 9/16	..	4 18 3
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 99	..	4 11 0
Do. 3½ % Mort Deb.	Stock	3½	3½	82 — 84	..	4 3 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 — 102	..	4 18 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10⅞	..	5 17 3
Oxford	5	7	7	5⅞ — 6⅛	..	5 10 0
St. James' and Pall Mall, Ord.	5	10	12	9⅜ — 9⅝	+ ⅛	6 1 6
Do. 7 % Pref.	5	7	7	6⅝ — 7¼	+ ⅛	4 16 7
Do. 3½ % Deb.	100	3½	3½	88 — 86	+1	4 1 4
South London, Ord.	4	5½	5½	2⅞ — 3¼	+ ⅛	6 15 4
Do. 5 % First Mort. Deb.	100	5	5	93 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1 3/16 — 1 5/16	..	5 6 8
Do. 4½ % First Deb. Stock	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£8	Nil	..	—	..	..
Do. 5 % Cum Pref.	5	3†	4	2⅜ — 3	..	6 13 4
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 3
Westminster, Ord.	5	10	10	8⅜ — 8¾	..	5 12 3
Do. 4½ % Cum Pref.	5	4½	4½	5 — 5½	+ 1/16	4 5 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Funded Certs.

Continued on next page.

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SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 28th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	£	6	6	5⅛ — 5⅜	..	£ s. d. 5 11 7
Calcutta, Ord.	£	8½	9	7¼ — 7⅜	..	5 16 2
Do. 5 % Pref.	£	5	5	5 — 5⅛	..	4 15 1
Calgary Power, 1st Mort. Bds. ..	100	5	5	86 — 88	..	5 18 8
Canadian Gen. El. Com.	$100	7	8	97 —102	—1	7 15 6
Do. 7 % Pref.	$100	7	7	116 —121	..	5 15 10
Cordoba Lt., Power and T., Ord.	1	5	..	⅞ — 1	..	7 12 0
Do. 5 % Deb.	100	5	5	81 — 86	+1	5 16 8
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	83 — 85	..	6 19 6
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	95 — 98	..	5 2 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93 — 95	..	5 5 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅞ — 1	..	Nil
Do. 6 % Pref.	1	6	4	½ — ⅝	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	99 —102	..	4 18 0
Madras, Ord.	£	Nil	..	1⅛ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	104 —107	+1	4 13 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	61 — 66	..	7 11 8
Mexican Lt. & Power, Common	$100	4	4†	44 — 47	—2	..
Do. 7 % Cum. Pref.	$100	7	7	69 — 74	—3½	9 9 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	79 — 84	—3	5 19 1
Do. 5 % 2nd Mort. Bonds ..	100	5	5	60 — 65	—5	7 18 10

NAME.	Stock or Share.	Dividends for 1913.	Dividends for 1913.	Closing Quotations July 28th.	Rise + or Fall —	Present Yield p.c.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	* 100	5	5	48 — 53	..	£ s. d. ..
Montreal, Lt., H. and Power ..	$100	9	10†	232 —238	..	4 4 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	10	235 —245	..	4 1 8
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	97 —108	..	5 16 6
Do. 5 % Deb. Stock	Do.	5	5	99 —101	..	4 19 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital ..	$100	5½	6	183 —187	—1	4 7 7
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	103 —106	..	4 14 4
Do. 4½ % Per. Deb.	Stock	4½	4½	100 —102	..	4 8 8
Toronto Power, 4½ % 1st Deb. ..	Do.	4½	4½	98 — 100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	83½ - 84½	..	5 18 4
Victoria Falls Power, Pref. ..	1	6	6	8½ — 8⅝	—⅛	8 6 8
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 - 105	..	5 14 8

MANUFACTURING COMPANIES.

Aron, Ord.	£	7	7	11 — 1⅛	..	8 12 4
Do. 6 % Pref.	£	6	6	⅝ — ¾	..	7 2 3
Babcock & Wilcox	£	16	16	28 — 2⅝	— ⅛	5 11 4
Do. Pref.	£	6	6	1⅝ — 1⅞	..	4 8 6
British Aluminium, Ord. ..	£	..	5	1⅝ — 1⅞	..	4 14 1
Do. 6 % Cum. Pref.	£	6	6	2⅝ — 2¾	..	6 9 0
Do. 5 % Prior Liens Debs. ..	100	5	5	96 — 98	..	5 2 0
Do. Deb. Stk.	100	5	5	90 — 95	..	5 5 3
B.I. & Helsby Cables	£	10	18	10½ — 10⅝	..	6 1 0
Do. Pref.	£	6	6	6 — 6⅛	..	4 12 4
Do. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref. ..	£	Nil	5	1⅜ — 1⅞	..	5 6 8
Do. Deb.	100	4	4	72 — 75	—1	5 6 8
Do. 6 % Prior Lien	100	6	6	101 —104	..	5 16 6
Browett, Lindley, Ord.	£	..	..	2/- —3/-	..	Nil
Do. Pref.	£	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	£	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb. ..	100	4½	4½	20 — 88	..	18 12 8
Callender's Cable	£	15	15	11½ — 12½	..	6 2 5
Do. Pref.	£	5	5	5 — 6¼	..	4 15 3
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	£	20	22½	2⅞ — 2⅞	..	8 15 5
Do. Deb.	100	4½	4½	104 —107	..	4 4 1

Dick, Kerr	£	Nil	..	⅜ — ½	..	..
Do. Pref.	£	6	6	2 — 2⅛	..	6 17 8
Edison & Swan, A, £2 paid ..	£	Nil	..	⅞ — 1	..	Nil
Do. fully paid	£	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	57 — 61	..	6 11 1
Do. 5 % Second Deb.	100	5	5	61 — 66	..	7 11 8
Electric Construction	£	5	5	⅝ — ¾	—⅛	8 8 8
Do. Pref.	£	7	7	1 — 1⅛	..	6 4 5
Greenwood & Batley, Pref. ..	£	10	7	6¾ — 7¼	..	9 18 9
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref. ..	£	10	6	10½ — 11	+ ⅛	5 9 1
Do. Deb.	100	4	4	88 — 92	..	4 7 0
Henley's, Ord.	£	15	20	14½ — 15½	..	6 9 0
Do. Pref.	£	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	99½ —101½	..	4 8 5
India-Rubber, G. & T.	£	10	7½	8½ — 9½	— 1	7 18 0
Do. Pref.	£	10	5	9 — 9¾	..	5 2 7
Telegraph Construction	£	12	20	20	87½ — 83½	..
Do. Deb.	100	4	4	97 — 99	..	4 0 10
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	..	63 — 67	..	5 19 8
Do. B 4 % Cum. Pref. ..	100	..	£4	37 — 41	..	9 15 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	£	10	4½	4½	5⅝ — 6⅛	..
Do. 5 % Deb. Red.	Stock	5	5	95 — 98	..	5 2 0
American Telep. & Teleg., Cap.	$100	8	8	119 —124	—1½	6 9 0
Do. Collat. Trust	$1000	4	4	90 — 93	—1	4 6 0
Anglo-American Telegraph ..	Stock	8	8	64 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	107 —109	+ ½	5 10 7
Do. Def.	Do.	30/-	30/-	22½ — 23½	— ½	6 9 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	£	8	6†	7½ — 7⅞	..	5 6 8
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80 — 82	— ½	4 17 7
Cuba Telegraph	£	10	6	6†	8 — 9	..
Do. 10 % Pref.	£	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	£	5	4	4	3⅞ — 4	..
Do. 10 % Cum. Pref.	£	5	10	10	7½ — 7⅞	..
Direct United States Cable ..	£	10	4	4	6⅜ — 7⅛	..
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	£	7	7	129 —132	—1	5 6 8
Do. 8½ % Pref. Stock	Do.	8½	8½	76½ — 78½	..	4 9 2
Do. 4 % Mort. Deb.	Do.	4	4	95½ — 97½	..	4 2 1
Eastern Extension	£	10	7	7	12½ — 13	— ½
Do. 4 % Deb.	Stock	4	4	96½ — 98½	+ ½	4 1 3
Globe Telegraph and Trust ..	£	10	6	6†	11 — 11½	..
Do. 6 % Pref.	£	10	6	6	12⅜ — 13⅜	..
Great Northern Telegraph ..	£	10	20	20	81 — 88	— ½
Indo-European Telegraph ..	£	25	18	18	58 — 60	..
Mackay Companies Common ..	$100	5	5	80 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 72	..	5 10 1

Marconi's Wireless Telegraph ..	£	1	20	20	1¼ — 1⅜	— ⅛
Do. 7 % Cum. Partic. Pref. ..	£	1	17	17	1⅜ — 1½	— ⅛
Monte Video Telephone, Ord. ..	£	1	6	6	⅛ — ⅜	..
Do. 5 % Pref.	£	1	5	5	⅛ — ⅜	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 —102	— ½	4 8 5
Oriental Telep. and Elec. ..	£	1	10	10	2⅛ — 2⅜	..
Do. 6 % Cum. Pref.	£	1	6	6	1⅝ — 1⅞	..
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 11 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	95 — 97	..	4 2 8
Reuter's	£	10	10	7	7 — 8	— ½
Submarine Cables Trust	£	Cert.	6	6	127 —130	..
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	97 — 99	— ½	4 11 0
United River Plate Telephone	£	5	8	6†	6⅜ — 6⅝	..
Do. 5 % Cum. Pref.	£	5	5	5	5 — 5⅛	..
West Coast of America	£	2½	2½	N	⅞ — 1⅛	..
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	£	10	1½	1½	1⅜ — 1⅝	— ⅛
Do. 6 % Cum. 1st Pref. ..	£	10	6	6	8 — 9	— ½
Do. 6 % Cum. 2nd Pref ..	£	10	6	6	8¼ — 8⅝	..
Do. 5 % Debs.	100	5	5	98 —101	..	4 19 0
Western Telegraph, Ltd. ..	£	10	7	7	18⅜ - 18⅝	..
Do. 4 % Debs.	Stock	4	4	95½ - 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	95 - 100	..	4 10 0

* Unless otherwise stated all shares are fully paid. † Interim dividend. a Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

London's Electricity Supply.—The following appeared in the *Financial Times* of July 24th, "From a correspondent":—

At a private meeting recently held, and attended by representatives of the thirteen electrical supply companies operating in the metropolis, the scheme drawn up at the companies' instigation as an alternative to the "super" undertaking proposed some time ago by a group of bankers was submitted, and as no information relating to this important gathering appears to have been published, it may be interesting to give a brief *résumé* of what took place on that occasion. The representatives of four companies, and these by no means the least important members of the group, declined to endorse the project submitted by the companies' own officials, while the remaining nine decided to refer the matter to the consideration of fresh experts. The alternative scheme was distinguished by the fact that it refrained from making any "constructive" proposals, its main purport being apparently to show that the bankers' project was unnecessary. There is, of course, nothing easier than to criticise the proposals put forward by other people, and this was the opinion of many of those who attended the recent meeting, and particularly, of course, of the dissentients. Apparently the companies' advisers are of opinion that a more favourable site for a central station could be obtained, and that other details of the bankers' scheme might also be modified, though how these improvements are to be effected is left for subsequent discussion. The net result of the inquiry set on foot by the companies with a view to counteracting the proposals submitted to them by the banking interests would, therefore, appear simply to have been to bring about an impasse without tending to solve the problem under consideration. Obviously this state of affairs cannot continue indefinitely, and in financial circles much interest is being shown as to the next step to be taken in connection with the matter. Apparently the banking syndicate will not make any further move until the companies have shown some disposition either to come to terms or else to formulate a concrete scheme of their own.

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ELECTRIC SIGNALLING AND THE SENGHENYDD DISASTER.

IN our leading article of a few weeks ago dealing with Mr. Redmayne's report on the Senghenydd explosion, we promised further details regarding the tests carried out on the electric signalling apparatus in what was apparently an endeavour to prove that the explosion was brought about by this means. In our opinion—and we are glad to note this was the opinion of all the practical mining engineers who gave evidence on the point—it was practically impossible for this to be the cause, for the reason that the spark emitted from an ordinary signal bell is not of sufficient intensity to ignite mine gas or "fire-damp." The question is a most important one from a mining standpoint, as Mr. Redmayne's remarks seemed to threaten a new regulation regarding the use of electricity in mines, and this would, we think, do more harm than good. It is at best a foolish policy to pursue any attempt to make accidents an impossibility in any industry by hampering it with legislative rules and regulations, as the industry may become so costly to operate that it is in danger of being regulated out of existence altogether.

Mr. Redmayne says:—This inquiry has shown quite clearly that the exemption from the requirements of the electricity regulations, which applies at present to electric signalling apparatus that happens to have been in use before June 1st, 1911, and that was in conformity with the code of electricity regulations then in force, goes too far. The regulation in the code of 1905 (which code was superseded by the present code in 1912) to which reference is made reads as below:—

In any place or part of the mine where general Rule No. 8 of the Coal Mines Regulation Act, 1887, applies, bare wires shall not be used for signalling circuits except in haulage roads, and the pressure shall not exceed 15 volts in any one circuit. This clearly permitted bare signal wires on haulage roads anywhere below ground even in places where inflammable gas might have occurred in quantity such as would have rendered the use of a naked light dangerous (General Rule 8, Coal Mines Regulation Act, 1887), provided the pressure did not exceed 15 volts, and Regulation 137, paragraph (*b*) of the present code allows the continued use of such wires (unless the Inspector of the district raises objection) until June 1st, 1920. It is clear from the evidence given at the inquiry that a pressure of 15 volts on bare signal wires may be dangerous in the presence of an explosive mixture of firedamp and air, and *I think, therefore, that a modification of Regulation* 137 *is desirable so as to exclude from its operation such signal wires and signalling apparatus as are in use in virtue of the Regulation of the code of* 1905 *quoted above.*

No apparatus other than signal wires was permitted by the code of 1905 to produce external sparks in places where gas might occur in quantity sufficient to be indicative of danger, and my recommendation is that it be made clear that signalling apparatus should be treated in the future as all other apparatus is treated, and that all open visible sparks should be avoided where gas may occur. This will require a slight modification of Regulation 137. I am encouraged to make this recommendation as signalling apparatus which is guaranteed by the makers not to produce an open or visible spark is readily obtainable.

The italics are ours. We do not cavil at any attempt to make a mine safe, and we have no doubt that it is an easy matter to make signalling apparatus that will not produce an open spark *so long as it is kept in order*. But there is rather too much "fool-proof" apparatus being introduced into mines, and the tendency is to employ fools, instead of relying more upon a workman doing his work and using the apparatus to hand with intelligence and care. Further, the manager is neither a competent electrician nor a skilled engineer, *he cannot be everything*, though he does his best to be what he is supposed to be under the present Coal Mines Regulation Act, and instead of placing a thoroughly competent and skilled engineer in charge of the plant, the manager is inclined to accept the manufacturer's word; so long as he complies with Mr. Redmayne's regulations he (the manager) cannot very well be held responsible if anything does happen, and so we go on—muddling along with red-tape rules and regulations, instead of giving common sense and intelligence and thoroughness a fair chance.

Another point in regard to this investigation is the fact that no one seemed to think the cause of the explosion would be the electric signal wires, until this was first put forward by Dr. Atkinson, H.M. Divisional Inspector for South Wales, and supported by his two colleagues, Mr. Dyer Lewis and Mr. Greenland Davies. Mr. Redmayne himself came to the same opinion as Dr. Atkinson, but we read: "As to the point of origin, the opinions expressed placed it at two fairly widely separated points."

Seven practical and responsible mining engineers, including the manager, Mr. Shaw, and one of the Commissioners, Mr. Evan Williams, thought the ignition took place at the lamp cabin, and it seems strange that only H.M. Inspectors should hold opposite views.

There was, however, so much doubt in the minds of everyone as to whether the signalling apparatus could cause an explosion, that a series of tests were carried out at the new Tredegar Rescue Station on June 1st and 29th, 1913, with an explosive mixture of pit gas (methane) from the Gymmer Pit, and out of 28 tests, each test consisting of several experiments, the mixture only ignited five times, in tests No. 9 and No. 11 with a pressure of 13½ volts, in No. 13 with a pressure of 18 volts, No. 14 with a pressure of 22½ volts, and in No. 12 of the second series with a pressure of 11·9 volts. There were two tests with town gas, which ignited *instantly* with a pressure of 13·5 volts—whereas with mine gas, and the same pressures, it took from 20 to 30 seconds, and in test No. 12 it took 4 minutes and 37 seconds of continuous intermittent contact to produce an ignition. Evidently the question of time producing some cumulative effect, probably by the sparks heating the gas in proximity to them, should be taken into consideration, and we must remember that these tests were made in a closed chamber, and not subject to an air current, as the bells would be in the mine itself. Further, in test No. 12 it was not the "Senghenydd" bell that was being used, but a bell belonging to the rescue station, which gave "more sparking than with Senghenydd bells." The voltage used in the signalling apparatus in the Senghenydd pit was said to be only nine volts, and it was found absolutely impossible to get an ignition with this pressure.

The tests, however, were not sufficient to satisfy the Inspectors, and Dr. Wheeler was instructed to carry out some experiments, which are, we think, so interesting, that we give his report in full, as follows:—

On March 21st there were received at the experimental station two signalling bells of the pattern used at Senghenydd Colliery, and a supply of dry cells of the make and size used at that colliery at the time of the explosion. I was instructed to carry out tests to determine the limiting conditions under which the electrical ignition of methane and air mixture could be effected when using a battery of dry cells connected through a bell, so as to form a signalling circuit.

A number of tests have been made, the results of which are given in detail later, using one of the "Senghenydd" bells, and, for comparison, a bell kindly lent me by Prof. Thornton, of Armstrong College, Newcastle-on-Tyne, from whose work our knowledge of the conditions necessary to obtain ignitions of gaseous mixtures by momentary electric arcs is mainly derived.

The experiments described in this report show, as Prof. Thornton's work with high voltages has also shown:—

1. That methane-air mixtures vary in their ease of ignition according to the percentage of methane present, being much more difficult to ignite as the "limit mixtures" (lower limit 5·6 and higher limit 14·8 per cent. methane) are approached.
2. That the inductance of the circuit is of prime importance in determining whether the flash produced on breaking the circuit can ignite an explosive mixture; and
3. That the amperage of the current is of more importance than the voltage.

Before describing the experiments that have been made regarding the general question of the electrical ignition of methane-air mixture, it will be as well to state the results obtained with the Senghenydd bell and cells under conditions comparable with those that would obtain in practice.

The bell was of the usual trembler pattern for continuous working with an iron cover (not gas-tight), which was removed during the tests. The bell had a resistance of 10 ohms.

The experiments were carried out in such a manner that either the bell or the signal wires, by the short circuiting of which the bell could be caused to ring, could be enclosed in a chamber containing an explosive mixture of methane and air. It was found that ignition at the bell, due to the maintained spark at the spring contact, could be obtained with a battery of five cells, the current when the circuit was closed being 0·70 amp., and the voltage across the terminals of the bell being 7·5 volts.

Of more importance to determine was the number of cells required to cause ignition by the flash produced by short-circuiting the signal wires to give a signal. With only the resistance due to the bell (10 ohms) in the circuit, a battery of three cells was sufficient to give a break-flash capable of igniting the most sensitive methane-air mixtures (containing from 8 to 9·5 per cent of methane).

To allow for the resistance afforded by the long lengths of signalling wire used in practice, non-inductive resistance coils were inserted, as shown in the series of experiments below, in

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which a mixture of methane and air containing 8·2 per cent. of methane was employed.

Resistance in circuit.	No. of cells required for ignition by break-flash.	Current on closed circuit. Amperes.	Voltage on open circuit.
Bell only (10 ohms) ...	3	0·45	4·5
Bell + 10 ohms	5	0·40	7·5
Bell + 20 ohms	7	0·35	10·5
Bell + 30 ohms	11	0·40	16 5
Bell + 50 ohms	15	0·35	22·5

A resistance of about 13 ohms is given by 1 mile of galvanised-iron signalling wire of No. 8 gauge.

The series of experiments just described were made, as already stated, with an 8·2 per cent. methane-air mixture, which is one of the mixtures most readily ignited. Mixtures containing smaller percentages of methane are less easily ignited, as the following experiments show :—

"Senghenydd" Bell in Circuit.

Percentage of methane in air.	No. of cells required for ignition by break-flash.	Current on closed circuit. Amperes.	Voltage on open circuit.
5·6 (lower-limit)	8	1·15	12·0
6·3 ,,	7	1·05	10·5
7·0 ,,	5	·70	7·5
8·0 ,,	3	·45	4·5
9·0 ,,	3	·45	4·5
9·5 ,,	3	·45	4·5
10·2 ,,	5	·70	7·5

The effect of methane-content on the ease of ignition is better shown when either the voltage or the amperage of the current is kept constant. In the table below are given the voltages required to cause the ignition of different methane-air mixtures by the break-flash when the current passing through the bell was kept constant at 0·60 ampere by the insertion of sufficient (non-inductive) resistance :—

"Senghenydd" Bell in Circuit. Current Maintained at 0·60 Ampere.

Percentage of methane in air.	Additional resistance to maintain current at 0·60 ampere.	Voltage required to cause ignition by break-flash.
5·8	70 ohms	70·5
6·0	31 ,, ...	25·5
6·4	13 ,, ...	15·0
6·6	9 ,, ...	12·0
7·3	2 ,, ...	7·5
8·0	nil	4·5
8 2	nil	4·5
8·5	nil	4·5
9·0	nil	4·5
9·4	nil	4·5
10·0	2 ohms	7·5
10·6	9 ,, ...	12·0
12·1	63 ,, ...	63·0

As Prof. Thornton has pointed out (*loc. cit.* p. 152) "with low-voltage apparatus the inductance of the circuit is of first importance from the point of view of safety at break."

This is illustrated by comparative tests made with the "Senghenydd" bell and that lent by Prof. Thornton (bell "A") the inductances of which, according to determinations kindly made by Prof. Thornton, were :—

"Senghenydd" bell : Mean inductance at all currents 0·344 henry.
Bell "A" ,, ,, ,, 0·135 henry.

Whereas with the "Senghenydd" bell in circuit a battery of three dry cells was required to cause the ignition of an 8 per cent. methane—air mixture by the break-flash, with bell "A" five cells were required, the currents being 0·45 amp. at 4·5 volts and 0·7 amp. at 7·5 volts respectively. Both bells had the same resistance, namely, 10 ohms.

The influence of amperage can be appreciated from an examination of the series of experiments with an 8·2 per cent. methane-air mixture, using the "Senghenydd" bell, when resistances of different values were included in the circuit. It would appear that if the current flowing round the signalling circuit could be reduced below 0·30 ampere by introducing suitable non-inductive resistances, there would be but little risk of ignition by break-flashes below 25 volts pressure. The use of Leclanché cells, therefore, owing to their high internal resistance, should afford greater comparative safety than the use of dry batteries. Comparative experiments illustrative of this were made using an 8·2 per cent. methane-air mixture and the "Senghenydd" bell, the results being as follows :—

	Number of cells required for ignition by break flash.	Current on closed circuit. Amps.	Voltage.
Dry cells	3	0·45	4·5
Leclanché cells ...	6	0·50	9·0

Whilst with the bell "A" the results were :—

Dry cells	5	0·70	7·5
Leclanché cells ...	9	0·60	13·5

The opportunity arose of testing a device of Prof. Thornton's intended to prevent sparking at the signal wires and at the bell. The bell used was bell "A" already referred to, and the circuit was modified by the addition of two circuits, termed respectively "Simplex" and "Duplex," which could be connected to the bell separately or together.

The tests with bell "A" alone have already been given ; the effect of adding the special circuits was as follows :—

Ignition of an 8·0 Per Cent. Methane-air Mixture.

	No of cells required for ignition by break flash.	Current on closed circuit. Amps.	Voltage.
Bell "Simplex" circuits...	15	2·225	22·5
Bell "Simplex" and "Duplex" circuits ...	15	2·275	22·5

The above results were obtained when a battery of dry cells was used. When Leclanché cells were employed no ignition of an 8·5 per cent. methane-air mixture could be effected with the maximum number of cells available, namely, 24 (current on closed circuit 1·0 ampere, voltage 34·5).

The addition of either the Simplex or the Duplex circuit practically eliminated sparking at the bell.

The preliminary experiments were made with an explosion-chamber of about 1 cb. ft. capacity, in which either the bell or the signalling contacts could be placed. The last-named consisted of two steel rods of ¼ in. diameter, one fixed firmly in position across the box, and the other running parallel with it for a few inches, and then turned at right angles. This bent rod could be moved round or backwards and forwards by hand, so that a rubbing contact or a rapid make and break of circuit could be made.

For the later comparative experiments a mechanical device for making and breaking circuit in an explosive mixture was employed as being more convenient and giving greater uniformity of results. The results obtained by the two methods of experiment were the same, but whereas with the hand-breaks some 30 or 40 contacts had to be made at the limiting voltages before ignition occurred—and the nature of the break-flash depending greatly on the rapidity with which contact was made and broken, and on whether the break at the signal wires synchronised with the break at the bell—with the mechanical break ignition was obtained at the limiting voltages at the first, or sometimes at the second, break.

The apparatus used consisted of a gas-tight wooden box of about ½ cb. ft. capacity, fitted with a glass window, and having one end removed. This end was covered by a sheet of oiled paper, and a measured volume of methane was passed in from a glass holder, displacing air The mixture was then made by rapidly revolving a small motor-driven fan for a given time, and a sample drawn out over mercury into a glass vessel, whence it was transferred to an apparatus for explosion analysis. The methane used was prepared from aluminium carbide and purified by passing through ammoniacal cuprous chloride (to remove traces of acetylene), and over "oxidised" palladium, precipitated, heated at 212° F. (to remove traces of hydrogen). Analysis showed it to contain 98 per cent. of methane and 2 per cent. of nitrogen.

The mechanical contacts and breaks were made by slowly revolving (by means of a motor and gearing) a turn-table carrying four metal rods, each of which just touched the end of a strip of metal fixed at right angles to them. For the majority of the experiments the contacts were steel and steel, but a comparative series was also made with zinc-zinc contacts without any difference being obtained in the results.

The value of the report cannot be over-estimated, as it seems to show some peculiar connection between the current passing and the percentage of gas or methane in the mixtures. Evidently an 8·2 per cent. methane-air mixture is very susceptible to an electric current, and we hope that Dr. Thornton, who has already done so much useful work on this subject, will continue his investigations.

We are, however, at present mainly concerned with the more practical side of electric signalling from the mining point of view, and in conclusion, we quote the following from the report of Mr. Evan Williams, one of the Assessors conducting the inquiry, with Mr. Redmayne as Commissioner ; Mr. Williams is chairman of the South Wales and Monmouthshire Coal Owners' Association, and is therefore entitled to give an authoritative opinion upon the question. He says :—

The evidence as to the electric signalling in this pit was very instructive though not quite conclusive. Whenever a signal was given, either by pressing the wires together or by drawing a file or other piece of metal across them, sparks easily visible must have been produced, both at the signalling point and at the bell. The question is whether such sparks, as produced at Senghenydd Collieries, were capable of igniting an explosive mixture of gas and air. It was made abundantly clear that sparks may be not only visible, but bright and luminous, and still be incapable of firing gas, and that the appearance of a spark was no criterion as to its power in this respect. Nor is the voltage of the battery used as the source of the current in itself a criterion, and it is wrong to say loosely, as is frequently done, that a certain voltage, say, 18½, will fire gas, while another voltage, say, 9, will not. The voltage is only one factor, and not the most important one.

The internal resistance of the cells themselves, of the wires, and of the bell, and particularly the inductance of the bell, have to be taken into account before the actual voltage that causes the spark can be determined. What is called the voltage of the battery is only the static difference of potential on open circuit ; the actual electromotive force when a signal is given is the voltage on closed

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circuit with the line and bell in series, and this may, and does differ, very largely between one installation and another, even though the voltages of the respective batteries on open circuit may be the same. In one case, it may be very near the voltage on open circuit, and in another it may be as low as one-fourth of it. The self-induction also, which causes by far the most dangerous spark when the contact between the wires is broken, depends upon the construction of the bell that is used. So that nine volts under one set of conditions of batteries, line and bell, may be more dangerous than 12 volts under another set of conditions, and it cannot be too strongly emphasised that all the characteristics of the signalling installations must be taken into consideration, and the prevailing impression that the voltage of the battery is the only thing that matters, corrected.

In face of the knowledge gained in our investigations on this subject, it appears to me most desirable that the Government should at once carry out an exhaustive series of experiments with a view to determining what may and may not be permitted to be used in mines liable to outbursts of gas.

The system of electric signalling with bare wires possesses, in its simplicity, ease and quickness of manipulation, and its reliability, so many practical advantages over all others that its prohibition would, I am convinced, lead to a big increase of accidents upon haulage roads, and the objection to visible sparks incapable of igniting gas is sentimental only.

Dr. Thornton, of Newcastle, showed us a very simple arrangement of by-pass consisting of a short length of thin wire connected across the terminals of the bell, which rendered a signalling installation quite incapable of igniting with a 12-volt battery a mixture of town gas and air, which, without the by-pass, was ignited by a 4-volt battery with the same bell and wires. (Town gas, owing to its high hydrogen content, can be exploded by a spark that will not fire pit gas.)

Dr. Thornton, who has made more investigations on this subject than any other man in this country, is firmly of opinion that this simple device will remove all risk from the ordinary signalling installations in mines, and I think this should be brought to the notice of all colliery managers by the Home Office.

Dr. Thornton and Mr. Sparks also agreed that the use of alternating current, within the limit of voltage laid down by the Regulation, viz., 25 volts, in place of direct current, would confer complete immunity from danger upon bare-wire signalling. With this there is no sparking at the bell, and the sparking on the line is very weak.

Turning to the consideration of the apparatus in use at Senghenydd, in trying to arrive at a conclusion as to whether there was a possibility of the ignition of gas from this cause, one can only be guided by the experiments made with the actual bells in use at the colliery, and not by anything done with other bells in other places, or with any gas other than natural pit gas.

It will be observed from the results of these experiments at the New Tredegar Rescue Station, given in an appendix to this report, that with a Senghenydd bell no ignition of gas was obtained in an explosive mixture of pit gas and air until a battery of nine cells, giving 13½ volts on open circuit, was used. With six cells giving nine volts, every one present at the station must have been convinced that every possible expedient for producing sparks was tried by Mr. Nelson without result, and that with this combination of bell, line and battery, no spark could be produced that would cause an ignition.

It will be observed also that in these experiments new cells were used, and that consequently the voltage on closed circuit was within a decimal point of the open voltage, so that it may be taken that under these conditions an actual E.M.F. of 8·9 volts was not sufficient to fire the explosive mixture.

It is true that the pit gas used was from another colliery, but Dr. Thornton's evidence was quite definite and conclusive that gas taken from Senghenydd, or any other pit in South Wales, would have behaved in exactly the same way.

Some doubt has been cast upon what was the actual voltage of the batteries in use at Senghenydd, and from Mr. Sparks's evidence it is clear that after a period of rest the pressure on open circuit of some of the batteries composed of eight or nine cells each may have been over 10 or 11 volts respectively, owing to the recovery of the partly exhausted cells during the week-end, or to a less degree in a night. This pressure would fall very rapidly as soon as the bells began to be rung, to what extent is not exactly known, as we have not the information as to the behaviour of old cells that we have for new cells, but we have it from the electrical experts that it would fall much more rapidly in old than in new cells.

I see no reason, therefore, to discredit the statements of the colliery electricians, and when measured by them during working hours, the voltage never exceeded nine on open circuit, although I think the method of measuring the voltage might have been improved upon by using a voltmeter from which the total voltage of the battery, as well as that of the individual cells, could be read without calculation. It was, however, clearly shown that the voltage on closed circuit, in the case of old cells, was less than half that on open circuit, so that the comparison to be made between the experiments at New Tredegar, and the actual working condition at Senghenydd, is as between working pressures of 8·9 volts on the one hand, and something actually below 6 volts on the other, and not between static pressures on open circuit of 9 volts and a possible 11·45 volts for a short time after a period of rest. To my mind the evidence is quite conclusive that the characteristics of the installation were such that no spark capable of igniting gas could have been produced.

There is another point which seems to me to bear upon this question as far as the signalling in the Mafeking hard heading is concerned. *From my own observation underground, as well as from the evidence, I am satisfied that the positions of the journeys at the top and bottom of the incline were such that no signalling could have been going on when the explosion occurred.*

Any sparking that may have taken place could, therefore, be produced only by the accidental contact of the two bare signalling wires.

When two wires are pressed together in any way the surfaces that touch have an area many times larger than the points of contact of a knife edge across them would have, and it is a well established fact that the current necessary to ignite gas increases in direct proportion to the area of the surfaces in contact. The further comparison must, therefore, be made as between the small area of contact of the knife edges at the Rescue Station experiments, and the larger area of the surfaces in contact of the two wires in the mine, and this strengthens my conviction that the possibility of an electrical cause of the origin of this explosion can be entirely dismissed.

The italics are ours, and in view of all that has gone before, we think that this statement ought to be accepted as conclusive that whatever did cause the explosion, it was not electric signalling.

A PROPOSED TESTING INSTITUTION FOR THE ELECTRICAL INDUSTRY.*

(COMMUNICATED.)

YEARS ago the Shipping Industry established Lloyds Register, which has proved a priceless boon to all concerned. In the following article, the proposal is made that a similar institution should be established for the electrical industry.

The effective application of the multitude of rules and regulations pertaining to the electrical world, is so rare that their very existence is a farce over large areas. Year by year, cheaper and poorer materials are more and more used, and it seems almost impossible to improve things without more facilities for testing than exist in the majority of stations. Association R.C. wires are almost supplanted in many districts by the cheaper non-Association wires supplied by reputable firms, and even they too often are displaced by the still cheaper foreign cables, whose only merit not seldom is their low prime cost. Experience shows that the life of many of the cheap dielectrics is short. The material becomes either brittle, or soft and "treacly" after a time, when the wires become a source of danger to their users. The need for weeding out of bad quality flexible wires is possibly even greater. Much of the flex now sold is unsuitable for carrying the heavy shades which have recently come into vogue, particularly where these hang from the roof of a high public building. The modern I.E.E. rules allow high current densities on the assumption that the conductivity of the copper is fully up to standard. If this should not be so, or if the wires should be overloaded, there may be serious heating, and this is particularly likely to happen where radiators have been added to an installation only wired for lamps. These conditions are aggravated where the wires are run near to flues or hot water pipes, as often occurs.

The station staff is supposed to look after installations in the supply area, but in actual practice little can be done effectively to get at the bad contractor, and unfortunately the worst contractor too often sets the price at which work must be done in the district. Should the engineer of the Supply Authority interfere in any specially bad case, the contractor generally states that the material is of the highest class, and when driven into a corner he

*The MS. of this article was received in April last, but was held back pending the result of Mr. Dana Pierce's visit to this country. In view of Mr. C. H. Wordingham's letter published in our last issue, the present seems a fitting time to publish it.—EDS. ELEC. REV.

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points out that similar work has been passed by the station when done by another firm, and then asks feelingly why he should be singled out for victimization. Where the supply is in municipal hands, there remains the private appeal to the committee, or worse than all, the contractor himself becomes a member of the Council, when, of course, he gets on to the Electricity Committee, where he may place his expert knowledge at the service of the town. Readers may call to mind cases of this kind where the contractor makes a point of attacking the engineer at all times and for all and no reasons. In many cases the contractors are allowed to do as they like, without let or hindrance, provided only that they bring a constant stream of new consumers on to the mains.

The present system of partial inspection, or none at all, is totally bad. It is unfair to the honest contractor, who is cut out by unscrupulous competitors. It is unfair to the consumer, who does not get what he pays for, and it is bad for the electrical industry, which suffers from the stigma of putting up with shoddy work and materials. The only permanently satisfactory method of dealing with the situation is to provide a recognised authority, which would issue specifications for all ordinary materials and apparatus used for electrical work, such an authority being equipped with an efficient laboratory to enable it to test materials sent to it, and to grant certificates to those which were satisfactory. The benefits, to all concerned, of such an institution would be enormous, immediate and lasting. First of all, it would inaugurate sensible standards in the present chaos of accessories. One need only mention plugs, which have become a byword on account of their unnecessary and silly variations. It would be difficult to estimate the loss which we have suffered from the lack of uniformity in this direction. In many houses people cannot carry even a portable lamp from room to room owing to the plugs being different, and they are thereby prevented from using apparatus which they desire to have.

The Testing Institution would enable reductions to be made in the unnecessary and redundant styles of rubber-covered wires now catalogued. One well-known firm lists the following varieties of I.R. wire: 300 meg. non-Association: taped and compounded; ditto braided. 600 meg. non-Association: taped and compounded; ditto braided. 300 meg. Association: taped and compounded; braided and compounded; taped, braided and compounded. 600 meg. Association: taped and compounded; braided without tape; taped, braided and compounded. 2,500 meg. Association: taped and compounded; braided without tape; taped, braided and compounded. 5,000 meg. taped, braided and compounded. In all there are no fewer than 14 varieties for each size of cable, a number far in excess of requirements. Why, for instance, should there be 600-meg. non-Association, and 300-meg. Association types? When one turns to flexible wires, one finds the same bewildering diversity, many types having been introduced to meet the demand for cheapness, and some of them makers will admit to be unsatisfactory. In some cases one hears that the cheaper wires are as good as, if not better than, the expensive kinds, but if this is so, why should we continue to spend money on the expensive kinds? There is an opportunity here for the Laboratory to do good work, as it is conceivable that it might discover that there was no benefit in using large proportions of pure Para in the insulation of house wires.

The laboratory could do a most useful work by examining and reporting on new materials and apparatus which come on the market from time to time. Under present conditions an engineer tries something new once in a while, but if he happens to have some failures he is apt to fall back on the old and tried materials, to the exclusion of new ideas, an attitude which is detrimental to the industry. Take, for instance, the recent proposal to use cab-tire cables for house wiring. If successful, this style of wiring will prove of the utmost benefit in many cases, being easily run and free from liability to go to earth. But who is to do the pioneer work?

A few years ago, paper lead-covered wire was used on a large scale for house work, and it has been found necessary to pull most of it out. How is one to know that cab-tire will eventually prove better? Then we have a continual flow of new kinds of switches, lamp-holders, and other apparatus, some of which prove good and some very bad. Some of these continue to sell in one district after another long after the original users have found them unreliable, and others progress with a slowness quite unworthy of their merits. So far there is no machinery in existence by which the experience of one user can be published for the benefit of others, and there seems no other means of filling the need save by the establishment of a Testing Institution. In one case, which the writer had to do with, it was found that a new type of insulated wire had so short a life that it should never have been placed on the market. In the course of a few months it became hard, developing cracks all along its length, while its insulating properties practically disappeared. The wire in question was by no means cheap, and it was introduced as the most perfect form of insulated wire to be obtained. In spite of its failure, through a clever selling organization, the makers managed to sell large quantities of it throughout the kingdom, and no doubt many users are now regretting their misfortune in having touched it. Incidents of this kind are by no means uncommon, and the industry should take steps to abolish their possibility.

The benefits of the proposed institution would apply to everyone concerned. The manufacturer would no longer have to produce stuff which he knew to be unreliable, merely to meet the competition of less scrupulous traders, for when putting forward his wares he would know that he was competing only with firms who were bound by the same conditions as himself. The wiring contractor would be protected from the competition of unscrupulous firms who rely on getting low quality materials accepted. The benefits to the consumer of electricity and to the supply authorities are self-evident, and there is no need to enumerate them. The institution would be of particular value in enabling new designs of apparatus to come quickly on to the market, for such would find ready acceptance by users when they had obtained the laboratory certificate, while we should be saved much expense by the rejection of new apparatus which proved unable to pass the stipulated tests. In many cases it would also be found that some of the cheaper designs were quite as good as the more expensive ones, and in this direction alone large savings would ensue to the electrical industry. The laboratory would further receive and tabulate complaints of all sorts from the users of electrical apparatus throughout the whole country, so that it would be able to pass on to manufacturers the accumulated experience of the whole country.

The method by which such a laboratory would be organized and worked would require more discussion than can be set out in an article like the present one, but the following suggestions may serve to open up the subject. The Testing Institution would primarily be controlled by a committee representing the various branches interested in the electrical industry. With the aid of the laboratory it would draw up specifications for the materials most commonly used, such as I.R. cables, switches, lamp-holders, etc., the list being extended as experience was gained. Two or three classes might be standardized to meet various requirements. Manufacturers who agreed to supply to the conditions of

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the specifications would become approved by the laboratory, after their samples had passed the tests. Where it was found that the actual materials supplied by any maker repeatedly failed to come up to the specifications, his name would be removed from the approved list. Makers would further agree to mark all their goods with their name or other approved mark, for which purpose the recent decision of cable makers to mark I.R. cables with their names will prove of great benefit. Should samples of the materials, on any installation, fail to pass the tests of the laboratory, then the consulting engineer would be reasonably able to demand that the installation be re-done. (At the same time, however, such contingencies would be extremely rare if the laboratory came into being, as few men would run the risk of putting in unsatisfactory materials.) It might also be found possible to set up local committees in various parts of the kingdom to deal with disputes between station or other engineers and contractors. At present contractors often complain that it is unfair that they should have to accept the verdict of the consultant, who may sometimes not be a particularly competent engineer, while the consultant who accepts something not up to the specification may be liable to very unpleasant consequences should the installation subsequently prove defective. One may remind readers of a case in the law-courts which may be fresh in their memories.

There should be no difficulty in meeting the expenses of the institution. A levy on the supply authorities would provide a good part of the money, while manufacturers, wiring contractors and insurance companies would also contribute. Fees for individual tests would cover the remainder of the expenses.

It may be argued that while the proposed Testing Institution is desirable, it would be unworkable. To this one may point out that something of the sort is done in America, as witness the following taken from the ELECTRICAL REVIEW of May 3rd, 1912:—

'The India-Rubber World' quotes the revised set of electrical regulations isued in 1911 by the Electrical Department of New York City, which provide that the insulation shall be rubber or other homogeneous compound which has been approved, and specify a definite thickness for each size of wire. As a protection against too soft an insulation, the rules stipulate certain tests, among which is the following:—The braiding is carefully removed from a portion of the sample, and the copper wire is connected to one terminal of an electric circuit of which the testing tool forms the other terminal. The portion of the sample, from which the braiding has been removed, is placed on a flat surface, and the tool edge, which is placed across the sample, is pressed down on the insulating cover with a pressure of 5 pounds, which is maintained for about a quarter of an hour. The electric current, which must be at least 100 volts alternating, is then turned on, and the tool edge must not sink far enough through the insulation to touch the copper wire and complete the electric circuit—a pretty hard test for a small wire, but one to which the best manufacturers have agreed.

We may, of course, be content merely to drift along and muddle through somehow, but such a method is unworthy of our traditions, and furthermore this policy is likely to result in incidents which will deal a blow at the very heart of the industry such as may be feared from no competitor.

REVIEWS.

Electrical Engineering Problems. By F. C. CALDWELL. London: Hill Publishing Co. Price 4/2 net.

THIS is another book of problems in Electrical Engineering, also without solutions or explanatory matter. As will be seen from the summary of its contents given below, it covers a very wide field, but the problems are all of a comparatively elementary character, and the earlier ones are evidently intended for the student who is only just beginning the study of the subject.

It will probably be useful to indicate very briefly the subject matter of the problems, in the first place, and then to make a few observations on the manner in which the author's plan is carried out.

Part I deals with direct-current circuits and apparatus, and includes chapters, or groups, of problems on the following subjects:—Ohm's Law, Wires and Wire Tables, Power and Work, Measurement of Current and E.M.F., Magnetism and Magnetic Circuits, Magnet Windings, Generation of E.M.F., Armature Windings, Armature Circuit Calculations, Armature Reactions, Magnetization Curves, Characteristics, Heating and Rating of Dynamos, Dynamo Losses and Efficiency, Motors.

In Part II, alternating-current circuits and apparatus are dealt with. The problems include questions on the alternating circuit, with inductance, resistance and capacity, measurement of power in single and polyphase circuits, transformers, alternator reactions and regulation, synchronous motors, converters and polyphase induction motors.

As already stated, the problems are intended for junior students, and the efforts made by the author to make their solution simple have in a good many cases led to a rather artificial type of question and to the omission of considerations which would affect the correctness of the deductions in practice. Further, the manner of stating the problems is often bald and incomplete, and sometimes the wording is so abrupt as to make it not easy to grasp the real meaning of the question. We should, for instance, have little respect for the thoughtfulness of a student who would solve the following problem without further question:—"Given a round bar 3 inches in diameter, bent into a magnet, and having the length of magnetic circuit 15.75 inches. Find the number of turns necessary to give a pull of 2,433 pounds with a current of 5.27 amperes." The time necessary for the solution of this problem is given as ten minutes, and this may be taken as representing what we conceive to be a serious shortcoming of the whole book. The tendency throughout is to present the problems in the form of a simple numerical statement, ready for solution in a very short time and with the expenditure of little reasoning power on the part of the student. In other words, the problems are rather a series of exercises in numerical calculation than a set of problems for training powers of thought and reasoning.

The first problem in the book is as follows:—"Given three 110-volt tungsten lamps with resistances of 50, 120 and 200 ohms in series, with 330 volts applied across the outside, what will be the difference of potential around each lamp?" The time required for the solution of this exercise is given as 3 minutes. If the problem were put to a practical test in the laboratory, we think its solution would occur almost simultaneously with the closing of the switch, and the "potential around the lamps" might rise to an unexpectedly high value.

In conclusion, while we do not think that this collection of problems is suitable for use as a class-book by students in this country, we have little doubt that teachers who have difficulty in finding numerical examples in sufficient number will be glad to turn to it for suggestions, and that they may find here many useful and suggestive problems which they can adapt to their own use.

Practical Illumination. By JUSTUS ECK, M.A., M.I.E.E. London: S. Rentell & Co., Ltd. Price 1/- net.

DURING the past few years a number of books have been published on the subjects of Light and Illumination, but so wide are they that hitherto no writer has been able to deal fully with them within the pages of a single volume. It may be said at

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once, in order to avoid misapprehension, that Mr. Eck has not attempted to do so. As is perhaps to be expected from one who is a high authority on the subject, the arc lamp receives a good deal of attention, although incandescent lamps of the metal-filament type are not by any means neglected.

The object which Mr. Eck appears to have had in view was that of providing a reference pocket book for engineers, electric light contractors and all interested in efficient illumination by electricity, and a close perusal of the 85 pages of which the book consists justifies the expression of opinion that he has succeeded in his aim. All the information given therein is of value; much of it is of exceptional interest, whilst some of the carefully worked out examples given will considerably lighten the task of preparing specifications and estimates for electric light installations.

An attempt is made in the pocket book to guide both customers and installation engineers, to help both of them to reason out each confronting problem and to enable them to arrive much closer to the correct solution than is often the case at present. The author states this apparently lest some readers might think the book had been written to take the place of others that had been published on the subject, whereas Mr. Eck had evidently in mind the encouraging of a more extended study of illumination.

The work consists of twelve sub-divisions, viz.:—Sunlight, artificial light, direct incandescent lighting, direct arc lighting, indirect lighting, light requirements, planning installations, cost of installation and maintenance, fallacies and arguments, size of light units, prismatic glassware for arc lamps, and globes and illumination. Each sub-division is necessarily short, but nothing of a superfluous character is included, and the information is practically offered in tabloid form. Under the heading of "Direct" incandescent lighting Mr. Eck points out very truly that, although the metal-filament lamp has become almost universally used, a large proportion of shades are still designed suitable for use only with the smaller carbon-filament lamp, and when these are used with the larger lamps the appearance is grotesque and the illumination effect unpleasant. That this is true will be readily admitted, and as a large proportion of the objections which one sometimes hears expressed with regard to electric light have to do with the intrinsic brilliancy of the filament, it would appear that were more attention paid to the subject of providing suitable shades it would be to the benefit of the industry generally.

The book is amply illustrated, but there are many reproductions which might have been left out with advantage. The illustrations of the four shades on page 17 are quite crude, and represent old and not up-to-date patterns. Following this unnecessary page is a half page taken up by the well-known "Focusing," "Intensive" and "Extensive" types of Holophane shades, and it would not be too much to say that the book would not have suffered in the slightest had all the blocks of shades been left out. The same remark applies to the illustrations of arc lamps, finished decoratively, on page 31. On the other hand, several of the photographs of premises lighted in different ways by arc or incandescent lamps are of distinct value as showing the effect that can be obtained when the lighting is planned out on scientific lines. The illustration of Messrs. T. H. Wallis's premises in particular is striking, as also is that on page 69 of a school-hall lighted indirectly by drawn-wire lamps. Another illustration of interest and value is that on page 81, showing the use of inverted arc lamps in shop lighting, where it was necessary to fit the lamps with large over-reflectors to prevent the direct rays being transmitted upwards to another part of the premises.

A number of valuable tables are included, one of the most generally useful being that compiled by Mr. W. E. Barrows, and originally published in "The Illuminating Engineer," giving the intrinsic brilliancy of various illuminants. From this it can be seen that the intrinsic brilliancy of the crater of the open arc is more than 200 times that of a tungsten filament operating at 1.25 watts per candle. The tables for direct and indirect arc lighting on pages 47 and 48 are also useful.

A table around which a certain amount of controversy will rage is that given on page 68, showing the cost of 2,000 candle-power for 1,000 hours by metal-filament and Union arc lamps. The debatable points are with regard to the cost of trimming and cleaning, and there are few of those who have had lengthy experience with metal-filament lamps who will agree that if it costs £6 5s. per 1,000 hours to clean 80 metal-filament lamps, it will cost 10s. to clean two metal-filament lamps of larger size used for a similar time. But, many will ask, is it necessary to clean metal-filament lamps at all in the comparatively short space of 1,000 hours? It is true that the slight accumulation of dust and dirt on the globes will render the lamps slightly less efficient, but it is a question whether it will make so great a difference that it would pay to spend over six pounds on having them cleaned. The figures given may be compared with the sums of 4s. 6d. and of 5s. which are given as representing the cost of cleaning and trimming four Kohinoor and one Excello arc respectively. An enclosed Kohinoor lamp requires trimming 36 times in 1,000 hours, at an expenditure, says Mr. Eck, of about 4 minutes a time. A 16-hour flame lamp requires 63 trims per 1,000 hours, and occupies about 5 minutes each time for the most thorough cleaning. In estimating the cost as above then it would appear that Mr. Eck has failed to take into account the time that the arc-lamp trimmers would occupy in walking from the shop to the lamp were a contractor's man employed. If on the other hand the lamps were cleaned by a man on the premises it is strange that it should cost 5s. for him to make 63 visits of 5 minutes' duration to an arc lamp, and yet cost £6 5s. for him to make 80 visits of certainly shorter duration (assuming that he only cleaned one lamp per visit, which is hardly likely) to an installation of 80 metal-filament lamps. There may be some factors which have not been taken into account either by Mr. Eck or ourselves. However, all cost comparisons are highly controversial, and apart from this one question we are disposed to agree with most of Mr. Eck's remarks on the subjects of light and illumination. The book is well written and always interesting, and should prove of value to all connected with the science of illuminating engineering.

THE TRAMWAY CONGRESS.

(*Concluded from page* 159.)

The second day's proceedings were again opened by Mr. STEPHEN SELLON, who read a letter from the Hon. Arthur Stanley, M.P., regretting that he could not be present at the conference. Mr. Sellon also read a telegram that had been received from Mr. Nance, Belfast, thanking the Association for their congratulatory message of the previous day. Later in the morning, Mr. Harry England, vice-chairman of the Association, arrived, and took the chair.

Rail Joints.

MR. R. HUMPHRIES, tramways engineer to the Birmingham and Midland Tramways Joint Committee, dealt with the construction and maintenance of rail joints. Of the many fish-plate joints that had been introduced, he referred only to the Dick, Kerr joint, in which the fish-plate was scarfed into the head of the rail, and the British Standard joint with a simple

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six-hole plate. Fish-plates, he said, allowed creeping with change of temperature, and dished joints were inevitable. The Continuous Rail Joint Co. recommended what was practically a combined fish and sole-plate; sole-plates and anchors, however, only postponed the evil day. Joints to be perfect must be strong enough to withstand temperature effects. The author had no hesitation in advocating the arc-welded joint with fish-plates, which he had been using for some time. A motor-generator was fitted into an old tramcar, taking current from the trolley wire, and supplying 250 amperes at 100 volts for the welding work. The positive pole of the generator was coupled to the wheels, and the negative to the arc carbon, with a resistance in circuit, leaving 70 volts at the arc. High-carbon steel sticks were used to feed the arc when filling in dished joints, which occupied a few minutes and consumed a couple of units. The surplus steel was then ground off and the joint filed level, the dish being thus filled with steel as hard as the rail. The fields of the generator were excited from the trolley wire, giving a steady voltage across the arc. Welding fish-plates solid to the rail took about half an hour per joint, and consumed about 10 units. The fish-plates were first removed and the rail was thoroughly cleaned; the plates were then bolted up tight and welded. The cost of filling a dished joint was 1s., and of welding a pair of fish-plates 5s. Fish-plates were welded on special work as well as to rails, and dishes in points and crossings were also easily handled. When the time came for renewals the rails were cut with the oxy-hydrogen blow-pipe. The welded fish-plate joint was at least as strong as the rail, and the conductance of the joint was higher, bonds being unnecessary. A smaller welding set on a four-wheeled cart was also used, and had the advantage that it did not interfere with the traffic. Another welding set was in use in the central repair shops, with which all kinds of work were tackled. The author also described the Thermit welded joint, which, he said, was at least as strong as the rail, with conductance about 9 per cent. lower than that of the rail; the Falk cast-welded joint, which required a portable cupola; the "D.A." system of jointing by welding a sole-plate to the base of the rail with oxy-acetylene gas, the Tudor Company's electrically welded joint; and the Lorain Steel Company's electric butt-welded joint, in which the flat steel bars were welded to the web of the rail with an alternating current of 5 volts, 25,000 amperes.

DISCUSSION.

Mr. SELLON, who was then presiding, suggested that some of the manufacturers should express their opinions upon Mr. Humphries' paper, and possibly upon their own special appliances for curing the trouble that arose from rail joints.

Mr. R. STUTZ, of the Thermit Company, said he was sorry the author advocated the use of welded joints with fish plates. In adopting such a joint for re-construction, or re-laying work they had, of course, to count the additional expense of the fish plates and the bolts. Such a joint, therefore, in his opinion, did not quite fulfil the requirement laid down by the author, that the joints should not be expensive, though it must be admitted that the cheapness, or otherwise, of a joint was only to be judged by the results obtained. The most ideal joint was no joint, but a system of continuous welding.

Mr. J. A. BRODIE (Liverpool) gave his experiences of a mechanical joint that had been largely used in Liverpool for the last four or five years—a fish-plate joint with eccentric bolts. The idea was to prevent any movement at all of the joint, and thereby do away with any trouble which might arise, due to expansion or contraction.

Mr. W. F. ENDEAN said that in the last three or four years he had had a good deal to do with joints that had been hammered and dished. He much preferred the joint which Mr. Humphries had remarked, was approved by Mr. Fitzmaurice. In his opinion it was a method by which companies without much money could get longer life out of their rails before scrapping. He had opened several of the joints since they were put in, and in every case he had found that the new concrete had amalgamated perfectly with the old substance, and that no movement had taken place. The joint was generally better than it was before.

Mr. H. M. SAYERS observed that with regard to new joints, ever since he had had anything to do with tramway permanent-way work he had looked upon the welded joint as ideal. For dished joints he had tried many methods, and he had found that the best was to crank up the fish-plate sufficiently to raise the ends of the rails and then to grind. It involved something more than merely cranking up the fish-plate; the latter had to be fitted to the rail. It was a somewhat expensive method of doing it, but it made the joint as good as new.

Mr. J. W. DUGDALE (Oldham) described some work they had done by the Tudor process. It was now three years since the work was done, and it was giving every satisfaction. With the exception of one joint, none of them had moved, and the exception was due to bad workmanship at the time. In places where they had narrow workings the fish-plate joint was the most satisfactory type. With regard to thumping joints, when the thump or bump first showed itself, a tramway man should at once go to that joint and right away tighten up the nuts and bolts, as was done on the railways. His men did that immediately there was bumping, and it was satisfactory.

A Wakefield gentleman said that there they had concrete stringers, and now they had put concrete right across the road. Since that had been done joints that had given no trouble before were causing difficulties, by beginning to hollow.

Mr. ROBINSON said the subject introduced for discussion by Mr. Humphries was the bugbear of the tramway managers and engineers. What was wanted was something resilent underneath the joint. If a track was laid on resilient material it seemed to him that nothing could ever possibly open it up.

Several other gentlemen contributed to the discussion.

The CHAIRMAN (Mr. Sellon) thought that in the discussion there had been a good deal more about re-construction than about construction. No doubt the matter of re-construction was a very difficult matter. He had obtained some excellent results by bringing up the rails and grinding them level, and the welded fish-plate joint was no doubt a very excellent thing; but he thought they should endeavour to find some system of construction that would not require all these very excellent efforts to remedy defects as they appeared. They wanted some system of laying down the rails whereby they could be assured that a joint would last the life of the rail. No matter what joint might be used, special attention should be given to guard against the rigidity that was so general in tramway construction. The County Council of London had an inverted rail rivetted on the bottom flange of the existing rail and then laid in a huge bunch of concrete. When one wanted to make a rivet head one used a good anvil, and here was provided just the proper anvil for dishing the joints. He believed in trying to get a road of the most elastic kind. When that was done, and proper fish-plates were provided, and if they had got them well fitted when they were laid down, he did not believe that the troubles would occur to the extent that they did at present. He therefore recommended managers to consider whther, as a real engineering proposition, it was not better to follow the example of the railways. They there got a joint which lasted as long as the rail, because there was no rigid bed.

Mr. HUMPHRIES, replying to the discussion, said the special car that was used was an "Old rooster," such as could probably be found on the system of any company. It had been scrapped for passenger work, and it not only answered the purpose he had described but also served as a towing car, and was used in every way possible. He thought the trouble at Wakefield with the concrete was due to the disturbance of the existing track. The mere presence of a creosoted sleeper underneath a joint had dished the latter on the Auckland Company's undertaking. His figures were only comparative for welding work. He agreed that if they could tighten their fish-plates that would as a rule do away with dished joints, but he thought there would be trouble if they pulled up their track say once a month to examine the fish-plates.

Town Planning in Relation to Tramways.

THIS subject was dealt with by Mr. J. A. BRODIE, city engineer to the Liverpool Corporation. The author said that speedy local passenger transport was likely to play a very important part in the development of town areas in the future. The satisfactory arrangement of main lines of communication had until recent years been seriously hampered by the lack of statutory powers, the obstructive attitude of neighbouring authorities, and the want of foresight of those who held the purse strings, and the new roads had been far too narrow; in laying out new areas the distance apart of the tramways would have to be considered, as well as the stopping places, and ample width must be provided for, 80 feet being the minimum for any important main thoroughfare leading towards the centre of the town. The width of the most important roads should be 120 feet if possible, and such roads had been constructed in Liverpool, with the tramways in the middle. The roadway was provided with a clinker concrete foundation overlaid with pitch macadam, and the tramways were laid on wooden cross sleepers, on a clinker foundation covered with grass. The total cost of the 120-ft. road and tramways was no greater than that of an 80-ft. road and tramways paved in the usual way; the cost of new tramway construction in Liverpool was £6,000 per mile of single track, exclusive of overhead equipment, but on the new road, the tramway cost was only £3,000 per mile of single track. Low hedges separated the tramway from the roadway, so that high speeds were permissible. Even in the centre of the town, to widen the road to 80 feet would not cost much more than to construct subways or tubes, while many indirect advantages were gained by the former policy. The essential factor of success in the competition of the tramways with other means of transport was, in the author's opinion, higher speed, which must be taken into consideration in all new plans. The time was not far distant when the present maximum speed on public roads of 20 miles per hour would become the average speed, but combined with speed there must be safety, comfort and economy. Noises and vibration must be minimised, and perhaps rubber tyres might be applied to tramcars; the wear on the tyres would be less than in the case of road vehicles, and would be compensated by reduced wear of rails, reduced maintenance costs, and elimination of the rail corrugation trouble. The noise of the gearing ought also to be stopped, and much could be done to reduce the weight per passenger of tramcars. Track maintenance could be reduced by using the best materials in Liverpool; Welsh stone pavement on a concrete foundation had

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lasted for 30 or 40 years with practically no cost for repairs. Numerous town planning schemes were under consideration or preparation, and every opportunity to introduce improved systems and arrangements should be utilised.

Discussion.

Alderman Fred Smith (Liverpool), agreed with Mr. Brodie that the tramcar must have speed, and they could not get that unless they had wide roads. There was a better feeling in regard to the widening of roads than there was a few years ago. He did not believe that people would travel in tunnels if they could have proper facilities on a properly widened street.

Mr. F. Coutts (Paisley), urged the desirability of having four tracks for the convenience of fast and slow traffic. Referring to the illustrations of the sections which Mr. Brodie had produced he drew attention to the grass-covered tracks, and said he had a private track and his great difficulty was to prevent grass growing. In his opinion earth mixed with the metal was most disastrous.

Mr. H. R. Hogg (Sunderland) said that to-day they wanted main thoroughfares which were not necessary when the towns were laid out. The cost of macadamising a wide road soon became a very serious matter indeed. A 90-ft. road was about as much as any large town could manage. That gave them room for tramways down the middle, and for plenty of traffic down both sides and footpaths as well. If they had several of these 90-ft. roads, even in such a place as London, he believed they would take as much traffic as one 120-ft. wide. The upkeep of a wide road made all the difference. He did not believe the final cost of widening a road was more than would have been expended had they maintained a wide road before it was needed.

Mr. S. Sellon said he would like to ask Mr. Brodie why he had not contemplated putting tramways down the side of the road. One of the greatest arguments for the motor 'bus was that it deposited its passengers at the side of the road, whilst the tramcars, because of the lines upon which they ran, were restricted as to position. In large towns such as Vienna, Buda-Pest, etc., their tramways were run at the sides and not in the centre, with success. It seemed to him under these circumstances they could get more ideal conditions than if the tramways were in the centre of the road, and they economised the road space enormously by giving other traffic much more of the roadway; at the same time they deposited their passengers on the footpath without requiring the people to walk across the road unnecessarily. He could not see why grass should not be allowed to grow on the track. His difficulty had been to keep the grass properly mown and looking respectable.

Mr. Fred Bland complained of the type of house that was being put up along tramroads that were being developed.

Mr. W. J. Steel, the City Engineer for Newcastle, said Mr. Brodie had laid down a sound plan. He was attempting to avoid the mistakes that were made a hundred years ago. Every town of large size had felt the necessity of widening the roads. The cost of doing this in old cities was almost prohibitive; to widen a thirty-feet road to sixty feet in Newcastle would cost, perhaps, from £500,000 to £800,000 per mile. Three-quarters at least of the cost was due to compensation that had to be paid for pulling down property and in meeting other interests. He considered any suggestion to construct tubes to be unsound. He should imagine that 99 out of every 100 persons would preferably travel over-head. Underground ways for trains or tramways were only permissible or desirable when absolutely no other way out of the difficulty was left. The system advocated by Mr. Brodie was, to his mind, the only system they could look to for dealing with the increasing traffic. If the tramways were run alongside the footpaths, they would defeat the very object which Mr. Brodie had in view, and that was high speed. By keeping the tramways in the centre of the road they could give the cross traffic a better chance to observe the coming traffic. If the tramways were alongside the kerb, a higher speed would increase the present danger. Then again, if the trams were put along one side of the street or road, passengers on the left side of the road who might wish to get across to the right side to board a car would have to walk right across the road instead of only half way across, as would be the case if the cars were in the centre of the roadway. If they could have the roads laid out in the way that had been suggested there was no doubt that they would be infinitely safer, cheaper to maintain, and much more convenient. There was a great scheme in London, and very largely in Liverpool, to make ring roads. He argued, however, that these ring roads would not be used by through traffic but only by local traffic.

Mr. Allen (Croydon) said he thought they would have to wait until the millenium before such an ideal class of roads could be carried into effect. The making of main roads like that must be an Imperial matter, because the cost would be so tremendous. No main road through a town should be less than 80 ft. wide, because traffic was bound to increase and faster speed was bound to come. The great difficulty authorities had always had when they wished to widen the road was the feeling on the part of shopkeepers that a wide street would interfere with their trade. He believed that to be a fallacy.

The Chairman (Mr. England) said he could not see why they should not maintain the same speed with the cars running alongside or near to the footpaths as could be maintained in the centre of the roadway, always provided that the tramways had their own right of way. The chief point that interested them in connection with the paper was the question of speed. The higher the average speed they could maintain, the lower the expenses must be, apart from depreciation of stock, and he thought that if it were possible for them as tramway companies to contribute a reasonable amount to road widening schemes when under consideration, it would be to their ultimate benfit.

Mr. Brodie, replying to the discussion, said there was a great deal of road widening going on in Liverpool. Ninety feet did not meet what he thought would be required by the conditions of traffic in the future. Within the last 50 years there had been four millions sterling spent in widening and improving roads in Liverpool, and that figure, he thought, was nothing in comparison with the road improvements that would have to be effected. He favoured the centre of the roadway for cars for two reasons. The first was that they could not prevent cross traffic coming on to the routes, and the second that some consideration must be shown to the occupants of the frontage houses along the routes, especially if the cars were to be run at twenty miles an hour. It was his opinion that people would take the fastest road, and that fast traffic would prefer the ring roads to the narrow streets in the middle of the town, where they would have to slow down. Heavy traffic, for which the ring roads were not designed, could not be kept off the ring roads at Liverpool, and that showed that they at least understood their value.

Correction.—In our last issue, page 158, Mr. Saunders was incorrectly reported as being at Maidstone; we learn that he left that town some four years ago, also that halfpenny fares, other than workmen's fares have never been instituted at Maidstone.

LONDON'S ELECTRICITY SUPPLY.

L.C.C. Report.

A lengthy report dealing with the establishment of an undertaking for the control, generation, and distribution of electricity in Greater London, was presented to the L.C.C. by the Special Committee on London Electricity Supply, on Tuesday.

After outlining the present situation the Committee say they feel strongly that proper lines of future development should be laid down now, and that they aim primarily at initiating a new policy rather than making any immediate change in the *status quo*.

Technically, the proposed scheme is based on the conclusions contained in Messrs. Merz and McLellan's report (see Elec. Rev. May 1st, page 759), and aims to gradually centralise production, unify distribution, and ultimately absorb all the existing undertakings in the area. The Committee think that the area should include the County of London and such of the districts adjacent thereto as together form, from the geographical and engineering points of view, the most appropriate field of supply, and that this should be dealt with as a whole, in order to secure the proper development of electricity supply so far as regards the commercial and general economical development of the metropolitan area.

The report says the question of the authority to be set up to deal with the electricity supply over an area of this character is a matter of considerable difficulty. Owing to the extension of the area of supply beyond the County of London, the London County Council could scarcely claim to be the sole authority. For one thing, it is proposed not only to include portions of the areas of five other counties and three county boroughs (including East Ham, which will shortly become a county borough) with the area of the county, but also to associate the councils of such areas in responsibility, financial and otherwise, for the scheme.

The Committee think that it will probably be convenient to establish an authority which should contain representatives of the London County Council and the five other county councils and the three county boroughs concerned, and are now taking steps with a view to consulting the councils concerned with regard to this matter.

On the whole, they are of opinion that the efficient and profitable working of the undertaking in the interests of all concerned will be most effectively secured by the adoption of an arrangement under which the capital required should be provided in definite proportions by the authority and the company, the company to have possession of the whole of the undertaking (including any undertakings acquired) for a definite period, subject to full powers of control and supervision by the authority. Under this arrangement they propose that the authority should advance, by way of loan, two-thirds of the capital required for fresh works. The remaining one-third of such capital would be found by the company. As regards the capital involved in the transfer of existing undertakings they suggest that the whole of the money required for this purpose should be provided by the authority. It is proposed that the whole undertaking should vest in the company during the period of the contract. The authority would be empowered to resume possession of the undertaking at the end of the term of the contract, on payment to the company of a sum equal to

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the capital provided by it for the purposes thereof. The authority would also be empowered to resume possession of the undertaking, and to do all necessary things in connection therewith, in the event of the company failing to fulfil its statutory and contract obligations. This arrangement provides for complete ultimate ownership by the authority, while it avoids many of the disadvantages which would attach to immediate possession, whether partial or complete.

It is proposed that the new undertaking shall be established and worked by a company to be constituted by statute, subject to effective powers of control being exercised by the authority.

It is essential for the success of the scheme that the area of supply shall be available at the outset. The Committee think that perhaps the best method of securing this would be that the operating company should at the outset have obtained control over a number of the existing undertakings. Failing a sufficient number of existing companies coming forward it may be necessary to consider proposals by other bodies.

The Committee consider that, from the point of view both of the authority and the company, it would be of great advantage to have an intermediate body consisting of a small number of engineering and financial experts who would be permanently appointed and paid for their services. Such a technical committee as this would, under the direction of the authority, act generally for it in executive matters, particularly as regards considering and advising upon technical questions arising. If such a committee were established, they suggest that it might be entrusted with the following duties:—

(*a*) Generally to consider and report to the authority on all matters connected with the establishment and working of the new undertaking on which the decision of the authority is required, and in particular—(i.) To approve designs, plans and systems of generation, distribution or supply, either for the purposes of the new or existing undertakings. (ii.) To approve from the technical point of view all arrangements for the purchase of existing electricity undertakings. (iii.) To approve contracts by the company for the purchase of materials, erection of buildings, purchase of sites and other purposes. (iv.) To approve contracts for the purchase or sale of energy in bulk. (v.) To approve arrangements made by the company for repairs and maintenance.

(*b*) To exercise, on behalf of the authority, such powers vested in the authority under the scheme as may be deemed desirable.

The powers to be conferred upon the new authority, and to be exercised wholly or partially by the operating company, under delegated powers (subject of course to proper control) would include, *inter alia*, (*a*) the acquisition of certain scheduled sites for generating stations, and (*b*) the erection and equipment of generating stations, the abstraction of water from the river, the breaking up of streets, the laying of mains, the construction of tunnels under the river and certain streets, and generally all necessary things in connection with the establishment and operation of the undertaking.

The powers of supply of the undertaking would include the following:—(*a*) the supply of electricity to authorised distributors; (*b*) the supply of electricity to consumers under the powers of any undertaking taken over; (*c*) the supply of electricity for railways and certain power purposes within the area, regard being had in respect of the latter to the existing powers of authorised distributors; (*d*) the supply of electricity for any purposes—(i.) in the district of an authorised distributor with the consent of such distributor, (ii.) in any district where no authorised distributor exists. There would be an obligation on the new undertaking to supply, subject to conditions.

The scheme will give the necessary power to the authority to enter into a contract with a company for the construction of all necessary works, whether of generation or distribution, and for the operation of the new and of existing undertakings acquired, for, say, 50 years.

It is suggested that the authority should exercise the undermentioned important powers of control:—

(1) Approval of all proposals by the company involving capital expenditure.

(2) Approval of the nature of the capital raised by the company and of the terms on which such capital is raised.

(3) Approval, during the last ten years of the contract, of all agreements and contracts entered into by the company.

(4 A scale of maximum charges by the company for energy supplied would be prescribed in the bill. Such maximum prices to be revised by the Board of Trade from time to time upon the application of either the authority or the company. The rebate (if any) to consumers to be fixed yearly.

(5) Powers to take action for the protection of the interests of retail and bulk consumers.

(6) The general powers relating to the electricity supply would be transferred to the authority, with certain necessary exceptions.

(7) An auditor to be appointed by the authority to audit each year, with an auditor appointed by the company, the accounts of the company.

The Committee suggest that powers should be sought to provide for the transfer to the new authority of existing powers of compulsory purchase, and also power to acquire by agreement or take on lease the undertakings of any company or companies or any local authority or authorities in the area, to merge such undertakings in the main undertaking, and to exercise all existing powers in connection therewith.

It would be proposed to include in the bill any necessary powers to provide for the compensation of those who might lose their office through the transfer of such undertakings.

The scheme should provide for the undermentioned arrangements governing generally the relations to be set up between the new undertaking and existing undertakers with a view to securing as far as possible that degree of continuous co-operation and interworking which is so important from the point of view of any scheme of ultimate unification:—

(1) Power to the authority to advance money to existing undertakings to enable them to take bulk supply, lay down standard networks, etc., subject to adequate guarantees.

(2) Approval of the authority to be obtained to the erection of any new generating stations, the extension of existing stations, or distribution networks, subject to appeal to the Board of Trade.

(3) Local authorities who are authorised distributors in the area of supply to be required to take from the new undertaking any additional power required by them if it can be shown to the satisfaction of the Board of Trade that it would be more profitable for them to do so than to extend their own plant. Extensions of generating stations or distributing networks allowed by the Board of Trade shall, as far as the Board considers practicable, be carried out in conformity with the standard system of supply.

(4) The attitude of the authority or the Board of Trade, as the case may be, in regard to proposed extensions by local authorities to be taken into account in connection with the consideration by the respective loan sanctioning authorities of applications for loans for the extensions, and opportunity to be given to the authority to state its views before a loan is granted.

(5) Approval by the authority of all agreements between the company and authorised undertakers, and, subject to appeal to the Board of Trade, of agreements between one authorised undertaker and another, affecting the sale, lease or working of undertakings or generating stations, or portions thereof, or the giving or taking of a supply of electricity.

The scheme should provide for the undermentioned arrangements in respect of finance, in addition to those already referred to:—

(1) The authority to be empowered to raise money for all or any of the purposes of the undertaking by the issue of electricity stock, or other means, upon the security of the new undertaking, and of the rates of the various districts represented or otherwise.

(2) Bodies represented on the authority to be empowered to accept financial responsibility for the London Electricity stock or other security or stock created for providing funds for the new undertaking, apart from those for which the company is responsible, and for defraying the expenses of the authority so far as the same are not otherwise provided for.

(3) The company to be empowered to raise capital, and to raise temporary loans in connection with the working of the undertaking. The company would not have any power to charge the assets of the undertaking.

(4) The authority to be empowered to pay in electricity stock for stations, undertakings and plant; and the company to be empowered to pay in shares for like purposes.

(5) A sinking fund to be established, to be vested in the authority, upon the basis of the capital expenditure in connection with the undertaking being written off in the undermentioned periods—land and engineering works, 60 years; cables, 40 years; power stations and sub-stations, with all plant therein, 25 years; service lines, 12 years; interest paid out of capital, 30 years; and purchase of existing undertakings, 30 years.

(6) A reserve fund to be established and the approval of the authority to be required to the arrangements with regard to the utilisation thereof.

(7) Power to deal as follows with the net revenue from the undertaking—(i.) The payment of interest at an assumed rate of 4 per cent. per annum on the proportion of capital found by the authority. (ii.) The provision of a sinking fund, to be owned by the authority, at the rate of about 2 per cent. per annum on the whole of the capital of the undertaking. (iii.) The payment of interest on the capital found by the company, assumed at the rate of 4 per cent. per annum. (iv.) The formation of a reserve fund calculated at one-half per cent. per annum on the whole of the capital of the undertaking. (v.) The surplus profits over and above the deductions for interest, sinking fund, and provision for reserve, already referred to, would be divided equally between the authority and the company, until the company receives a share sufficient to pay a further 4 per cent. interest upon its capital expenditure, making in all a return of 8 per cent. interest to the company. Any further profits would, as regards 75 per cent., be utilised in giving a rebate on the prices charged to consumers, and the remaining 25 per cent. would be divided equally between the authority and the company.

(8) The authority to be empowered to utilise the profits received from the undertaking in excess of the capital charges on the money raised for the purposes of the undertaking and the establishment expenses of the authority not otherwise provided for, for the relief of rates in the areas represented on the authority, or for such other purposes connected with the undertaking as may be deemed desirable.

In conclusion, the Committee point out that the scheme outlined differs from previous proposals in three important respects:—

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(i.) It represents a combination of municipal and private enterprise designed to ensure full control by, and an adequate share of profits to, the public, with the flexibility and commercial enterprise of company management. The best features of both systems of working will thus, it is hoped, be secured. Moreover, under the arrangements contemplated it is hoped that the services will be secured in the working of the new undertaking of those who have wide experience of the electrical industry and of the peculiar conditions obtaining in the area dealt with.

(ii.) It involves the co-operation of the authorities in outer London with the London County Council, and in view of the importance of the outside area to a thoroughly satisfactory scheme of supply the Committee regard this as a very important point.

(iii.) No compulsory purchase of existing undertakings will be entailed, and interference with existing undertakings will be reduced to a minimum.

The keynote of the whole proposal is that it is an offer to the existing undertakings of a means of increasing the efficiency of their present undertakings, or, if they prefer it, an offer of a means of handing over their complete undertakings, upon terms to be agreed, to a central authority. Under the scheme put forward no immediate or drastic "scrapping" of existing capital is contemplated, but a great increase in consumption and a reduction in the selling price will be effected at an early date. The date and extent of this reduction will depend upon the rate at which the existing undertakings realise the advantages offered to them and come into line with the central authority.

The Committee are advised that, having regard to the nature of the subject, it will be necessary to proceed under the provisions of the Borough Funds Act, 1872, as applied to the County Councils (Bills in Parliament) Act, 1903. Ten clear days' notice will, therefore, have to be given by public advertisement that the question of promoting legislation on the subject will be considered by the Council at a meeting to be held on a specific date, which they suggest should be 10th November, 1914.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

16,653. "Electric glow lamps and methods of manufacturing and operating the same for illumination, heating, and other purposes." C. O. BASTIAN. July 13th. (Divided application on 28,935/13. December 15th.)

16,659. "Transmission of electric waves in the interior of the earth." ERFORSCHUNG DES ERDINNERN G.M.B.H. July 13th. (Convention date, July 11th, 1913, Germany.) (Complete.)

16,660. "Process for directly exciting a Marconi antenna." ERFORSCHUNG DES ERDINNERN G.M.B.H. July 13th. (Convention date, July 11th, 1913, Germany.) (Complete.)

16,661. "Means for pulling off electrical overhead conductors or contact-wires." SIEMENS-SCHUCKERTWERKE G.M.B.H. July 13th. (Addition to 30,045/13. Convention date, July 12th, 1913, Germany.) (Complete.)

16,696. "Railway block telegraph signalling apparatus." O. W. BRAIN and C. A. HODGSON. July 13th. (Complete.)

16,712. "Telephone systems, more particularly for police and fire-alarms." G. L. HUGHES and R. E. COOPER. July 13th. (Complete.)

16,776. "Apparatus for producing galvanic or electrolytic deposits." P. I. OZIL. July 14th. (Convention date, July 15th, 1913, France.) (Complete.)

16,797. "Additional use for the tapping key of any telegraphic transmitting apparatus." A. E. NIBLETT and D. C. SHARP. July 15th.

16,809. "Means of insulating and gripping insulated wires in electric-lamp-holders and fittings." B. DEAKIN. July 15th.

16,819. "Automatic electric safety catches or locks." A. A. SMETHURST and G. W. SIZER. July 15th.

16,828. "Electric sign or display system and apparatus therefor." E. M. WILDEY. July 15th.

16,833. "Control gear for electric burglar alarms." LICHTENFELD BURGLAR ALARM CO., LTD., and S. LICHTENFELD. July 15th.

16,839. "Telephone apparatus." E. A. GRAHAM. July 15th. (Complete.)

16,850. "Manufacture of incandescent electric lamps." H. G. FINCH, otherwise known as LORD GUERNSEY, and J. F. POYNTER. July 15th. (Complete.)

16,860. "Protective arrangements for electric installations". SIEMENS-SCHUCKERTWERKE G.M.B.H. July 15th. (Convention date, July 15th, 1913, Germany.) (Complete.)

16,869. "Electric meters." BRITISH THOMSON-HOUSTON CO., LTD. July 15th. (General Electric Co., United States.)

16,897. "Means for locking the detachable connections of electric lamps and their holders." H. J. G. JONES. July 16th.

16,901. "Electric furnaces for producing steel and iron." C. BRACKELSBERG. July 16th. (Complete.)

16,905. "Devices for correcting the difference of phase in telegraphic receiving apparatus." A. C. BARONIO and K. L. WOOD. July 16th.

16,915. "Apparatus for converting or transforming electric currents." K. T. WANG. July 16th.

16,935. "Combined dynamo and accumulator electric systems." SOC. ANON. DES ETABLISSEMENTS L. BLERIOT. July 16th. (Convention date, September 24th, 1913, Belgium.) (Complete.)

16,936. "Control systems for electric installations. SOC. ANON. DES ETABLISSEMENTS L. BLERIOT. July 16th. (Convention date, September 24th, 1913, Belgium.) (Complete.)

16,941. "Electrical apparatus." H. J. G. PESSERS. July 15th.

16,945. "Electrometers." B. SZILARD. July 16th. (Divided application on 20,008/13, September 4th. Convention date, October 15th, 1912.) (Complete.)

16,962. "Galvanic devices applicable to boots and shoes and like footwear." H. J. BIGGIN. July 17th.

16,963. "Insulating the joints of electric railway rails." J. A. SUTCLIFFE. July 17th.

16,979. "Cooling-arrangements for dynamo-electric machinery. SIEMENS-BROS. DYNAMO WORKS, LTD., and E. O. KIEFFNER. July 17th.

16,983. "Automatic magnetic fastening for the doors of railway carriages." G. R. PEARSON. July 17th.

16,984. "Circuit breakers." G. ELLISON. July 17th.

16,986. "Dynamo-electric machinery." HON. SIR C. A. PARSONS. July 17th.

16,988. "Wireless telegraphy systems." A. PEDERY, F. FORBATH, and D. VARSANYI. July 17th. (Complete.)

17,004. "Machine switching telephone systems." WESTERN ELECTRIC CO., LTD. July 17th. (F. T. Woodward, Belgium.) (Complete.)

17,007. "Apparatus for automatically exchanging incandescent bodies." SVENSKA AKTIEBOLAGET GASACCUMULATOR. July 17th. (Convention date, July 19th, 1913, Germany.) (Complete.)

17,022. "Filament supports for electric incandescent lamps." JULIUS PINTSCH AKT. GES. July 17th. (Convention date, February 11th, 1914, Germany.) (Complete.)

17,023. "Incandescent electric lamp filaments and method of mounting the same." JULIUS PINTSCH AKT. GES. July 17th. (Convention date, February 16th, 1914, Germany.) (Complete.)

17,025. "Electric pocket lamp and the like." G. F. HITZELBERGER and NEW BRITISH EVER READY CO., LTD. July 17th. (Complete.)

17,033. "Lighting devices for illuminating purposes." A. W. BEUTTELL and A. W. BEUTTELL, LTD. July 17th.

17,036. "Electric gas-lamps." A. LEDERER. July 17th. (Convention date, July 19th, 1913, Austria.) (Complete.)

17,037. "System for the operation of electric winding-motors and the like." S. H. ECKMANN. July 17th.

17,038. "Systems and methods of electric motor control." L. G. RILEY. July 17th. (Convention date, October 3rd, 1913, United States.) (Complete.)

17,052. "Means for supporting electric lamps." M. J. D. CARTER, G. MAURICE, and M. J. RAILING. July 18th.

17,065. "Apparatus for use in the electro-deposition of metals." S. O. COWPER-COLES. July 18th.

17,082. "Electric starters for use on motor-cars and the like." A. H. MIDGLEY and C. A. VANDERVELL. July 18th.

17,089. "Process and apparatus for the electrolysis of halogen alkalies." SIEMENS & HALSKE AKT. GES. July 18th. (Addition to 18,102/13. Convention date, July 26th, 1913, Germany.) (Complete.)

17,105. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. July 18th. (Automatic Electric Co., United States.) (Complete.)

17,110. "Ball or roller bearings with electric insulation." C. E. WIESELGREEN. July 18th. (Convention date, July 22nd, 1913, Sweden.) (Complete.)

17,111. "Electro air-percussion apparatus." G. ROBINSON, H. ROBINSON, and H. KIRSCHEN. July 18th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

12,428. AUTOMATIC ELECTRIC CONTACT APPARATUS. V. Von Vangel. May 28th.

12,578. ELECTRICAL REGULATING SYSTEMS FOR VARIABLE-SPEED DYNAMOS. W. J. Mellersh-Jackson. (United States Light and Heating Co.) May 29th.

14,741. REGULATORS FOR USE IN CHARGING ACCUMULATOR CELLS FOR MOTOR-CAR LIGHTING AND STARTING AND FOR SIMILAR PURPOSES. W. H. Scott. June 26th.

14,807. MANUFACTURE OF METALLIC FILAMENTS FOR INCANDESCENT ELECTRIC LAMPS. J. A. Scoular, and Dick, Kerr & Co. June 26th. (Addition to 11,455/12.)

14,892. VACUUM TUBES. British Thomson-Houston Co. (General Electric Co. June 27th. (Cognate application 25,849/13.)

14,947. RAILWAY SIGNALLING. W. R. Sykes Interlocking Signal Co., J. C. Sykes and R. W. Tarrant. June 28th.

15,064. DEVICE FOR DETECTING COMBUSTIBLE OR EXPLOSIVE GASES, ESPECIALLY FIRE-DAMP Accumulatoren Fabrik Akt. Ges. and F. Rüsse. June 30th.

15,175. SOUND-TRANSMITTING DEVICES FOR TALKING MOTION PICTURE APPARATUS. W. G. Hammack. July 1st.

15,251. ELECTRIC RELAY SYSTEMS AND APPARATUS THEREFOR. A. W. Harris. July 2nd.

15,516. MEANS FOR USING AUXILIARY PETROL ELECTRIC SUPPLY FOR ELECTRIC RAIL CARS, TRACKLESS TROLLEY VEHICLES, AND THE LIKE. W. A. Stevens. July 5th.

15,673. WIRELESS TELEGRAPH TRANSMITTER. J. G. Balsillie. July 7th. (September 23rd, 1912.)

15,721. STAND LAMP REFLECTORS. P. M. Hotchkin. July 8th.

15,748. TELEPHONE SYSTEMS. W. D. Derriman (Russell). July 8th.

15,780. APPARATUS FOR THE TRANSMISSION OF AUDIBLE SIGNALS. R. Klinger. July 8th.

16,027. ALKALINE ELECTRIC ACCUMULATORS. E. Foss, F. Harris, and B. W. Parker. July 11th.

16,157. MEANS FOR INDICATING WHEN LAMPS, SUCH AS THE TAIL LAMPS OF MOTOR-CARS AND LIKE VEHICLES, BECOME EXTINGUISHED. W. H. Taylor. July 14th.

17,174. ELECTRIC FUSES OR CUT-OUTS. C. W. Cox. July 26th.

18,069. LAMPS FOR VEHICLES. T. L. Griffiths. August 8th

18,355. ELECTRODES SUITABLE FOR ELECTRIC ARC LAMPS. British Thomson-Houston Co. (General Electric Co.) August 12th.

22,138. RAILWAY SIGNALS. J. E. Bousefield. (Dutton.) October 1st.

22,390. SYSTEMS AND METHODS OF CONTROL FOR ELECTRIC MOTORS. N. W. Storer. October 4th. (October 5th, 1912.)

24,226. SAFETY DEVICE FOR USE IN CONNECTION WITH ELECTRIC MOTORS. W. Rogers and J. S. Davies. October 25th.

25,497. LAMPS FITTED WITH REFLECTORS. Robert Bosch (firm of). November 7th. (December 31st, 1912.)

26,356. FIRE-PREVENTING AND EXTINGUISHING SYSTEMS. T. P. Shaw. November 17th.

1914.

226. ELECTRIC FURNACES. I. Rennerfelt. January 5th. (January 4th, 1913.)

314. LAMPS FOR PROJECTION. R. I. Atherton and D. B. Jones. January 5th.

540. ELECTRIC INCANDESCENT LAMPS. Westinghouse Metallfaden Gluhlampenfabrik Ges. January 8th. (January 13th, 1913.)

3,197. METHOD OF AND MEANS FOR EQUALISING THE POTENTIALS OF GROUNDING POINTS. A. B. Clark. February 6th. (October 29th, 1913.)

4,436. APPARATUS FOR UNDERGROUND ELECTRICAL SIGNALLING IN COLLIERIES. E. Edwards. February 20th.

4,979. WINDINGS OF DYNAMO-ELECTRIC MACHINES. F. Ljungstrom. February 26th. (April 8th, 1913.)

5,246. TELEPHONE SYSTEMS. T. Shaw. February 28th. (February 28th, 1913.)

5,506. CASING FOR PORTABLE ELECTRIC BATTERY LAMPS. B. Pordes. March 4th.

6,050. INCANDESCENT ELECTRIC LAMPS. R. W. Birkett and J. H. Weiss. March 10th.

7,465. ELECTRIC IGNITION SYSTEMS FOR INTERNAL-COMBUSTION ENGINES. C. F. Kettering and W. A. Chryst. March 31st. (November 20th, 1912. Divided application on 7,545/13. March 31st.)

9,051. LAMPS FOR MOTOR VEHICLES. B. R. Banks and Brown Bros., Ltd. April 9th.

10,493. INDUCTION REGULATORS. Siemens-Schuckertwerke Ges. April 28th. (April 29th, 1913.)

10,945. BRUSH-HOLDERS FOR MULTIPOLAR ELECTRIC MOTORS. Robert Bosch (firm of). May 4th. (March 5th, 1914.)

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THE

ELECTRICAL REVIEW.

VOL. LXXV. AUGUST 7, 1914. No. 1,915.

ELECTRICAL REVIEW.

Vol. LXXV.] CONTENTS: August 7, 1914. [No. 1,915.

	Page
Our Duty	201
Lead	202
Engineers and the War	202
A Curious Workman's Compensation Case	202
The City and the Crisis	203
Overhead Wires and the Law	204
A Differential Relay for Heavy Work, by H. E. Day (*illus.*)	206
The Present State of Electrical Industries in Japan, by Prof. S. Kimura	207
Correspondence—	
Electrical Apparatus for Shearing Wool	208
Cab Tire Sheathed Cable	208
Colonial Appointments	209
Electrical Treatment of Milk	209
Electrical Engineers and the War	209
New Three-Phase Repulsion Motor (*illus.*)	209
The Development of the Mercury Rectifier for Large Outputs (*illus.*)	210
New Electrical Devices, Fittings and Plant (*illus.*)	211
Legal	213
Our Legal Query Column	213
Parliamentary	214
Business Notes	214
Induction Regulators as Phase Displacers (*illus.*)	220
The Premium Wages System	221
Notes	222
City Notes	225
Stocks and Shares	226
Electric Tramway and Railway Traffic Receipts	224
Share List of Electrical Companies	227
Metal Market—Fluctuations in July	229
Reviews	229
Establishment Charges, by T. B. L. Newstead	230
Electro-Depositing Nickel: Its Applicability to the Printing Trade, by G. B. Barham	231
Unemployment Insurance Amendments, by J. J. H. Stansfield	232
Water-Power in Finland	233
Compressed Air	234
Foreign and Colonial Tariffs on Electrical Goods	235
New Patents Applied For, 1914	236
Abstracts of Published Specifications	236
Contractors' Column ... Advertisement page	xxii

THE ELECTRICAL REVIEW.

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1914 EDITION

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

OUR DUTY.

THE peace of more than half a century has been broken, and we find ourselves at war with a hitherto friendly nation to which we are bound not only by the ties of kinship, but also by the bonds of an immense volume of reciprocal trade, and by the pursuit of common aims and aspirations. The Continent of Europe has been shaken to its foundations, and war, unprecedented in extent, and, we fear, in horror, rages between five great nations. It is useless to repine; every possible effort was exerted by our statesmen to prevent the disaster which has overtaken the European peoples, but in vain, and for weeks, or it may be months, the gigantic struggle between the mightiest armies that the world has ever seen will continue, drenching the soil with blood. The strain is too terrific to be endured for long, though he would be a bold prophet who would undertake to forecast its duration; neither is it possible to predict the consequences of so vast an upheaval—but that they will be fundamental and world-wide cannot be doubted. The effects of the struggle will be felt for generations, and the whole course of civilisation—if a state of things which permits of wholesale carnage can be called such—will be changed.

In the midst of these unparalleled conditions there is but one honourable course of action open to every Briton, and that is to obey the call of duty—whether it lead him to the field of battle or to the less glorious but no less worthy occupation of the humble greaser. The nation is dependent upon trade and industry, not only for its prosperity, but also for its very livelihood, and those of us who are not needed for the defence of the nation's interests must put forth every effort to maintain the greatest possible volume of trade and thus secure continued employment for the bread-winners of our country. Fortunately there is no lack of food-stuffs within our borders, and no reason to anticipate the interruption of our supplies of food and of the raw materials of industry. The markets of the Continent are closed to us; the rest of the world is open, and the demand for goods hitherto obtained from the Continent will be diverted largely to our shores. Hence there should be no lack of work to do, and it is the plain duty of non-combatants to "carry on" with redoubled energy and application. Thus, while we shall not avoid we shall minimise the evils of the world-war and the sufferings of our industrial population. We have no wish to make capital out of the misfortunes of our neighbours; we seek only to lighten the burden of trouble and sorrow that is about to be laid upon our own people.

The Government have declared their intention of adopting every possible means to ensure the continuance of trade and industry, and though for a time abnormal conditions will obtain, due to the calling-out of the Reserves, the embodiment of the Territorial Force, and the use of the railways for military purposes, we believe the dislocation of internal affairs will be but temporary. In this respect we are vastly more favourably situated than the Continental nations, whose workmen have been called out practically *en masse*; but whether that is a matter for congratulation is somewhat questionable—had we possessed an army of a million men, the war might have been prevented. Our thanks are due to the members of the Territorial Force, who have voluntarily prepared themselves for the defence of our shores.

We cannot close this article without a reference also to our fellow-craftsmen—the Electrical Engineers—who have

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devoted their leisure to military training, and are now called upon to bear their share, working searchlights for coast defence, laying field telegraphs and telephones, and helping in numerous other ways, as they did so well in the South African war. All honour to them for their patriotic self-denial. Nor should we fail to express our thankfulness that by the aid of wireless telegraphy, for which we are so largely indebted to Mr. Marconi, it is now possible for our Admiralty to maintain continuous communication with the fleets no matter where they may be engaged. But for the regrettable incidents which occurred two years ago, the Imperial wireless chain might have been far advanced towards completion; the emergency so contemptuously scouted by politicians has already arisen. Fortunately it is not likely, so far as can be seen at present, that our cable communications will be interrupted, or that we shall feel the want of the wireless service to India, South Africa and Australia—but we may do so before the curtain is rung down upon this most lamentable scene in the world's history.

Lead.

All through the financial panic which entailed the closing of the London Metal Exchange and most other trading institutions throughout Europe and in parts of North America, lead held firmly on its course with hardly a flicker. Since our last writing on the metal, there has been some abatement on the whole of the extreme tension of supplies, and prices have fallen below the parity of America, hence no further business worth considering has been done in Europe in United States lead. Nevertheless, however, there is still American metal ready to be sold if circumstances allow, and if prices recover somewhat. America is not a willing seller of lead at anything below £19 5s. London terms, and this price has to be obtained for pretty early shipment if sales are to be made.

The trade buying was on quite a fair scale until all business was stopped by the war panic abroad, and by the financial crisis. It is possible that the war conditions on the Continent may mean that quantities of lead which have been going direct to Germany and Russia will in future be diverted to British ports, in which event an entirely changed set of conditions will be set up from those ruling recently, but the drift in such a contingency would be to ease down the position from the point of view of consumers, whose efforts to keep themselves fully covered, when they have left over the replenishment of their needs till the last moment, have on many recent occasions had the result of driving up prices sharply. There can hardly be any violent export demand for immediate shipment of lead, now that war conditions are in full force on the Continent, so that the home trade will find the field pretty much to themselves so far as can be gathered at the moment. There has been a certain amount of American lead coming in against old contracts, and a little more is due to arrive, but otherwise there is no feature calling for special attention.

The resumption of smelters in Mexico is a most important factor bearing upon the United States situation, for even without Mexican raw material available, the United States has been actually selling domestic lead to the export markets; hence the resumption of shipments of Mexican silver lead to United States refineries must increase the amount of soft lead which these will have available for disposal either at home or abroad. Meantime, for the present all market conditions are subservient to war influences, and the future is past all human knowledge.

Owing to war conditions, the metal markets have now been closed for several days, and a very limited business is being done. As we go to press we learn that the Government has practically secured the option on all the lead now available in this country, and leading dealers intimate that they are not prepared at the moment to make sales to private consumers. In view of all the circumstances, it will be understood that the market is now exceedingly firm, and probably round about £20 a ton is a nominal quotation for prompt deliveries. We may add that considerable purchases of antimonial lead have been made by the authorities within the last few days.

Engineers and the War.

A letter appears in our "Correspondence" columns to-day suggesting that British electrical engineers should form a committee to collect the names of those who are willing to serve their country in the present crisis. A still better suggestion has since come to hand, from a member of the Institution of Electrical Engineers who desires to remain anonymous, in the form of a letter addressed to the Secretary of the I.E.E., as follows:—

Having regard to the extent and importance of Military and Naval services involving electrical and mechanical engineering, and to the present state of public affairs, I suggest that the I.E.E. should open a register of members able and willing to take temporary Government service; and put that register at the disposal of the Government. I enclose a suggested draft of the statement of particulars which should be on the register.

Temporary Government service; mechanical and electrical engineers. Offer, with personal and professional particulars:—

I, ..., am able and willing to entertain proposals for temporary service under H.M.'s Government, in services involving engineering duties.

Signed .....

Name in full; postal address; age; notice required; single or married; No. of dependent children; health; physical defects; occupation; employer; professional status; practical experience; military, naval, or marine experience and status; experience in control of men; languages; service offered for; specially qualified for.

We cordially commend this proposal to the notice of our readers, many of whom, we feel certain, will be anxious to place their skill and experience at the disposal of the Government in this hour of supreme trial of the nation's strength. It will not be forgotten, of course, that the London Electrical Engineers Territorial Force provides the necessary organisation so far as London is concerned.

A Curious Workman's Compensation Case.

Those who are wont to follow the reports of workmen's compensation cases are accustomed to anomalous and extraordinary decisions. In one County Court the Judge will appear to strain every nerve to find in favour of the working man; in another attention is sometimes paid to the pleas put forward on behalf of the employer. Further, inasmuch as the opinion of a County Court Judge is final on a question of fact, a search through the records of the Courts discloses numerous decisions which appear to be diametrically opposed! Of all the orders which are made adversely to the interests of employers, perhaps the most irritating are those which go by the name of "suspensory awards." The liability to pay is kept open by means of a nominal or practically nominal payment, which can be increased at any time on application to the Court should it be shown that the injured man has become less capable of working. To have a large number of suspensory awards in his pigeonhole is a very nice little asset to the solicitor who does a workmen's compensation practice. Every now and then he can set a few little applications on foot, and run up some nice little bills of costs. An extraordinary attempt to obtain a suspensory award has recently been brought to our knowledge. A wireman who was temporarily employed by the London Electric Railway knocked the skin off his knuckles. He took no notice of the injury, except that he reported it. Three days later he was discharged, and he subsequently suffered from blood poisoning, for which he claimed compensation. The employers consented to pay the full amount, namely, half wages, which came to 20s. a week. Notwithstanding that they were doing all that they were compelled to do by law, a claim for compensation was made against them in the County Court. The Judge actually made an award, but we are glad to find that the Court of Appeal overruled him. As the Master of the Rolls pointed out, no question had ever arisen under the Act, nor could it arise, so long as the employers continued to do all that was required of them.

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The City and the Crisis.

The City of London faced the war situation calmly and collectedly. There was no trace of panic when a dozen firms were hammered in the Stock Exchange last week. There was no violent excitement in the money market when the Bank of England raised its minimum rate of discount from 4 per cent. to 8 per cent. last Friday, following this with an increase to 10 per cent. on Saturday. Rhapsodies of the half-penny-a-line order can be left safely to quarters which rarely betray their trust; it is sufficient for the plain man of affairs to state, and to read, that the attitude of the City throughout the present crisis has been one of calmness and self-possession.

Stock Exchange markets had been severely mauled for weeks prior to the outbreak of hostilities. The Ulster crisis in itself had been a standing menace for months past, and the volume of speculation had shrunk sensibly from what it is in normal times. The Austro-Servian quarrel provoked uneasiness, but little worse; and it was not until Austria practically declared war upon Servia last Saturday week that Stock Exchange and money markets grew perturbed.

Not even then was it supposed that the difficulties would lead to actual fighting. The Bank of England put up its discount rate from 3 per cent. to 4 per cent. upon the increasing rumbles of the war spirit in Germany and Russia. Before the Stock Exchange settlement took place, business in securities had marched to an abrupt standstill. In Consols it was still possible to deal; in a few Home Railway securities there remained a mockery of a market; in Brazilian Tractions some people dealt at margins of 5 points between the buying and selling quotations.

Seven failures occurred on pay-day. The Paris Bourse postponed its monthly settlement for another month. Some London firms who had heavy engagements to meet on behalf of German and French clients made no secret of the certainty that they would have to hammer themselves. The Stock Exchange Committee, however, saved the immediate situation by closing the House last Friday, and closing it until further notice. With the Bank Holiday extended until Friday in this week, a week's breathing space has been given; and the London Stock Exchange followed the French example by postponing until the end of the month the settlement which in the ordinary way would have taken place next week. Meanwhile, the Bank of England on Saturday, while the Stock Exchange was closed, raised its rate to 10 per cent., a rise of seven points within as many days; and the Bank Act has been suspended, which permits the issue of notes to a greater extent than is allowed in the ordinary way.

The Bank Rate, of course, is the charge made by the Bank for discounting bills of the highest grade. In other words, if a firm of unimpeachable standing had given another firm, of the same character, a bill for certain goods, the latter house could take it to the Bank of England and get the money straight away instead of waiting until the time when the bill became payable, the Bank of England charging discount at the Bank Rate of the day. The effect of this is to retain money in the country, although to show how this comes about might prove a tedious process for the reader. How extraordinary are the ideas prevalent with regard to what the Bank Rate really is, most people know. A dear old lady explained to us the other day that the effect of a 10 per cent. Bank Rate meant the deduction of half-a-sovereign from every five-pound-note when the note came to be cashed at the bank.

The effect of monetary stringency such as is reflected in a high Bank Rate is far-reaching and important. The delicate intricacies of credit, built up laboriously through so many years, become mere *culs-de-sac* when the imperative call is for gold. The commercial undertaking keeps a substantial cash balance at the bankers, but a much bigger reserve in securities available in the ordinary way for purposes of temporary loans; and if the structure of security be shaken, the base of gold upon which it is reared cannot be chopped up in sufficiently small pieces to go round.

The great money mart, after all, is the Stock Exchange; and the confidence of credit rests largely upon the fact that the proprietor of securities knows that he can sell these, and get the money within a fortnight, through the ordinary medium of Throgmorton Street. Close these avenues, and the community, in general is up against a proposition unique in the memory of the present generation. To deal through other directions is a different matter from buying and selling beneath the protection of Stock Exchange rules and regulations. The sooner the Stock Exchange is open again, therefore, if only for cash transactions, the better might it be for everyone.

We venture to take the view—and this not merely as a personal one, but as reflecting into one focus the opinions literally of many dozens of City men experienced in the money and the stock markets—that although there may be a run on the banks, and although people will feel secure only when they have lined their safes with sovereigns, the situation will gradually clear itself, and currency conditions drop into the normal, perhaps within the course of a day or two. The worst, practically, is known; and it is not the worst, but suspense, which kills.

The calm and steady way in which London—speaking principally for the City and its financial organisations—has withstood the shock of the crisis is rational ground for assuming that no new alarm is likely further to unsettle it. The people who are laying in supplies of flour, of sugar, of condensed milk and so on, are in a large minority. Prices will rise, have already done so, in fact; but they are not likely to advance exorbitantly. Out of the evil, good will come. Canada and the United States, for example, may find their financial salvation by reason of the present grave condition of affairs. Afterwards there will arise such activity in trade, in metals, in stocks and shares, as few can remember. These, however, are for the future. The immediate outlook is too serious to be illumined by more than hope, but that hope is fortified and cheered by the steadfast way in which the financial institutions of the City of London, and the people whom they affect, have met a situation that might have precipitated a panic which nobody could have called surprising.

Electrical Trades Union Conference.—On Monday a special Conference of the Electrical Trades Union, which was expected to last the whole of the week, was opened at the Holyoake House, Manchester, for the purpose of revising rules. Mr. J. W. Ball, of Stockport, presided, and 80 delegates, representing 96 branches, were present. The chairman said that since the last Conference, three years ago, the membership had increased by 6,253, and was now 8,364. Appealing for solidity in the trade, Mr. Ball said they did not desire to have control of the electrical industry, but the sequence of events forced matters upon them, and they would have to control it, or someone else would. Before they could stop the influx of unskilled labour into the trade they would have to control that labour itself, and the only way to do it was to open the gates for them to enter and organise themselves after the ideas of the Union; otherwise they would either organise outside or continue to be picked up by other societies. That could be done without injustice to anyone or jeopardising their own interests, and they would protect their apprentice members at the same time. The Union embraced shipping, engineering, building, tramways, mines and maintenance work. Their aim ought to be to get absolute control of the industry and of every man engaged in it, so that no worker could be exploited to the detriment of others. Having completed their organisation, they must seek continuity of membership, and so settle for all time any disruption between branches.

An Electrical Engineer's Fee.—At the Liverpool City Council on July 29th, on the proceedings of the Tramways and Electric Power and Lighting Committee, Mr. Gates raised a question on the standing orders with regard to a payment by the Salford Corporation of 150 guineas to the electrical engineer for services rendered. He was against allowing their engineer to compete with private enterprise, and moved that the matter be referred back. Dr. Utting pointed out that it was a practice of municipalities to indulge in matters of that kind and allow their principal expert officers to advise for corporations. The standing orders expressly provided for an officer taking work of that kind, and the question of fees had never been one for the Council to deal with. Ald. Fred. Smith said the action of the Committee would be quite regular and proper. The amendment was defeated by a large majority.

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OVERHEAD WIRES AND THE LAW.

[FROM A LEGAL CONTRIBUTOR.]

Among the legal queries addressed to the Editors of the Review, problems relating to the use of overhead wires are frequently to be found. The use of wires so placed is an obvious and inexpensive method of transmitting power from place to place. What, then, are the legal restrictions affecting this means of transmission?

The "common law" upon the subject may be stated to be that anyone who stretches a wire across the land of another without leave or licence is guilty of a technical trespass. Again, if wires are stretched along or across a street or highway, the person who puts them in that position does so at his peril, inasmuch as the public who are using the street are entitled to be protected against falling wires. But there may be circumstances in which a man owning land on either side of a highway has the right to stretch wires across it. In such a case he owns the surface of the "hard high road," and so long as the right of the public to pass and repass along it is not interfered with, he cannot (at common law) be prevented even by the highway authority from stretching his wires, whether they be for the purposes of telephone, telegraph or the transmission of energy.

By a process of evolution the Legislature has gradually placed restrictions upon the use of overhead wires. Prior to the Electric Lighting Acts the matter never assumed any importance, except in relation to telephone and telegraph wires with which we are not greatly concerned. The first Electric Lighting Act (1882), however, imposed restrictions upon the use of aerial cables. By S. 14 of that Act: "Notwithstanding anything in this Act or in any Act incorporated therewith, the undertakers shall not be authorised to place any electric line above ground, along, over, or across any street, without the express consent of the local authority, and the local authority may require the undertakers to forthwith remove any electric line placed by them contrary to the provisions of this section, or may themselves remove the same, and recover the expenses of such removal from the undertakers in a summary manner; and where any electric line has been placed above ground by the undertakers in any position a court of summary jurisdiction, upon complaint made, if they are of opinion that such electric line is or is likely to become dangerous to the public safety, may, notwithstanding any such consent as aforesaid, make an order directing and authorising the removal of such electric line by such person and upon such terms as they may think fit."

This section, however, was apparently found not to impose restrictions on the use of overhead wires. Accordingly it was further provided by S. 10 (*b*) of the Schedule to the Electric Lighting (Clauses) Act, 1899, that "The undertakers shall not, without the express consent of the Board of Trade, and, where the local authority are not themselves the undertakers of the local authority also, place any electric line above ground except within premises in the sole occupation or control of the undertakers, and except so much of any service line as is necessarily so placed for the purpose of supply."

In County of London Orders, and under the London Electric Supply Act, 1908, S. 15 (2), the consent of the County Council and of the Board of Trade is required, while in some of the Power Acts it is provided that in the case of rural authorities their consent shall not be unreasonably withheld, the Board of Trade being authorised to decide any difference (see *e.g.*, The Somerset and District Electric Power Act, 1903, S. 48).

Even where the necessary consents are obtained, the works are subject to the regulations prescribed by the Board of Trade in reference to aerial lines. Further, the undertakers cannot carry such lines over land not dedicated to the public use without the consent of the owner of such land. In doing so they would be guilty of a trespass. Thus in the case of *Levy v. National Telephone Company, Limited*, the plaintiff brought an action for damages for trespass by stretching wires over his house, and also for an injunction for the removal of the wires. The defendant company, in resisting an application for interim injunction, urged that some of the wires had been over the house in question for thirteen years and that the plaintiff had only been in occupation of it for a short time; and that there was no danger to the plaintiff's house in allowing the wires to remain until the trial. Day, J., granted an interim injunction directing the defendants within two months to remove their wires. On appeal this decision was affirmed by the Court of Appeal. (See *Times*, December 18th, 1897).

Nor does the consent or approval above mentioned excuse the undertakers from the consequences of neglect or falling wires. For instance, in *Watson v. Sunderland Corporation* (cited in Shiress Will's Law Relating to Electric Lighting, p. 100), in an action for damages for an injury suffered by the plaintiff through the fall of a "live" overhead wire, the plaintiff proved the fall of the wire and the injury. The defendants submitted that there was no evidence of negligence, the system having been inspected by the Board of Trade, and weekly by the defendant's employees. The County Court Judge left the case to the jury, who found negligence. On appeal, the Divisional Court, held that the judge was right in allowing the case to go to the jury.

The law, however, cannot be regarded as fully stated unless one deals with the rights of persons supplying electricity otherwise than in accordance with the provisions of a special act. In this respect the person who supplies electricity privately was formerly in a better position that a supply authority. It was held in *Finchley Electric Lighting Co. v. Finchley Urban District Council* (1903), I. Ch. 437, that where a company was supplying electricity privately they could not be prevented by a highway authority from suspending wires over a highway, having previously entered into an agreement with the frontagers on either side of the road in order to be allowed to fix the posts necessary for the suspension of the wires. The right there asserted is not, however, very likely to be of much more than academic interest in the future, having regard to the fact that the supply of electricity otherwise than by a supply authority is now virtually taken away. Thus by S.23 of the Electric Lighting Act, 1909, "Where in any area a local authority, company or person is authorised to supply electricity under Act of Parliament or under licence or Provisional Order granted under the Electric Lighting Acts, it shall not, after the passing of this Act, be lawful for any other local authority, company or person to commence to supply or distribute electricity within the same area unless such supply or distribution is authorised by Act of Parliament, or by licence or Provisional Order granted in terms of the Electric Lighting Acts: Provided that this section shall not prevent any company or person from affording a supply of electrical energy to any other company or person where the business of the company or person affording the supply is not primarily that of the supply of electrical energy to consumers.

"Provided also that this section shall not prevent any company, who, at the passing of this Act, are empowered by their memorandum of association to generate electrical energy from affording a supply to a railway company for purposes incidental to that company's undertaking other than the conveyance of public traffic."

The suspension of overhead wires in any position —even on private land, is subject to certain other

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statutory regulations which are of considerable importance.

They must by virtue of the Electric Lighting Act, 1888, S.4 (I.), only be so placed in accordance with the regulations of the Board of Trade. Again, in London, their use is subject to the provisions of the London Overhead Wires Act, 1891. With regard to Urban Districts the Public Health Acts Amendment Act, 1890, contains powers to urban authorities to make by-laws for the prevention of danger or obstruction to the public from posts, wires, tubes, or any other apparatus stretched or placed above, over, along, or across any street, whether before or after the adoption of the Act for the purpose of any telegraph, telephone, lighting, railway signalling or other purpose.

These by-laws are not to take effect unless confirmed by the Board of Trade. It is necessary to observe that the Act of 1890 is an adoptive Act and is of no force until adopted. Moreover, the Act does not extend to any works of any undertaker within the meaning of the Electric Lighting Acts, 1882, to 1888, to which the provisions of those Acts apply.

It will be seen from what has been said above that to suspend wires in any position is a matter which is attended with some danger of legal consequences of an unpleasant character.

Wholly apart from the prospect of being interfered with by the authorities there is always the danger of proceedings for damage caused by falling wires. Our knowledge of the liability of those whose wires fall about and injure people must, of necessity, be largely derived from a study of the law relating to tramway companies, and it may be convenient to review some of the cases in which the liability of these bodies has been considered.

In the first place, it may be stated that by the Tramways Act, 1870, Sec. 55, which applies to every tramway company, it is provided that the promoters or lessees of a tramway (as the case may be) shall be answerable for all accidents, damages, or injuries happening through their act or default or through the act or default of any person in their employment by reason or in consequence of any of their works or carriages, and shall save harmless all road and other authorities, companies or bodies collectively and individually, and their officers and servants from all damages and costs in respect of such accidents, damages and injuries.

The above provision prevents a tramway company, when sued by a person who has been injured by a falling trolley wire, from raising the defence that they are protected from actions for negligence owing to the fact that they work under statutory powers. This was made clear in a number of accident cases. For instance, in *Sadler v. South Staffordshire, &c., Steam Tramways Co.*, 1889 (23 Q.B.D. 17), it appeared that an accident was caused by the company's car which ran off the line at a point where that line joined that of another system, over which the company had running powers. It ran off the line owing to a defect in the points at the junction, but it was not clear whose duty it was to repair the points. It was held that in any event the owners of the car were liable, because their statutory powers did not extend to authorise their running along the highway on a track which was in a defective condition. Again, in an Irish case, a tramway company were held liable for injuries caused by the worn and slippery condition of their track.

Where trolley wires are insulated, and there are no guard wires above them, a broken telephone wire sometimes makes contact with the trolley wire. The result is that serious injury is caused by electric shock. In these circumstances it appears upon the authority of a County Court Judge, that responsibility does not rest with the tramway company. In *Bedworth & Son v. The National Telephone Co.*, an action was brought against the company for the price of a horse killed by an electric shock. It appeared that a broken telephone wire which fell on the horse, had short circuited a trolley wire belonging to the South Staffordshire Tramway Company who were joined as defendants. The judge held that the telephone company were liable, as they had been guilty of a trespass in allowing their wire to touch that of the tramway company, and he made them responsible in damages.

Owing to a number of accidents which took place at Liverpool from the entanglement of broken telephone wires with trolley wires, the late National Telephone Co. brought forward a clause excluding them from liability in such cases unless it was proved that the escape of electricity was due to the fault of the telephone company. A clause of this kind appeared in the Tyneside Bill of 1901 and a number of others. (See Elec. Rev., August 23rd, 1901, p. 330).

In America it was held that where one defendant's wire carrying a dangerous current crossed that of the other defendant's carrying a harmless current, and there were no guards between them, then both defendants might be found guilty of negligence, where an accident occured owing to a contact of the wires (*Rowe v. N.Y. and N. J. Telergaph Co.* (1901), N.J. 48, At.I.Rep. 523): but it was otherwise where the contact was caused by the fault of the owners of the dangerous wire, owing to the slipping of the trolley pole of one of their cars, or where it was due to the fault of the owners of the harmless wire in suffering it to get out of repair (*Western Union Telegraph Co. v. Thorn*, 1894, 64 Fed. Rep. 287).

The question whether the person who sustains injury can be guilty of contributory negligence which will relieve the tramway company does not appear to have been decided in the English Courts. It is submitted that if a passenger on the roof of a double-decker were to deliberately grasp a naked trolley wire, or otherwise expose himself to danger in contravention of the notices and bye-laws of the company he could be found guilty of such contributory negligence, then the tramway company could be relieved. At any rate, the decisions of the American Courts could be cited in support of such an argument. In *Freeman v. Brooklyn Heights Railroad Co.*, 1900 (66 N.Y.S.I., 052), a company was held not to be liable when its guard wire had become charged and injured a boy who was walking on the girder of a bridge where he had no business to be, although it was the custom of boys so to walk. There is no contributory negligence, however, if the injured person is under duty to be where he is at the time of the accident, or where a wire is dangerously near a public passage, although the injury is caused by an unusual act on the part of the passer by.

It may be said, and with reason, that many of the cases above referred to do not particularly concern electric lighting authorities, inasmuch as the cables which they would suspend are higher up, subjected to no wear and tear, and are heavily insulated. The underlying principle, however, that the person suspending cables is liable for negligence applies with equal force to cables of this character.

Canada.—The Montreal City Board of Control and the Montreal Light, Heat and Power Co. have reached a deadlock on the question of street lighting. The company has quoted £32 10s. per lamp per annum for the centre of the city, where underground cables are to be used, while Mr. Parent, the Board's lighting superintendent, estimates that, by a municipal scheme, the price could be reduced to £22 10s. per annum. Mr. Parent has now submitted a report to the Board, in which he estimates the capital expenditure of such a scheme at £34,500, and the total annual expenditure at £10,820. Officials of the Board and the company are to meet shortly, and the matter will then be decided. *Financial News.*

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A DIFFERENTIAL RELAY FOR HEAVY WORK.*

By HARRY E. DEY.

Some time ago the writer had occasion to use a differential relay that involved unusual requirements inasmuch as it had to be very sensitive, operating upon a small fraction of 1 per cent. of change in current, and was used for closing and opening a pilot motor circuit (0.0825 H.P.) every few seconds, the motor running in two directions.

A prominent electrical instrument manufacturer had previously reported that he could provide nothing, either special or from stock, to fulfil the conditions, as the design of his instruments necessitated that the spring should be a conductor, while the current requirements involved were too great for this service. Upon further investigation the writer came to the conclusion that it was necessary for him to design some device to be made in the shop. Before entering upon a description of the device built it may be well to give a general idea of the purpose for which it was intended.

A 40-H.P. motor of special design and construction was installed on a United States cruiser for steering purposes. This motor was controlled for speed, direction and stoppage by means of a field rheostat only. Mounted on a standard on the bridge of the ship was a bronze case which contained a small high-resistance rheostat (*a* in Fig. 1), which was operated by

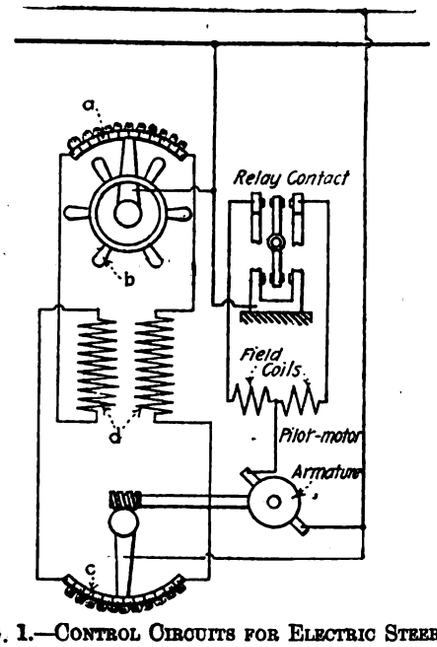

Fig. 1.—Control Circuits for Electric Steering.

means of a hand wheel *b*, the shaft of which was passed through the case. A line wire was connected to the contacting finger, which was normally at the centre of the commutating arc, thus giving equal resistance to each side. Down in the steering room a duplicate of this rheostat *c* was connected with the finger of the steering-motor field rheostat in a manner to cause them to move together. The differential relay was also installed in the steering room. Two wires connected the extremes of the arc of one rheostat to corresponding points of the other rheostat, the coils *d* of the differential relay being inserted in the circuits between the two rheostats in such a manner that the two windings opposed one another.

If the helmsman desired to turn the rudder, say, 5 deg. to starboard, he would turn the hand wheel until the index to which it was geared pointed to 5 deg. starboard. This would upset the equilibrium of the relay circuit, causing its pendulum to swing over to starboard and close the pilot-motor circuit. The latter would immediately operate, moving the arm of the field rheostat to a position that would cause the steering motor to run in the proper direction to carry the rudder to starboard. The pilot motor, besides changing the field rheostat, drove the contacting finger of the relay rheostat to a position which would neutralize the change of resistances in the rheostat on the bridge. This again balanced the two circuits, allowing the relay pendulum to swing to the centre and thus break the pilot-motor circuit. If the pilot motor overran by momentum, the relay would become unbalanced and thus swing over to the other side and reverse the motor. The overrun would be so short, however, that the motor would not have enough momentum on the return to pass over, consequently no brake was required. The net result was, therefore, a slight overrun, a rebound and a dead stop.

When the steering motor operates, in addition to moving the rudder, it drives, through a chain of gearing, the field rheostat body in the base of the machine. This rheostat body is driven in the same direction that the contact finger was moved, so that by the time the rudder has reached the end of its 5-deg. travel the relative positions of the finger and the body are unchanged from what they were before the helmsman acted. An overrun of the steering motor from momentum acts in a similar manner to that with the pilot motor, unbalancing the field rheostat and causing the motor to rebound with an easy elastic movement and to stop at the point required. It was interesting to watch this motor with its slow elastic movements for small changes and quick rotation for the greater rudder movements.

The relay, as illustrated herewith, is made from a brass spool 4 in. long and with heads 4 in. in diameter; the hole is 1.75 in. in diameter. After providing the proper insulation the spool was wound with two parallel insulated wires separated by a coarse thread. The four terminals were brought out to binding posts, which were later connected to the circuit in such a manner that the currents oppose one another. This causes a high difference of potential between the adjacent wires near their terminals, consequently extreme care is required in the winding. Each layer should be especially well insulated from the layer beneath. This parallel winding provides an absolutely accurate balance that can never be secured by winding the two circuits in separate coils. A brass shell slipped over the spool completes the metal housing. A hard-rubber plate is attached to one of the heads, for holding the binding posts, and the whole is fastened to a base plate by lugs as seen in Fig. 2.

Another brass spool was made to provide a snug fit in the first spool when forced in with its axis at right angles to the former. It is held from endwise movement by means of rods suspended from the binding-post plate which is mounted on top of the main spool. This spool is wound with a single insulated wire of a resistance sufficient to take care of the full line voltage, for it is connected directly across the circuit. A wide deep groove is cut across each head of this spool, extending lengthwise of the main spool. A soft-iron core, having considerable clearance within the hole of the spool, is mounted upon pivots at the centre, the clearance permitting a slight rocking motion up and down. This core is shouldered and threaded at the ends. An elliptically shaped ring is sprung over the ends of the core, when assembling, and held in place by thin iron nuts, the latter also serving as pole pieces.

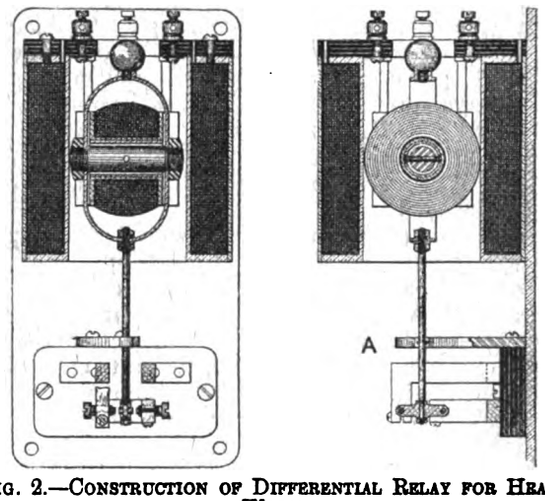

Fig. 2.—Construction of Differential Relay for Heavy Work.

It will be noted that none of the wires has any motion, and also that the iron core is traversed by a constant number of magnetic lines regardless of the balanced or unbalanced condition of the differential coils. In other words, it is equivalent to a permanent bar magnet, the only object of the winding being to obtain additional strength of magnetism. Owing to this fixed magnetism there is no magnetic lag and consequent loss of sensitiveness, as would be the case were the changing magnetism of a piece of iron depended on. With this design the slightest unbalancing of the currents of the outside spool is at once manifested.

A pendulum rod is attached to the lower part of the elliptical ring, while a ball serves as a counterbalance at the top. The lower end of the rod is turned off to form a shoulder and to provide a bearing for a bar about 1 in. long loosely mounted thereon. This bar is provided with platinum contacts, four in number, set upon opposite sides of its two ends. Corresponding contacts are set upon brackets mounted upon the base of the instrument. Two of these latter contacts are electrically identical, being attached to a bracket common to both. The double-contact bracket is connected directly to the line, while the single contacts are led to the pilot motor. The contact bar acts as a bridge between the double-contact bracket and one or the other single contacts, thus obviating any flexible connections between moving parts and also providing a double series break when opening the circuit. This greatly reduces the arc and also acts as a safeguard against sticking, for if one side did stick there would still be enough hinge action to allow the other side to open the circuit.

One problem that caused considerable difficulty was that of obtaining a spring to bring the pendulum to its neutral or

* From the *Electrical World*.

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centre position and which would at the same time be practically frictionless. Another desirable feature in the spring was to have it decrease its pulling power as it left the neutral point so that by the time the contacts were reached there would be very little pull remaining, and thus the electrical contacts would be proportionately improved. These requirements are directly opposed to the principle of action of any mechanical spring, but the happy thought finally struck the writer of using a permanent steel magnet for a spring. The magnet included both the important elements of being frictionless and having the pull decrease with the distance moved, besides being easy to adjust by filing off the small wire used as an armature. The device as finally built consisted of a specially designed magnet, cut out of sheet tool-steel and hardened, of the form shown at A in Fig. 2. It will be noted that the pole pieces are sharply pointed, like the teeth of a saw, and are separated by about 0.25 in. The magnet is fastened to the insulating block in a position that will permit the pendulum to swing between the pole pieces without touching them. The pendulum at this point is drilled to receive a small iron wire, which passes through and is pointed at both ends. It is made short enough to afford a liberal clearance when passing between the poles. In operation the poles draw the iron wire, and hence the pendulum, to the exact centre and hold it there with all the force desired. This magnetic spring completely solved the problem, and it appears that there may be other cases where it might be used to advantage.

Before the sea trials the writer feared that the pendulum might vibrate, owing to the rolling and pitching of the ship and the vibration of the machinery, and thus keep up a continuous "seesawing" of the steering, for the magnetic spring had to be made quite weak in order to preserve the sensitiveness of the relay. But, as usually happens, the expected difficulty did not come to pass, and in the worst of seas the pendulum never wavered.

Another problem that came up in this steering device was that of reversing the pilot motor without the complication of a pole-changing switch on the relay. This was accomplished by providing the field with two sets of windings. Two terminals, one from each winding and of opposite signs, were joined together to one of the commutator brushes (see Fig. 1). Of the other two terminals, one was connected to one of the relay contact points and the other to the remaining contact. The other commutator brush was connected to the line. The resultant operation was that when the relay closed one circuit it sent the current through one set of field coils and thence through the armature in series. When the circuit was closed through the other contact the current passed through the other field coil in the reverse direction, which reversed the field, and thence through the armature in the same direction as formerly. This gives a reversing motor with only a single contact required for each direction. There are many cases where a control of this kind can be made to fit in to advantage.

The motor used was of standard manufacture and of the fan-motor type, but its builders refused to take any responsibility if they provided it with two fields. The writer lost patience with their ultra-conservatism, had the old field coils removed and replaced them with new ones of enameled wire. The saving in space due to using this enamel conductor in place of the former cotton-covered wire permitted almost as many ampereturns for each coil as there were in the original windings. The motor never gave the slightest trouble. Without any external resistance it was thrown on, back and forth, every few seconds, for periods sometimes extending over several days.

THE PRESENT STATE OF ELECTRICAL INDUSTRIES IN JAPAN.*

By Professor Shunkichi Kimura, Ph.D.
Consulting and Commercial Engineer for Electrical Industries and Applications, Tokio, Japan.

Home industry in Japan is progressing, but much more slowly than in Europe or America, and in the case of electrical industries Japan is from ten to fifteen years behind other countries in the West.

In the domain of electrical industries, water-power plants throughout the country are numerous and widely distributed. According to the most reliable report, those water-power plants alone which can be most easily and economically turned to electric power amount in the aggregate to about ten million horse-power; of this only three hundred thousand have already been utilised for the public, while one-half of it is in actual operation, and that mostly for lighting and power in cities and towns. Ordinary types of motors, generators and transformers are now made here of creditable quality, but iron and steel of special descriptions are imported every year to a great amount. Patent rights and manufacturing processes may be acquired from abroad, but without the help of trained foreign engineers, at least during the trial stage, it will be difficult to turn out articles of high-class quality.

Apparently there is a great boom in electrical industries in Japan, yet if we deduct the imported articles only a little will remain as the genuine product of home industry. One hears from contractors that all kinds of machines, both mechanical and electrical, are still imported through their hands, without any change, for places where reliable machines are in demand. These contractors are generally large firms, having long experience and trained hands. The so-called importers, whose business is conducted by foreigners with low-grade native employés, and without respectable Japanese associates, seem to have felt the effects of the change.

Of the present system of industry, as regards either sale or management on a scale fit for cheap production and a wide market, Japanese men of business have as yet had only short experience. Those industries which are now flourishing do not belong to the class of pioneer industries, and the channels of business have been prepared by the so-called importers. It will be clear that the co-operation of foreigners trained in international business is desirable, while for the manufacture of articles, complicated as regards process, delicate in fixing, or precise in measurement, the co-operation of trained foreign hands will be imperative. But on the side of management dealing with customers, understanding public taste, and the proper ways of speaking and writing, or in selecting the right person to communicate with—in short, in all that cannot be reached by reasoning and calculations alone—the co-operation of Japanese managers will be desirable. Further, the protective policy of the government and its general encouragement of home industries will be met by joint capitalisation. The days of monopolising interests are now gone for ever, and the day has come for mutual interest with joint responsibility, the rights of both parties being justly considered and clearly defined.

To me it seems that foreign firms and inventors are too neglectful of securing their patent rights in Japan. All the details of their inventions, so far as they are expounded in the technical papers in their own lands, are of course open to public scrutiny here and the so-called inventors here may resort to these papers and utilise them for their own benefit. In granting patent rights in this country, officials do not search through foreign patent records; it is advisable, therefore, that the real inventors or the lawful possessors of patent rights should pay more attention to this matter. The best thing to be done would be to secure their patent rights here, and to look at once for their exploitation, either in the form of co-operative working, or of selling the rights, or else on the basis of royalties. The market here is, of course, too small for large industries; and the most profitable inventions will be those dealing with the commonest kinds of articles, widely used in industry or by the public, or else such as will replace others which have already created a good market in this country.

In the exploitation of inventions and manufacturing processes there is one thing which might with benefit be resorted to. This is the publication in industrial or trade journals, in the Japanese language, of the general nature of the invention, of the manufacturing facilities, of the properties of the articles made, of places in which they may be most profitably employed, and so forth, accompanied with cuts or illustrations, and, when necessary, with the result of scientific testings, and with anything which will instruct people and induce them to make further inquiry. A few lines of advertisement in daily papers offering for sale the patent rights are of course useless, since their nature can only be understood by a few specialists, but not by the men who might take real interest in the transaction.

The following brief survey of the present state of electrical industries in Japan may be of some interest. The data have been collected within the last six months in the factories throughout the country and under my own personal observation.

Motors, generators, and transformers are made here in large quantities, to meet a very great demand which increases every year. As to the size, generators have been made up to 6,000-k.w. giving very good results under test. There are two large factories with long experience, one in some connection with the General Electric Company of the United States of America, the other as a part of a dockyard. Besides there is a large factory adjoining and in possession of a copper-mine, which promises to have a splendid future. Smaller factories which turn out smaller articles are many in number, and compete keenly with each other. All special iron and steel parts are imported, and these factories have always to keep them in stock, thereby causing unnecessary loss and inconvenience. Special types of machines, and those directly coupled with water and steam turbines, have been supplied by the importers and contractors; but even these are now being made in Japan to a small extent.

Carbon filament lamps are made here in a satisfactory way, though some difficulty is experienced in making them for 220 volts, and the filaments of superior qualities are all imported. Tungsten lamps of ordinary size are also made here in many places, both drawn and squirted wires being imported. Large factories in Kawasaki and Osaka are turning out tens of thousands of lamps every day, yet hardly enough to meet the public demand.

Porcelain insulators of good quality are made here to a large amount, leaving no room for importation, as suitable raw materials are plentiful in Kiushiu and other places. Among solid insulating materials other than porcelain, ebonite

*Abstract, from the *Journal* of the Society of Arts.

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is the only sort which can be made in a good quality. No substitutes for ebonite nor any insulators to meet special circumstances are yet forthcoming, although such forms as lamp-sockets or ball-insulators for trolley lines are made to a great extent. Mica is largely found in Corea and Manchuria, though the quality is not high-grade. There is a prospect of finding the mineral of good quality in deeper places in the mines. It is still good enough for making some sort of micanite; but there was no factory for it till very recently. Superior kinds of mica are imported through London firms from India, and in most of the electric workshops they are used even where smaller pieces of inferior quality are good enough for the purpose. Very recently a patent right for bakelite has been acquired, and the manufacture will begin after one year. India-rubber insulating tapes are made in many places, usually on a small scale and in a very primitive way. Insulating compounds and varnishes are made only to a small extent; and none with special features are yet touched upon. Transformer oils are made at oil refineries, but it is not known whether they meet the strict requirements of electrical engineers. All other oils for making varnishes and compounds are imported, and they secure good prices.

Ammeters, voltmeters and kilowatt-hour meters are largely imported. Ammeters and voltmeters for A.C. and D.C. are also made here on a fair business scale and supplied for use with small motors, but they serve for indicating rather than for measuring, and the consumers of electric power in general are indifferent. I have seen such meters in process of calibration by an ordinary workman with no proper education for such work, who was giving an allowance of 20 per cent. either way, and calibrating with the fluctuating city supply as the electric source. There are some factories where they make switchboard instruments, accurate to within 3 or 4 per cent., supplied with the generators made by themselves, but these cost much more than imported ones made by well-known specialist firms in America and Europe. There is no manufacturer of instruments of precision fit for scientific use. For hot-wire instruments there is difficulty in obtaining proper wires. In some factories resistance-boxes are made, but with materials having high temperature co-efficients. The employment of physicists in factories began only a few years ago, and there are still places where men with no proper education hold the place of chief engineer. There is no place such as the National Physical Laboratory, or the Bureau of Standards. I have not seen at any commercial industrial workshop a really good potentiometer from well-known makers, and preserved in perfect condition, nor have I seen a battery of secondary cells for the electric source in calibration or testing of D.C. instruments, or in driving a motor-generator for A.C. instruments. Such special instruments as the oscillograph are still considered a luxurious equipment in places where they are much needed; but ohmmeters and such like are used to a great extent. Those meters, which serve in selling and buying electricity, must now pass the examination of the Teishinsho (Department of Communication). Among these meters, tariff meters are imported to a large amount, but competition being keen, and under the public idea that electric apparatus has no fixed price, they are sold at half the catalogue price, and in addition one quarter of the selling price is paid for the fee of examination. The number of these meters examined at the Teishinsho last year reached thirty-eight thousand, and the figure increases every year at a rapid rate.

None of the alloys used as the materials for electric resistances, except a small amount of German silver, are made here. Consequently all heating elements must be imported.

Rubber works are in a prosperous condition, but not sufficiently so to stop the importation entirely. The rubber works for the purpose of insulation have now become a part of wire and cable factories. Good rubber is, of course, imported from South America through London and New York firms, inferior quality rubber comes from the Straits Settlements, while the experimental cultivation of the tree in Formosa is likely to end in disappointment.

Copper wires of all descriptions, from power cables down to silk-covered wires and rubber cords, are made here almost to the entire exclusion of imported articles, and all these factories are apparently in a prosperous condition, though competition is very keen in this as in other industries. Enamelled wires are made in some of the factories, but the demand is still small and not yet established.

Dry cells are made in many places on a small scale, but the demand is increasing every year. Most of the factories do not possess the proper apparatus for testing their products, the general public accepting them untested, while in supplying governmental customers rigorous specifications are observed. Dry cells fit for storing, made of the type in which some liquid is poured in at the time they are used, are in demand by the Army, the Navy, and in the telegraph and telephone departments. Secondary cells of lead type are now made in two or three places, but the greater part of the demand, which is increasing every year, is supplied by importers. Those who are going to install them naturally pay attention to the life of the cells, and therefore look for the products of well-established foreign factories, native factories being still too young to insure good records for their products. Governmental customers use the native products, because they are instructed to do so and they have no personal interest in the question.

Electric carbons for dry cells and for arc lamps, and also those carbons which do not require special processes, are made in many places, though on a small scale. Thick carbon rods for searchlights and carbon granules for telephone work are not yet made here in proper quality; carbon brushes, though made, are much inferior to imported ones.

Public telephones and telegraphs are government monopolies, and the apparatus, being fixed in form, are old in type, except in a few instances where new inventions are employed by way of trials. Most of these public telephone and telegraph apparatus have been supplied by two firms, one purely Japanese and the other in close connection with the West, and the apparatus were subjected to severe trials according to the policy of the government.

Fittings for lighting used in Japanese houses are developing to meet the tastes of the people; but those for buildings of foreign style, for offices and dwelling-houses, which are increasing very rapidly, are imported articles. No electric irons are made here, nor any electric heaters or cooking utensils, while electric fans are only manufactured to a very limited extent. Suppliers of electricity are now competing fiercely with one another, but for current for lighting purposes only. When this contest comes to an end, and that will be very soon, the manufacture of all kinds of apparatus for domestic purposes will rise quickly to a state of prosperity.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electrical Apparatus for Shearing Wool.

I have recently received an inquiry from a woolstapler for electrical apparatus for shearing wool from skins, and from what I can gather this is carried out by means of a wire kept at white heat by electricity. The idea, as above, hardly seems practicable, but perhaps some modified form may be in use at present. Would you be kind enough to insert this letter in your columns in order that I may get in touch with agents or manufacturers who specialise in electrical shearing apparatus?

My client informs me that he has been told by friends in the trade that apparatus working on the above lines is in successful use in Germany at the present time.

J. G. Bomford.

Stratford-on-Avon, *July 24th*, 1914.

Cab Tire Sheathed Cable.

We are interested to note your article on the proposed Testing Institution in the current week's issue, and agree with the author that a method which will prevent inferior material from being foisted upon the electrical industry will be of considerable value to that industry, especially in regard to its future.

Reference is made to the suitability of this Institution for testing electrical machinery and material which have not been long in practical operation, and the author of the article mentions cab tire sheathed cables for house wiring in this connection. He further states that, if suitable, this style of wiring will prove of the utmost benefit, but refers to other classes of cable which have not been successful, and queries how one is to know that cab tire sheathed cables will eventually prove to be any better than these.

We trust we may be allowed, as inventors and patentees of the cab tire sheathed type of cable, to give reasons for our opinion that this type will do what we claim for it.

In the first place, we have been makers of cab tires for the past 12 years, and at the present moment are about the largest manufacturers of these in the United Kingdom, turning out 5 or 6 tons per week of cab tires alone, for use all over the world.

It was in consequence of this intimate knowledge of the almost indestructible nature of cab tire compound that we decided to use it for sheathing electric cables; but before putting it on the market seriously, we carried out severe practical and laboratory tests upon it, with acids, oils, alkalis, ozone, &c., and we also examined cab tires in service that had been made by us as long ago as possible, to confirm our opinion as to absence of deterioration. Enclosed, for instance, is a piece of cab tire which was

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supplied in May, 1906, to a coachbuilder's shop in the Newcastle district, where it was put on "show wheels" in the window, and which you will see is in perfect condition after this exposure of over eight years.

We also started testing the cable under working conditions at the earliest date possible, and can now show C.T.S. cables which have been in use in the most exposed positions for over three years, without the slightest indication of deterioration.

Under these circumstances, and in regard to the fact that we have largely advertised and sold this C.T.S. cable for use in the worst positions (where other cables have quickly failed) during the past three years, and that we have had practically no complaints during that period, we think that the confidence of our customers and ourselves in C.T.S. should now be shared in by the electrical profession generally.

May we add that while it is pleasant to note the gradual adoption of C.T.S. for wiring, by the more enterprising, it is interesting to observe how some electrical engineers shake their heads warily and continue to use the old-fashioned wiring systems which give trouble in so many cases, and which are frequently replaced by C.T.S.

St. Helens Cable and Rubber Co., Ltd.,
J. H. C. Brooking, *Manager.*

Warrington,
August 1st, 1914.

Colonial Appointments.

Apropos of the letter in this week's Review on the subject of Colonial appointments, I should like to endorse your correspondent's warning, especially as regards the East, and that Cinderella of our profession, "Telegraph engineering."

Married men should never venture to the great cities of the East on salaries of less than £500 per annum. I could give you particulars of a married engineer, who, out of a salary of £450, had to pay £200 per annum for a suitable house.

M.I.E.E.

Arnside, Westmorland,
August 2nd, 1914.

Electrical Treatment of Milk.

Your article in this week's Electrical Review on the above subject of my patents is somewhat misleading and incorrect in various details.

I may say that after working on the problem for some months and taking out the customary patent protection, Mr. F. C. Lewis, then assistant in the Bacteriological Laboratory at the Liverpool University, was called in by me, and assisted me in the solving of the problem, but the patents therein are mine and will be strictly enforced.

A. Shelmerdine.

Liverpool, *August 1st*, 1914.

Electrical Engineers and the War.

Feeling sure that many experienced electrical engineers would willingly offer their services to the Government if required for duty in the event of war commencing against Britain, I should be pleased to hear from gentlemen willing to co-operate in forming a committee with the intention of creating an organisation for this purpose at the earliest possible moment.

W. Ellerd-Styles.

91, Forest Drive West, Leytonstone.

[A further reference to this matter will be found in our leading columns to-day.—Eds. Elec. Rev.]

Electric Light and Roman Catholicism.—A long and strict decree has just been issued by the Sacred Congregation of Rites, Rome, in which electric lights are absolutely forbidden on or over any altar containing the blessed sacrament or the relics of a saint.

NEW THREE-PHASE REPULSION MOTOR.

Three-phase, series-wound commutator motors with starting and speed regulation by brush displacement have found extensive practical application during recent years; they do not involve the complicated regulating devices, stepped or rotary transformers, stator tappings and the like, which are required by shunt motors. Nevertheless the transformer required between the stator and rotor of a series motor is an undesirable complication, particularly since it must be designed for the same power as the motor itself. A single-phase repulsion motor requires no transformer, and it is possible in some cases to replace with advantage a single three-phase motor by two single-phase Scott-connected repulsion motors. A. Heyland* has recently patented a design for a three-phase repulsion motor which is built, not as a simple rotating field machine, but with a chord winding (as in the Scherbius motor) and three pairs of short-circuited brushes, the angle between the brushes in each pair being rather less than the angle between the neighbouring stator phases. Such a motor is slightly smaller than a single-phase repulsion machine of equal power and much smaller than the equivalent pair of single-phase machines arranged for operation on three-phase current; it is larger than the pure rotating field series motor, but this is compensated by elimination of the transformer required by the latter. The new machine has identically the same characteristics as a series motor and combines therewith the well-known advantages of the single-phase repulsion motor.

Fig. 1 represents a two-pole machine, S being the stator winding with terminals 1, 2, 3, and R the rotor winding and commutator with three pairs of short-circuited brushes capable of simultaneous displacement. For simplicity, ring windings are assumed. The brushes are shown in their neutral position. The stator field is tri-axial, and linked between phases, as indicated by the triangularly arranged arrows in the rotor. In the free spaces between adjacent

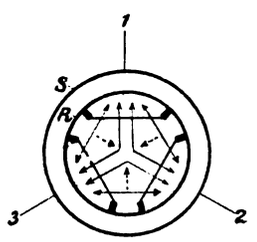

Fig. 1.

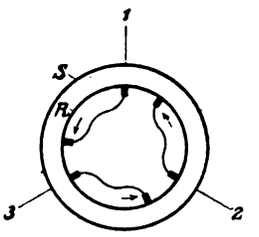

Fig. 2.

pairs of brushes, fields represented by the dotted arrows are produced by the currents induced in the short-circuit paths. The resultant effect is a single-axis field between the brushes of each pair (as represented by the pairs of parallel arrows), and this corresponds to the conditions in a single-phase repulsion motor. In the neutral position shown, the current between brushes is only sufficient to produce the dotted compensating field. At full speed the compensating field vanishes, and the machine is superior to a single-phase repulsion motor in that part only of the rotating field is produced by the rotor rotation, the remainder being produced directly by the three-phase stator winding; in consequence, phase displacement is less than in a single-phase repulsion motor, and can be corrected entirely by introducing a small compensating E.M.F. in the brush short-circuit. Exact compensation can be provided at all speeds, and the machine can be given shunt characteristics under working conditions. The important point is, however, that the machine operates as a pure repulsion motor at starting, and approaches more and more closely the characteristics of a rotating field motor as its speed increases.

As shown in fig. 2, the machine may be arranged on the Deri principle with one fixed and one movable brush in each pair. The same advantages are secured as in the Deri one-phase machine; the P.D. between brushes increases with their separation. If each moving brush be brought right up to the fixed brush in the next pair, the machine attains the characteristics of a rotating field motor.

The new motor is but little larger than the ordinary three-phase machine of equal output. The chord winding produces less favourable loading of the slot bars, and the iron dimensions should be rather more liberal. The 10 per cent. additional outlay thus incurred is offset by elimination of the transformer. For a certain 50-H.P. hoisting installation, the cost of a three-phase series motor with transformer was £122 (£98 + £24); of two Scott-connected one-phase repulsion motors, £146; and of a Heyland three-phase repulsion motor, £108. Hitherto it has been considered necessary to carry current into the rotor to effect compensation, but in the Heyland motor the brushes are simply short-circuited. When the distance between the short-circuit brushes is extended beyond the angle of the stator phases, automatic internal phase compensation is set up by a resultant magnetising component due to overlapping of the stator phases by rotor current induced from the phases lying opposite. The automatic internal compensation effected is characteristic of this particular machine, and cannot be secured in a single-phase repulsion motor.

Fig. 3 shows diagrammatically a two-pole Heyland motor with crossed brush connections. In multipolar machines direct cross-overs are not necessary if the brush pairs be correctly spaced on

* See also *E.T.Z.*, pp. 85-86; 1914.

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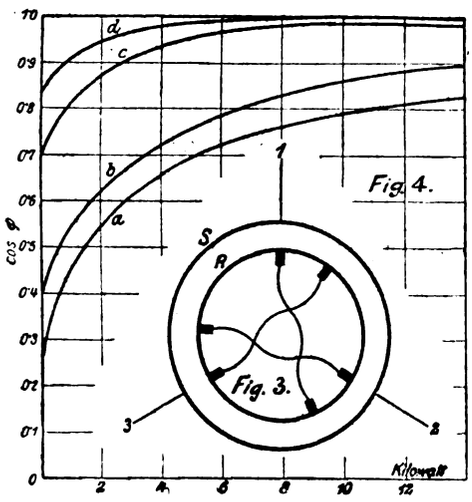
part only of the circumference (*e.g.*, every second one omitted); equalising connections between the commutator-bars are then required in wave windings. Generally the stationary brushes are mounted inside, and the movable brushes on the bearing side of the commutator. Fig. 4 shows the power factor under various loads of an 8·84-KW. motor :—(*a*) With simple squirrel-cage rotor ; (*b*) with brushes at 120° (the brushes of neighbouring sets coinciding in position) ; (*c*) with brushes at 160°, as in fig. 1 ; (*d*) with brushes at 160° and stationary brushes set forward 40° from the neutral position. Curve *b* shows a slight improvement in power factor due to suppression of harmonic fields ; curve *c* shows unity power factor at considerably lower loads. Compensation being by a current component which is proportional to the main current, the power factor curves fig. 4 are quite smooth. In reversible motors, the commutator frictional drag advances the stationary brushes automatically.

Phase compensation is best near synchronous speed. Corresponding to various brush settings, the machine runs at certain speeds which do not rise much above synchronism as the load is



Figs. 3 and 4.

reduced. The compensating action resembles the behaviour of a synchronous motor except in respect of the internal self-excitation and variable speed characteristics. The new machine possesses the simplicity of a single-phase repulsion motor without its disadvantages in the shape of auxiliary compensation, &c. In size and efficiency the Heyland three-phase repulsion motor is practically identical with the corresponding series motor, the stator winding and number of poles being altered to allow for the fact that the series motor runs 50 per cent. over synchronism whereas the repulsion machine runs more or less synchronously. Below synchronism the new machine has series characteristics, but near synchronism it assumes shunt characteristics, and is, therefore, an ideal hoisting motor. The automatic internal compensation permits the machine to be designed with relatively weak field even for heavy overload and hence keeps the KVA. demand low when starting under heavy load. The motor is the simplest yet available for power factor improvement.

THE DEVELOPMENT OF THE MERCURY RECTIFIER FOR LARGE OUTPUTS.*

The idea of employing an iron enclosing case in place of a glass one for the mercury rectifier is an old one and was, in fact, suggested by Cooper-Hewitt, the discoverer of the rectifier, in a Swiss patent of 1903. The clearing up of the many minor difficulties in connection with the small power glass rectifiers, however, seems to have kept this suggestion in the background for some years. The first forward step in this direction was made by the General Electric Co., of America, and their experimental work was embodied in various patents in 1909 and 1910. The Allgemeine Elektrizitäts Gesellschaft also took out a patent on the same lines in 1910. From that time onwards work has been going on steadily in this direction. In 1912 the first model of the G.E.C. iron-cased rectifier was tested in Germany. It consisted of two tall iron cylinders, each containing a subdivided mercury cathode and two anodes, and each cylinder was surrounded by a cooling chamber with water circulation. Two such cylinders in parallel were used to convert 80 KW. of single-phase alternating-current power into direct current. The sealing of the chambers was accomplished by alternate concentric rings of rubber and lead or asbestos and lead and was satisfactory, although the exhausting pump had to be kept continuously at work whilst the rectifier was in operation. For three-phase work three cylinders were used.

A little later the A.E.G. introduced a construction in which a single cylinder contained all the anodes and the cathode required for three-phase work. With this single cylinder construction, however, when as much as 100 KW. had to be dealt with, considerable difficulty was experienced in removing the heat from the internal parts and in sufficiently insulating the various anodes from one another.

Finally, the shape which had already worked successfully in the case of the glass rectifiers has been adopted both by the G.E.C. and the A.E.G. The anodes, in fact, are placed in separate side chambers projecting more or less radially at intervals out of a central cylinder containing the common cathode. In this way the anodes are removed from the path of the so-called "cathode flame," consisting of electrically neutral particles of mercury

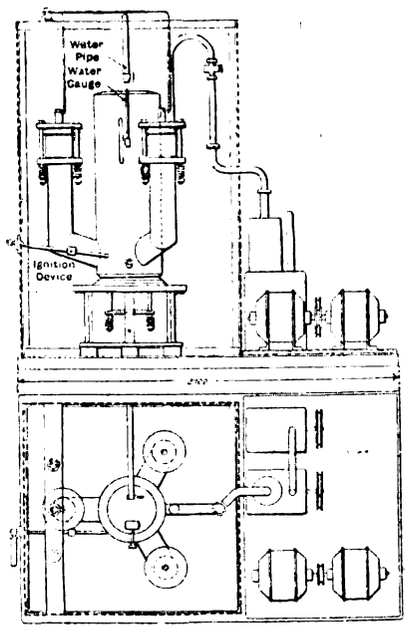


Fig. 1.—100-KW. Mercury Rectifier.

which have been driven upwards by the heat. In previous constructions trouble often resulted from some of these particles reaching the anode surface, and when this occurs, even if only momentarily, there is the risk of one of the anodes being converted into a temporary mercury cathode, and so stopping the valve action of the apparatus and leading to a short circuit between anodes.

In fig. 1 is given a dimensioned drawing of an A.E.G. rectifier of this latest type (1913) for an output of 100 KW. from three-phase to direct current, the direct current output being 350 volts 300 amperes. It consists of a cylindrical iron vessel about 1 m. high and ·415 m. diameter. The cylinder is entirely closed at the

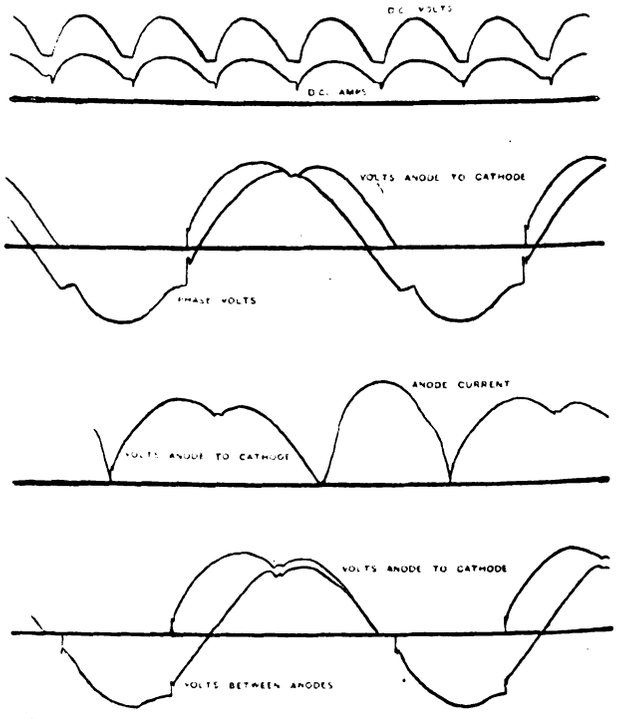


Fig. 2.—Oscillograph Records of Rectifier Working.

bottom, whilst the top cover is formed by an open tank ·8 m. deep and ·3 m. in diameter, the bottom of which closes the condensing chamber of the rectifier, whilst the tank itself is filled with about 55 litres of water, which, by its slow evaporation, gives all the necessary cooling effect, and only requires refilling about once in 24 hours of continuous work.

* Dr. K. Norden, in the *E.T.Z.*,

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At the lower part of the cylinder three iron pipes are welded on radially, with an upward bend. At the top of these pipes the three iron anodes are fixed in insulating and air-tight supports, consisting of porcelain, asbestos and mica, sealed with lead rings against the atmospheric pressure. The mercury cathode lies at the bottom of the central cylinder. The starting or ignition anode is fixed to a slanting rotatable axis, which can be operated either by hand or automatically. The arc can be examined through a small window covered with mica.

The following results of a test carried out by Prof. E Orlich on one of these rectifiers show the capabilities of the apparatus. The rectifier was supplied from a three-phase transformer at 50 ~. Three dynamometer wattmeters were connected on the A.C. side to measure the input power. These three meters showed practically equal powers, indicating effective symmetry of the load. The rectifier was loaded by connecting a 110-volt D.C. supply circuit through a practically non-inductive resistance between the cathode and the neutral point of the three-phase transformer. No choking coil was introduced to smooth out the direct-current fluctuations. As measurements of only the true direct-current component of the output were required, moving coil d'Arsonval instruments were used on the D C. side, so that, if anything, the efficiency obtained is a little on the low side. The readings were quite steady, and all the apparatus was checked after the test by potentiometer. As will be seen, the rectifier was run continuously for four hours at 100 KW., and throughout this test, with the exception of the first reading, when the rectifier had not yet warmed up, the efficiency remained constant at about 90 per cent. The starting electrode was disconnected soon after the start of the test, and was not required again. The pump was kept running during the first three hours, and was then cut off, and the vacuum remained good not only for the remaining hour, but during various other tests carried out during the evening. It was, however, found impossible to work continuously without running the pumps. The efficiency was still very good at such low loads as 10 KW., or even 2·3 KW. When the direct-current output was still further reduced, the rectifier still operated satisfactorily down to a minimum of about 3 amperes, when it went out, and could not be re-started at this low value. Even when cold, the operation was satisfactory from 7 amperes upwards without the continuous use of the starting electrode.

Time.	Three phase			Direct current			Efficiency.
	Line volts.	Amps. per phase.	Total KW.	Volts.	Amps.	KW.	
2.41	557	100	69·7	332	182	60·4	86·7%
2.50	550	170	110·5	338	295	99·5	90·1%
3.13	559	170	110·1	337	292	98·4	90·2%
3.48	558	170	108·8	338	291	98·2	90·3%*
4.37	554	170	108·9	338	290	98·1	90·1%
5.58	565	170	111·4	342	294	100·6	90·4%†
7.3	579	80	54·1	358	137	49	90·6%
	579	—	2·69	358	6·5	2·31	86 %
	578	—	11·1	358	27·7	9·9	89 %

* Starting arc cut out at 3.45.
† Pumps cut off at 6.20, and test continued at 100 KW. till 7 p.m.

The oscillograph records in fig. 2 indicate that the change of the rectifier arc from one anode to another takes place reliably and regularly; they are in all respects comparable with the results from the older rectifiers. The temperature reached, although higher than allowed in ordinary electrical machinery, is moderate and permissible considering the materials employed in this case.

Besides this 350-volt 300-ampere size, the A.E.G. has now in preparation similar rectifiers with longer anode tubes for higher voltages, and others with wider anode tubes for heavier currents. The General Electric Co., of America, has, on the same lines, produced sizes which give outputs of as much as 1,000 KW., viz., 600 or 700 amps. at 1,200 volts continuously (and even 2,400 volts), whilst intermittently as much as 2,700 volts is obtainable.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electrical Colliery Plant.

The first consideration in the arrangement of a scheme for sinking a shaft is the electrical installation, for, in modern colliery practice, electrical power is used right from the commencement, enabling considerable economies to be effected.

At the Coventry Colliery of the Warwickshire Coal Co., where sinking operations are at present proceeding, one of the first steps was the installation of a large electric power house with sufficient plant to afford an adequate supply of electric power for sinking, while ample space has been left for future extensions. Steam winding engines have been installed, and their exhaust is utilised in mixed-pressure turbine-generators.

In the exhaust mains a Rateau-Morrison steam accumulator is inserted to afford a uniform supply of steam to the exhaust turbines with sufficient capacity to bridge over a stoppage of half-a-minute. In addition, there is a connection direct from the boilers to the mixed-pressure turbines by means of which the turbines can draw live steam at times when the winding engines are not at work or do not afford an adequate supply of exhaust steam. The condensing water is cooled by the spray method, in a cooling pond constructed of concrete throughout, 152 ft. long, 113 ft. wide, and 4 ft. deep. There are 224 nozzles. The pond has a capacity of 315,000 gallons per hour, effecting a reduction in temperature from 95° F. to 80° F. The pond also acts as a reservoir.

It is anticipated that with coal winning in full swing the engines will afford an average supply of 50,000 lb. of steam per hour at a pressure of 2 lb. per sq. in. to the turbines, or sufficient to generate 1,250 KW. continuously.

The present generating plant consists of two 880-K.V.A. "Witton" turbo-alternators driven by the mixed-pressure turbines at a speed of 3,000 R.P.M. Three-phase power is generated at a

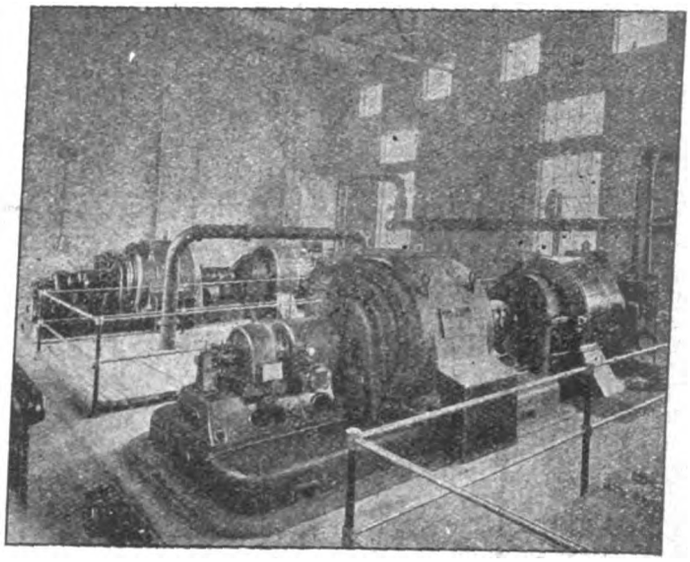

Fig. 1.—Colliery Power House, showing two 880-K.V.A. "Witton" Turbo-Generators.

pressure of 2,750 volts, 50 cycles. The exciters for the turbines are direct coupled, as shown in the view of the engine room, fig. 1. A third and similar set will probably be installed. The air pumps and other auxiliaries are steam driven, with the exception of two centrifugal pumps giving a supply of 240 gallons of water per minute against a total head of 39 ft., and driven by 7·5-H.P. "Witton" motors. These are used for supplying water to cool the oil which lubricates the bearings of the turbines, and for emptying the cooling pond.

For lighting purposes there has been installed a 55-KW. "Witton" generator driven by a high-speed steam engine, which gives a three-wire D.C. supply at 230 volts across the outers, a static balancer giving the necessary neutral connection. This set is only used when the winding engines are not at work. When exhaust steam is available lighting current is taken from the main alternating-current supply, the conversion from alternating to direct-current being effected by a 55-KW. "Witton" motor-generator running at 580 R.P.M.

The generators have been designed with high internal leakage reactance in order to enable them to withstand heavy short-circuits without damage to the windings. Close regulation is obtained by means of a Brown, Boveri veltage regulator. The colliery works with an insulated neutral.

The electrical generating plant was supplied by the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., and Mr. W. C. Mountain, of Newcastle-on-Tyne, is the consulting engineer for the scheme. We are indebted to Mr. A. M. Russell and Mr. J. W. Liddell, the agent and manager of the colliery, for permission to publish this description, and to Mr. W. C. Mountain for particulars of the plant.

Electrolytic Rectifier.

Messrs. Isenthal & Co., of Denzil Works, Neasden, N.W., have introduced an improved grid type electrolytic rectifier, in which the heavy glass containers have been replaced by a single steel tank container only, although both half waves of the A.C. are utilised.

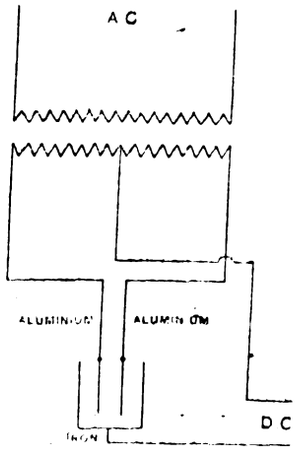

Fig. 2.—Rectifier Connections.

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The critical voltage of the cells has been raised, and higher D.C. voltages than formerly can be secured. The leakage current has been reduced, and no special cooling arrangements are necessary.

Rectifier, switchboard and transformers now form a self-contained set, and various control panels can be provided according to the purpose for which the apparatus is used.

Fig. 3 illustrates the positive elements of a 5-ampere type rectifier.

These are rigidly assembled, but can be easily replaced; the portion of the element which passes through the level of the

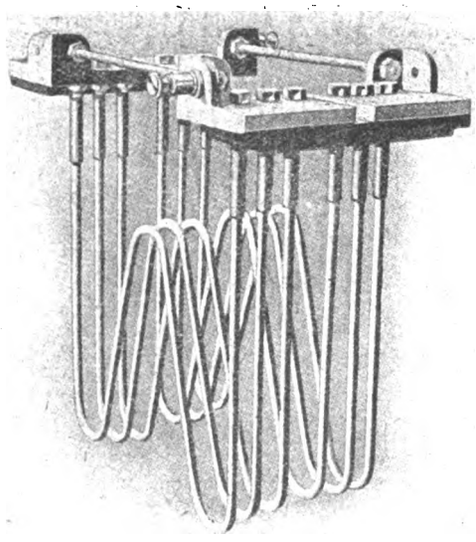


Fig. 3.—Positive Elements, Improved Rectifier.

electrolyte is carefully protected from corrosive effects. The positive elements when sent out are practically ready for work, having undergone formation.

The standard types are for use on single-phase A.C. or on one phase of a multiphase supply; the design can, however, be modified to utilise all phases equally, if necessary. The apparatus is suitable for charging ignition and other accumulators, for running D.C. motors, working mercury vapour, and projection lamps, &c.

Self-Acting Starter for Polyphase Pump Motors.

Particulars of a new controlling apparatus, illustrated in fig. 4, have been sent to us by the Igranic Electric Co., of 147, Queen Victoria Street, London. We understand that many of these self-

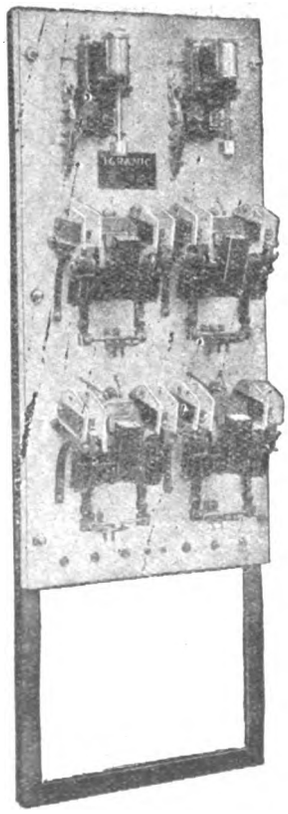


Fig. 4.—Self-acting Starter.

acting starters have already been installed and are working in various parts of the country driving centrifugal pumps and apparatus with similar load characteristics.

The self-starter is of the multiple clapper type, consisting of a plain slate switchboard which carries the clapper switches and the relays controlling the motor and auto-transformer circuits, and it can be controlled either by push buttons, float switch, tappet switch or pressure regulator. This type of self-starter we are informed is standardised from 15 to 175 B.H.P.

Temporary Wiring.

Fig. 5 shows the wall plugs introduced by Messrs. Reyrolle and Co., of Hebburn, used for stage purposes. The object has been to provide a good mechanical job of the wiring up to the

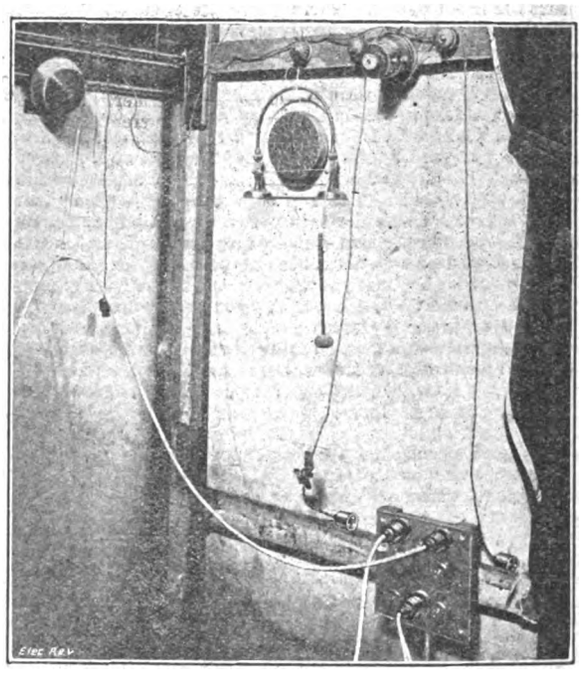
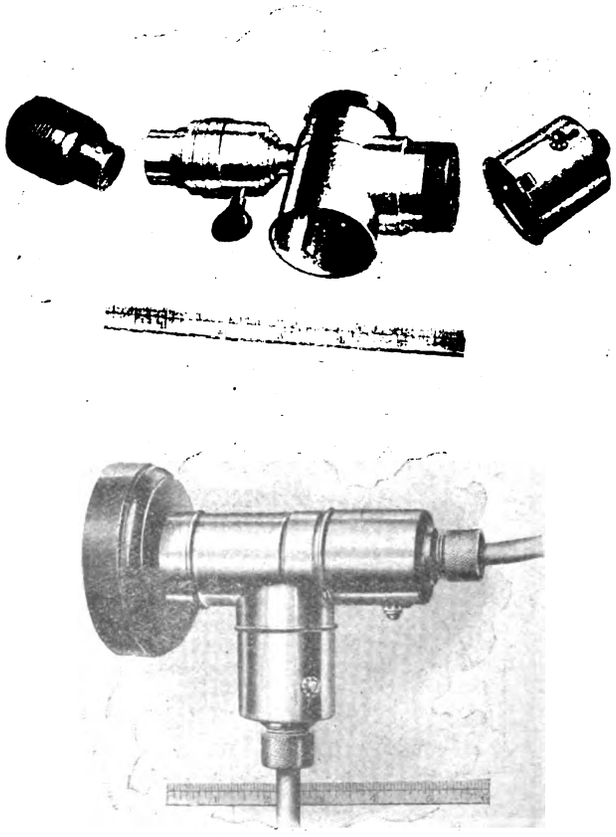


Fig. 5.—Reyrolle Wall Plugs on the Stage.

plugs, the rest may be more or less of a temporary nature according to the work that it has to do, and the length of service that it is in commission.



Figs. 6 and 7.—Reyrolle Adapters.

The plugs are made so that the pins are shrouded by the cover and it is impossible to make accidental contact with the pins when

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alive; in cases such as that illustrated, when plugs have to be manipulated in a hurry, this feature is very necessary. Also the mechanical protection afforded by the shroud avoids risk of injuring the pins in rough service.

Figs. 6 and 7 illustrate adapters provided for use with the plug board in order to obtain more than one connection from a socket, or to insert dimmers or any other apparatus for various stage effects.

LEGAL.

Powers of Jamaica Electric Co., Ltd.

On July 29th judgment was given at the Privy Council in two appeals, in the first of which the West India Electric Co., Ltd., was the respondent, and in the second appellant. The appeals were tried together as they both involved the construction of the Electric Co.'s licence to work tramways in the neighbourhood of Kingston, Jamaica.

Lord Sumner, who delivered the judgment of the Court, said the action was brought to recover 6*l.* paid under protest. Shortly, the appellant's grievance was that he ought to be carried for a maximum fare of 2*l.* between any two points in any one of the three districts defined by the respondents' licence, whether or not such journey involved a change of cars. The Supreme Court of Jamaica held that the charges made by the Electric Co. were within the powers conferred on them by the licence, and dismissed his action.

His Lordship said that they were of opinion that the decision appealed from must be affirmed, with costs.

In the second appeal, in which the company were appellants and the Attorney-General of Jamaica respondent, the company were again successful.

Lord Sumner said that this action was brought by the company against the Attorney-General as representing the executive of the Colony, in order to settle various questions long at issue between the company and the Government. The Board was of opinion that the appeal of the Electric Co. should be allowed, with costs, and the judgment of the Supreme Court and that of the Chief Justice of Jamaica, which it affirmed, set aside.

Oriental Telephone and Electric Co., Ltd.

The case of Baillie *v.* The Oriental Telephone and Electric Co., Ltd., came before Mr. Justice Astbury, on a motion by the plaintiff, to restrain the company and its directors from acting on resolutions on the ground alleged, that they were invalid, because of insufficient notice.

Mr. Russell, K.C., for plaintiff, said that the evidence on both sides was in conflict, and it having been stated that the directors did not intend to act on the resolutions, he suggested that the motion should stand over till the second motion day next sittings.

Sir C. Macassey, for the defendants, agreed.

His Lordship directed the motion to stand over accordingly, and gave leave to each party, on 10 days' notice before it came on, to give notice to cross-examine witnesses.

A Lift Case.

At the West Riding Assizes last week, Henry Redfearn, a labourer, was awarded £250 damages against Messrs. Smith, Major and Stevens, Ltd., Birmingham. Plaintiff was injured by a falling balance weight while assisting in the erection of lift gates which Messrs. Smith, Major & Stevens were installing at Messrs. Reckitts' works. Redfearn only claimed £41, £24 of which represented wages.

A Kite and a Colliery.

Two young kite flyers were recently summoned at Tredegar for wilfully damaging electric power lines at the Markham Colliery. The lads were flying a kite with a wire attached, and the latter apparently came into contact with and short-circuited the transmission line to the Markham Colliery, which was immediately shut down. Two hundred men were in the mine, and the ventilating plant was stopped.

A Tramway Ticket.

At Bolton, last week, John Richardson was summoned under a local by-law for failing to produce his ticket when requested to do so by an inspector. It was stated that the defendant boarded a tramcar on July 9th and received a ticket, for which he paid a penny.

The defence was that the defendant never received a ticket, owing, he suggested, to the fact that the conductor had not at the moment change for a shilling. There was no dispute, said defendant, about the fact that he had paid the penny.

The case was dismissed, the Mayor stating that the Bench believed the defendant had paid his fare.

Carrickmacross Lighting.—The Urban Council has arranged a three years' contract for the electric lighting of the town.

OUR LEGAL QUERY COLUMN.

"Pacific" writes:—"According to the Electric Lighting Acts the undertakers have the right of admission 'at all reasonable times to any premises to which electricity is supplied by the undertakers' in order to inspect the electrical apparatus or disconnect supply, &c. (Sec. 24, Electric Lighting Act, 1882.)

"In some cases the tenants wilfully refuse admission, or will not answer the door.

"What is the correct procedure on the part of the undertakers who have been kept out for, say, six months, while the refusal to admit for the inspection of meters or disconnection continues? Can the undertakers make a forced entry after serving a proper notice on the tenant, and then finding that the obstruction on the part of the tenant still continues; or should the undertakers apply for a magistrate's warrant?"

*** Sec. 24 of the Act of 1882 provides that any officer appointed by the undertakers may at all reasonable times enter any premises to which electricity is, or has been, supplied by the undertakers, in order to inspect the electric lines, meters, accumulators, fittings, works and apparatus for the supply of electricity belonging to the undertakers, and for the purpose of ascertaining the quantity of electricity consumed or supplied, or where a supply of electricity is no longer required, or when the undertakers are authorised to take away and cut off the supply of electricity from any premises, for the purpose of removing any electric lines, accumulators, fittings, works or apparatus belonging to the undertakers, repairing all damage caused by such entry, inspection or removal. This section corresponds to Sec. 21 of the Gasworks Clauses Act, 1871, but strange to say the latter provides for a penalty for hindering the officer. There is apparently one law for gas and another for electricity in this respect. The question is:—How can the undertakers enforce their rights? It would seem that the provisional order really amounts to a contract between the consumer and those who supply electric light, and the remedy would be to bring an action to compel the consumer to allow an inspector to enter. No lawyer would advise forcible entry; but if such entry were effected and an action, or prosecution, were commenced for the trespass, the defence of leave and licence by statutory authority would probably hold good.

"Wulfruna" writes:—"Are electric supply undertakings liable for damages caused by fire: (*a*) Due to faults of service cables on consumers' premises; (*b*) due to faults in wiring installations which are the property of the undertaking, assuming there is no evidence of negligence on the part of the undertakers?"

*** Sec. 77 of the schedule to the Electric Lighting (Clauses) Act, 1899, provides that: "The undertakers shall be answerable for all accidents, damages, and injuries happening through the Act or default of the undertakers, or of any person in their employment, by reason of, or in consequence of, any of the undertaker's works, and shall save harmless all authorities, bodies, and persons by whom any street is repairable, and all other authorities, companies, and bodies collectively and individually, and their officers and servants, from all damages and costs in respect of those accidents, damages and injuries." By Clause 81 "Nothing in the Special Order shall exonerate the undertakers from any indictment, action, or other proceedings for nuisance in the event of any nuisance being caused or permitted by them." It has been decided that in the case of mains in the street being defective and fire resulting, the undertakers are liable. In Midwood *v.* Manchester Corporation (1905) 2 K.B. 597, the facts were that a main fused and the bitumen in which the main was laid, in consequence, became volatilised into an inflammable gas, which accumulated for some time, and then exploded, causing a fire, by which the plaintiffs' goods were damaged. It was held by the Court of Appeal that apart from negligence the Corporation were liable to the plaintiffs as for a nuisance by reason of a section similar to Sec. 77 *supra*. It is apprehended that if the service cables on a consumer's premises were defective, and the lines had been laid by, and were under the control of, the undertakers, they would be responsible for any consequences that might ensue.

Mail, Telegraph and Telephone in Europe and the States.—Comparison between the use made of letter post, telegraph and telephone services in Europe and the United States shows predominance of the letter post in Europe and of the telephone in the States (chiefly due to the great use made of local telephone service in America). As shown by the following statistics, referring to 1911 and the latest available, relatively few messages are transmitted by telegraph either in Europe or the States. (Population of Europe approximately 400 millions, of U.S.A. approximately 100 millions).

	Messages by—		
Europe—	Letter.	Telegram.	Telephone.
Total (millions)	16,500	370	6,000
Per cent. of total	72·2	1·6	26·2
Per 1,000 inhabitants ...	37·3	0·8	13·6
United States—			
Total (millions)—	9,700	108	14,400
Per cent. of total	40·07	0·45	59·48
Per 1,000 inhabitants ...	102·5	1·1	152·1

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PARLIAMENTARY.

Manchester Corporation Bill.

The Bill of the Manchester Corporation, which had already been before a House of Lords Committee, came up for consideration before a Select Committee of the House of Commons. Under the Bill the Corporation were seeking various powers, some of which, as reported in the Electrical Review at the time, were rejected by the House of Lords' Committee. The Bill as now modified, amongst other things, authorises the Corporation to erect a generating station at Davyhulme, at a cost of £1,200,000. Additional powers were also sought for the provision of motor-omnibuses, and an extension of the time for the construction of certain pieces of tramway already authorised was asked for.

Mr. McElroy, the manager of the Corporation tramways, was examined at considerable length in regard to that part of the Bill referring to motor-'buses. He said that they desired to carry parcels on the 'buses exactly in the same way as they did now on the tramways. He thought it would be very unfair to put a charge upon the Corporation for running over the bridges of the Great Central Railway—railway companies had the full use of the roads belonging to the Corporation without any special charge.

On the 28th ult., after hearing further evidence, the Committee passed the preamble of the Bill. On the question of road contributions, the Committee decided that inside the city no contribution should be paid other than that provided by a clause under which the Corporation already undertake to contribute to the cost of the repair of the bridges, if, by their excessive use of them, such work is rendered necessary. With regard to roads outside the city, if the road authorities are paid any sum for the right to run motor-'buses, the railway companies are to be treated in the same way as regards their roads and bridges.

Bristol Tramways Bill.

After three days' hearing of the Tramways Bill promoted by the Bristol Corporation before a Select Committee of the House of Commons, presided over by Sir Edwin Cornwall, the parties came to an agreement, and the Bill was reported for third reading. There was a large array of counsel, as besides those representing the Corporation and the Tramways Co., a number of property owners and ratepayers were represented.

The Hon. J. D. Fitzgerald, K.C., who led for the Corporation, explained that the object of the Bill was to enable the Corporation to purchase the tramway undertaking of the Tramways Co. and work the same. The Bill had passed a Committee of the House of Lords, and was now being opposed by certain ratepayers and property owners. He contended that the poll of the citizens, which was taken, showed that the proposals of the Corporation had the support of the bulk of the ratepapers.

Mr. Freeman, K.C., argued the case generally for the opponents, and contended that the Corporation were plunging into an undertaking which they could not get out of, on entirely insufficient data. Obviously, the whole foundation of the question whether the bargain was good or bad depended on the price to be paid. They knew that the price was £300,000 for the part of the undertaking inside the city, and £70,000 for the part outside, but a point which had not been taken into consideration was what the Corporation might have to pay for lines not yet constructed if the company exercised its rights and constructed such lines.

In the end the parties came to an agreement to insert a clause providing that, if the Corporation exercised their option of purchase in May next, they must acquire the whole undertaking of the company.

Royal Assent.—The following Acts have received the Royal Assent:—

Electric Lighting Orders Confirmation Acts, Nos. 2, 4, 6, 7 and 9.
North Metropolitan Electric Power Supply Act.
Norwich Electric Tramways Act.
Hightown Gas and Electricity Act.
Deal and Walmer Gas and Electricity Act.
Shropshire, Worcestershire and Staffordshire Electric Power Act.
London United Tramways Act.
Yorkshire Electric Power Act.
London, Brighton and South Coast Railway Act.

Motor-'buses and Road Tax.—The House of Lords Committee which has been considering the Sheffield Corporation Bill in regard to running motor-'bus services over four local routes, generally upheld the decision of the Commons Committee in regard to road maintenance contributions, but held that any Government road grant should be used to diminish *pro rata* the expense borne by the County Councils and the Corporation, and that in no case should the benefit of the grant accrue solely to the Corporation.

Electric Vehicle Committee.—The Electric Vehicle Association of America, which is holding its annual convention in Philadelphia on October 19th, 20th and 21st, has issued a welcome to any British engineers interested in the electric vehicle, who propose being in the United States at the time. The Electric Vehicle Committee is being represented by its chairman, Mr. R. A. Chattock, of Birmingham.

BUSINESS NOTES.

Consular Notes.—RUSSIAN FAR EAST.—The American Consul at Vladivostok reports that the Vladivostok Trading Port having been unsuccessful in coming to an agreement with the municipality on the question of furnishing electric power, it has been decided by the Department of Commerce and Industry that an independent station shall be built to supply the necessary power for the Trading Port.

CHINA.—According to the American Consul at Hankow, a large German firm has been attempting to secure a franchise from the several foreign concessions in Hankow for a short railway. The matter came before the ratepayers of the British concession at Hankow on March 12th, when it was decided to refer it to a committee appointed by the Municipal Council, no final scheme to be adopted without sanction of the ratepayers at a special meeting. It was also stipulated that the line should not be allowed to pass along the Bund. The Consul observes that this is an example of the kind of opportunities which would present themselves to American firms if they were established in the district. Without more or less permanent representation business of this kind cannot be handled.

TURKEY.—A monthly report of the French Chamber of Commerce at Constantinople points out that, although electric table lamps have not as yet been imported into Turkey in any quantity, a rapidly increasing demand for these goods may confidently be anticipated in the future. At the present moment the majority of the imports come from Germany, and the remainder from France.

ITALY.—A recent issue of the "Handelsmuseum," the official organ of the Austrian Commercial Intelligence Office, states that the use of water power for agricultural and industrial purposes in Italy is rapidly increasing, for the more intensive cultivation of the soil in the case of agriculture, and, in the case of industries, to relieve the manufacturers of the expense entailed by importing foreign coal. The Government recently presented to Parliament a Bill to provide for the construction of dams and artificial lakes in Calabria and Sardinia; in the former case chiefly for the development and distribution of motive power, and in the latter chiefly for irrigation purposes. It is estimated that in Calabria 170,000 H.P. will be made available, whilst in Sardinia 20,000 hectares of land can be watered, and power developed to the extent of 11,000 H.P., which in part can be utilised for pumping the water into the irrigation channels.

MEXICO.—The British Consul at Colima reports that the new Hydro-Electric Co. (German-Mexican) has completed the transmission line from its proposed power station to the distributing station in the city of Colima. The first power station, situated about 20 miles from Colima, on the Tuxpan River, is expected to generate some 6,000 H.P. According to its concession, the company can erect two other power stations higher up the river, as may be needed. On neither the first dam nor the power station has work been commenced. It is proposed to finance the undertaking in London, and the Consul advises intending investors carefully to study the situation.

SWEDEN.—The American Consul at Gothenburg, in a recent report, states that though electric supplies are extensively manufactured in Sweden, imports from foreign countries are considerable, especially from Germany. Lamps, sockets, insulators, wiring material and fixtures are all imported. Sockets are always of the American Edison screw standard. The demand may be said to be for rather cheap articles, which the dealers seem to handle almost to the entire exclusion of the more expensive grades. This is doubtless due to the fact that individual dwellings are few, and, comparatively speaking, the number of householders small. The population is housed almost entirely in apartments, and in the construction of them every expense possible is spared. There are usually from six to ten apartments in each house. The buildings are almost always of brick, though stone basements are frequently seen. In most of the buildings now being erected the wires are concealed within the walls and ceilings. For protection, metal-covered conduits (Bergmann's) are in general use. Both lead and steel are used. In the older buildings the wiring is run along the surface. It is customary for the owners of the apartment houses to put in the wiring, but the light fixtures are owned by the persons leasing the property. On April 1st, 1913, it was estimated that there were 12,845 consumers of electricity in Gothenburg, mostly for lighting, and it is estimated that 190,000 lamps of various sizes are in use. Electricity is also used to a certain extent for cooking and heating, and, of course, for general industrial purposes. Similar conditions prevail in Malmo, a city of 90,000 inhabitants, and second in importance to Gothenburg in the district. It is possible, however, that the consumption of electricity is relatively somewhat less in Malmo. There are, in addition, a number of smaller towns in which electricity for lighting and industrial purposes is in general use, among them Helsingborg and Jonkoping. Prices quoted to Gothenburg dealers are subject to a discount of 20 to 30 per cent. German manufacturers usually extend to the Swedish importers three months' credit, or even longer at times, if desired. For cash within 30 days a discount of 2 per cent. is allowed. Similar terms are given by Swedish manufacturers. There are no large dealers in electrical supplies in the district. The business is in the hands of contractors, who do installation work, and carry more or less limited stocks to meet their own needs and the general trade.

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These contractors import direct from foreign manufacturers or buy from the Swedish concerns. The municipal laws of Gothenburg require that a contractor must have a special licence before he may undertake to install electric wiring, the object being to ensure care and safety in installation.

In attempting to develop a market in Sweden, it should be borne in mind that the importers and dealers here are familiar with the metric system only. They are not disposed to concern themselves with catalogues that quote measurements in inches and feet, and weights in ounces and pounds. This is a matter of the utmost importance. If prices could be given in the currency of Sweden, that also would be an advantage, but it is not nearly so important as the question of measurement.

Importers in Sweden generally understand English, but in the electrical-supply business it is probable that German is read by more persons than English. If a catalogue is prepared for the German-speaking peoples, such a catalogue will prove very useful in Sweden, especially if the metric system is used and prices are quoted in German currency. It should be made very clear, however, that the catalogue is not that of a German house. This suggestion is made in view of the fact that it would hardly be advisable to prepare catalogues for Sweden alone.

The electric light plants in Gothenburg and Malmo and most of the other cities are the property of the municipalities. Supplies for them are obtained when possible from Swedish manufacturers, otherwise they are imported direct.

In 1910 there were two Swedish manufactories of electric lamps, and their combined output was valued at £62,000. The same year four factories were engaged in making insulating material, and the output was valued at £130,000. On the other hand, incandescent lamps to the value of £59,000 were imported in 1911, besides wiring material, insulated and uninsulated, £360,000; and Bergmann's conduits, £9,000. These latter appear to have been almost all of iron, with a few of brass or paper. Decidedly the most important item in the import of wiring was electric cables, sheathed with lead or armoured with iron, valued at over £200,000.

Germany supplied nine-tenths of the lamps, with a few from the Netherlands and other countries, and a similar proportion of the import of wiring materials of all sorts, conduits, and electric meters, with negligible imports from Great Britain and the Netherlands.

The export of electrical material from Sweden in 1911 was: Lamps, £11,000; wires and cables, £43,000. Russia was the largest purchaser.

Trade Announcements.—The Edison & Swan United Electric Light Co, Ltd., notify us that, owing to important Government business, they have been compelled to abandon the holidays fixed for the present week, and they re-opened on Monday last, August 3rd.

The business of the Rhondda Electrical Installation Co., of 25 and 125, High Street, Treforhy, has been taken over by Mr. David Lewis Short.

Messrs. Andrew Brown & Co., 118, Cannon Street, E.C. have been appointed sole agents for the United Kingdom for La Société Anonyme L'Industrie, of Louvain (Belgium), manufacturers of rolling stock for railways, tramways and mines, contractors' wagons, ore wagons, &c.

Catalogues and Lists.—Edward Duisberg, 28, Victoria Street, S.W.—Thirty-six-page catalogue, E14, giving full particulars, prices, &c., of Gunther twist drills, countersinks, reamers, sleeves, extension sockets, &c. The first few pages contain instructive data regarding drilling, grinding and lubrication.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C.—Leaflet describing an interesting application of overhead aluminium feeders, effecting a saving of 36 per cent. in cost of conductors.

British Thomson-Houston Co., Mazda House, 77, Upper Thames Street, E.C.—Price list, No. 10,160, of B.T.H. Edison carbon lamps, containing in addition to the usual data as to prices and candle-power, and information as to comparative tests on these and other lamps.

Union Electric Co., Ltd., Park Street, Southwark, S.E.—First number of the "Union Quarterly," a house journal, containing 16 pages of illustrated matter. No. 1 contains an article on belt driving, descriptions of the "Diamax" Excello arc lamp, and the Union Co.'s dynamo and motor works, and other matters of interest.

Igranic Electric Co., Ltd., 147, Queen Victoria Street, E.C.—Pamphlet No. 613, entitled "The Compulsion of Utility," describing the Igranic push-button control system.

Germany.—The cartel of German manufacturers of high-pressure cable, which expires on December 21st this year, is, says the *Elektrotechnische Nachrichten*, not likely to be continued beyond that date. Foreign competition and the need for expansion of certain firms, are obstacles to its continuance.

Book Notices.—"Programme of the Department of Technology, City and Guilds of London Institute, 1914-15."—London: John Murray. Price 9d. net.

"Regulations for Technical Schools, Schools of Art, and Other Forms of Provision of Further Education in England and Wales."—London: Wyman & Sons, Ltd. Price 2d.

Liquidations and Dissolutions.—Accumulator Industries, Ltd.—This company is winding up voluntarily, with Mr. A. W. Sully, of 19-21, Queen Victoria Street, E.C., as liquidator. A meeting of creditors is called for to-day (August 7th), at Winchester House (hall 43), Old Broad Street, E.C.

Dry Gas Electric Fire Extinguisher Co., Ltd.—This company is winding up voluntarily, with Mr. H. Keeling, of 109, Colmore Row, Birmingham, as liquidator.

The partnership between Messrs. F. J. Allen & E. C. Beman (trading as the Electrical Supplies Co.) has been dissolved by mutual agreement. All debts will be received and paid by Mr. E. C. Beman, who will continue to carry on the business under the same style as heretofore.

Foreign and Colonial Lighting, Ltd.—A meeting will be held at 3, 4 and 5, Broad Street House, New Broad Street, E.C., on September 4th, to hear an account of the winding-up from the liquidator, Mr. W. Reacher.

Bankruptcy Proceedings.—F. Behrens (F. Burns), electrical engineer, Barnsley.—A first and final dividend of 7s. 5d. in the £ is payable on August 7th at the Official Receiver's office, 21, King Street, Wakefield.

T. Moore, electrical engineer, Headingley, Leeds.—Adjudication order, July 27th.

T. M. Woodcock, electrical engineer, Sheffield.—A first and final dividend of 7½d. in the £ is payable on August 5th, at the Official Receiver's offices, Figtree Lane, Sheffield.

W. H. Davis (General Incandescent Fittings Co.), Saltley, Birmingham.—Trustee (A. S. Culley, Official Receiver), released May 28th.

J. W. Garsden (J. W. Garsden & Co.), electrical engineers, Blackburn.—Trustee (Mr. J. Smith, 27, Ainsworth Street, Blackburn) released July 22nd.

Turbine Contracts.—Orders recently received by Messrs. Boving & Co., Ltd., include the following:—

Piracicaba Hydro-Electric Co., Brazil.—One turbine of 1,400 H.P., for 22 m. head.

Kawasugawa Hydro-Electric Co., Japan.—One turbine of 730 B.H.P., for 81 m. head.

Dominion Portland Cement Co., New Zealand.—Two main turbines, each of 1,500 H.P., for 180 ft. head; two exciter turbines of 45 B.H.P.

Anglo-Japanese Power Co.—Two spiral Francis turbines, each of 2,900 H.P., for 295 ft. head.

F. Streets & Co., Oporto.—Two turbines, each of 73 H.P., for 18·2 m. head.

Pump orders have also been placed with them at Middlesbrough, Bolivia, Cairo, Wellington (N.Z.), and Nigeria for outputs up to 900 G.P.M., and heads up to 620 ft., and they have on order 18 Mendheim kilns for baking cassettes, for the British Aluminium Co., Kinlochleven.

Exhibition at Manchester.—We have received the prospectus of the "Second Northern International Engineering Exhibition," which is to be held under the auspices of the Northern Engineering Industries Exhibitors' Committee at Manchester from October 29th to November 20th, 1915. The directors are Messrs. C. H. Luke and F. W. Bridges, of 196, Deansgate, Manchester, from whom particulars can be obtained.

Holidays.—The Crypto Electrical Co.—The works are closed from August 3rd until August 10th.

LIGHTING and POWER NOTES.

Aylesbury.—Loan Sanction.—Subject to B. of T. approval of the site for the generating station, the L.G.B. has informed the U.D.C. that it is prepared to sanction a loan of £21,323 for E.L. purposes. The approval of the site has now been forwarded to the L.G.B.

As the time for carrying out the scheme expires on August 7th, the Council has secured a year's extension of time from the L.G.B.

Bexhill-on-Sea.—Loan Sanction.—The L.G.B. has sanctioned the borrowing by the T.C. of £2,150 for mains for the Little Common district, and booster machinery.

Bournemouth.—Bungalow Lighting.—Electricity is being supplied to beach bungalows from the cables along the front by the Bournemouth and Poole Electricity Supply Co. There are at present 126 of these structures.

Brentford.—Workhouse Lighting.—The B. of G. has decided to have electric lighting installed, by way of experiment, in two blocks at the Workhouse Infirmary. The service will be provided, free of charge, by the Heston and Isleworth U.D.C.

Brighton.—Loan Sanction.—The T.C. has received L.G.B. sanction to loans for electricity purposes, as follows:—£5,000 for mains; £3,000 for motors for hire; £2,500 for heating and cooking apparatus; and £450 for alterations and additions to the North Road offices.

Canterbury.—Electric Vehicle Charging.—The T.C. has fixed a tariff of 1d. per unit for charging electric vehicles, except during the winter, from sunset to 9 p.m., when the charge is to be 3d. per unit, with a minimum charge of 2s. in each case.

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Cardiff.—Annual Report.—In his report of the working of the Corporation electricity undertaking for the year ended March 31st last, the borough treasurer states that the income was £58,704, an increase of £5,351 on the previous year, and the gross profit was £22,768, an increase of £1,480. At the presentation of the report to the Council, Mr. Arthur Ellis, the borough electrical engineer, stated that the surplus in hand was £10,502, and the number of units sold, 6,883,797, was an increase of 656,910. At his instigation a resolution was passed providing that the profit on the undertaking should be carried to the revenue account. The department purchased from the Roath tramway power station 7,548,277 units and generated 664,177 units at its Eldon Road station.

Cassop.—Street Lighting.—The P.C. has accepted the offer of Messrs. Bell Bros., of Bowburn Colliery, to light Bowburn Village and Hengh Hall with electricity, at 45s. per 50-c.p. lamp, and 40s. per 32-c.p. lamp, per annum.

Cefn Mawr.—Proposed E.L.—A Ruthin company has informed the P.C. that it intends applying for a prov. order for E.L. at Cefn Mawr, Acrefair, and Rhosymedre, and the Council, before consenting to the application, has decided to seek further information.

Cleckheaton.—Proposed Loan.—The U.D.C. has decided to apply to the L.G.B. for sanction to borrow £8,085 for plant extensions, &c., at the electricity works, including one 400-kw. mixed-pressure turbine and direct-driven, D.C. generator, with surface condensing plant, £3,600; water filter and pipe work, £850; switchgear and connections, £500; extension boiler, with setting and superheater, £1,400; buildings and alterations, £1,000; and sundries, £735.

Connah's Quay.—Proposed E.L.—In connection with the proposed E.L. scheme, the U.D.C. has decided to include the village of Northop in the area of supply.

Continental Notes.—Austria.—The T.C. of Vienna has purchased the undertaking of the Allgemeine Oesterreichische Elektricitäts-Gesellschaft, for 11,400,000 kronen, and the company has gone into voluntary liquidation.

Finland.—According to the *Times*, the Finnish Senate is discussing the scheme for obtaining electrical power from the Imatra Waterfall, one of the largest unused water powers in Europe. The scheme provides for a yield of 300,000 H.P., and the station is expected to generate 1,600 milliards of KW.-hours per annum, or sufficient to supply the lighting, tramway and electric railway requirements of St. Petersburg and Wiborg, and also the St. Petersburg manufacturing district.

A scheme for harnessing the Volkhov Rapids, between Lakes Ladaga and Illmen, is being discussed afresh.

Russia.—A company has acquired a huge stretch of peat land near Moscow with a view to generating electricity from the peat. A generating station, said to be one of the largest in Europe, is to be erected. The current is to supply the villages and factories in the immediate neighbourhood, and is also to be transmitted to Moscow.—*Elektrotechnische Nachrichten.*

Darwen.—Annual Report.—The net profit of the electricity department during the past year was £972, against £912 in 1913. The balance was £2,261, out of which £1,000 was transferred in aid of the rates, and £70 applied towards improvements to the switchboards at the works; thus leaving a disposable balance of £1,191, out of which it is proposed to transfer a sum of £500 in aid of rates during the current year. In the case of the tramways, the year's working resulted in a net profit of £418, which reduced the deficit on this department to £1,077.

East Ham.—Annual Accounts.—The accounts of the electricity undertaking for the year ending March 31st last show a total income of £32,626, an increase of £2,402. The expenditure £20,228, was an increase of £3,136; the gross profit was £12,398, a decrease of £734 as compared with the previous 12 months. After meeting all charges, there remained a surplus at the close of the year of £955. In making any comparison between this figure and the surplus at the close of the previous year, the Electricity Committee states that it must be borne in mind that in the latter case the surplus of £1,582 was smaller to the extent of £454 by a transfer from tramways fund in respect of the adjustment of loan debit.

Eccles.—New Charges and Loans.—The T.C. is prepared to re-charge electric vehicle batteries at the rate of 1d. per unit, other than at peak load hours. The E.S. Committee has decided to reduce the charge for the supply of energy for cooking, heating and domestic purposes, other than lighting, from a sliding scale of 3d. to ½d. per unit, to a flat rate of 1d. per unit, as from April 1st last. Application is to be made to the L.G.B. for sanction to the borrowing of £4,000 for E.L. mains during the next four years; and £450 for a coal conveyor and elevator.

Edinburgh.—Annual Report.—Treasurer Macleod, in his financial statement to the Council, mentioned that the balance on the electric light account at the close of the year and available for appropriation was £3,834. The total revenue was £145,022, and the total expenditure was £141,187. The working expenditure was £79,957. Interest and sinking fund contributions amounted to £61,230. Despite price reductions, the revenue amounted practically to the total estimated on the original scale of charges.

Gillingham (Kent).—Proposed Loan.—The T.C. has applied to the L.G.B. for sanction to a loan of £5,000 for mains and services, to be increased to £7,500 in order to include sub-stations.

Gloucester.—Annual Report.—In his report on the past year's working of the Corporation electricity department, the electrical engineer, Mr. F. H. Corson, states that the revenue amounted to £15,125, an increase of £650 over the previous year, and the working expenses to £7,509, an increase of over £200. Capital charges totalled £7,021, leaving a surplus of £595, compared with last year's deficit of £106. The output was over 1,900,000 units, including private lighting, 600,000, an increase of 33,000; power, 590,000, an increase of 167,000; tramways supply, 467,000; and street lighting, 207,000.

Grimsby.—Proposed Loan.—The Lighting Committee has recommended the T.C. to apply for sanction to a loan of £24,500 for the extension of the plant at the electricity works, in addition to the £5,000 referred to in our last issue. It was mentioned that, in view of the probable industrial development of the town, a H.T. system of supply would be necessary.

Hereford.—Loan Sanction.—The T.C. has received from the L.G.B. sanction to a loan of £2,530 for electricity purposes, including £1,500 for mains.

Heston-Isleworth.—Loan Sanction.—Sanction has been received by the U.D.C. to the borrowing of £3,569 for E.L. cables, and £1,200 for prospective expenditure on mains. An electric car is to be purchased from the Opel Motor Co., at a cost of £185.

Japan.—In the town of Gifu, as the outcome of a public protest against the high rates charged for electric lighting, a number of citizens recently attempted to set fire to one of the buildings of the Electricity Co. The police intervened, and over 30 persons were arrested.

Llandyssul.—Proposed E.L.—As a result of a canvass, by which 1,151 shares have been taken up, the promoters of the E.L. undertaking have decided to engage an expert to prepare a scheme.

London.—Islington.—The B.C. has had under consideration schemes prepared by the electrical engineer for the extension of mains, and the provision of sub-stations, additional boilers, coal storage, &c., in connection with the undertaking. Mr. Albion T. Snell has been appointed at a fee of 100 guineas, to report on the scheme.

The Lambeth B.C. has been in correspondence with the South London Electric Supply Corporation with regard to the increase of price of electricity in the area, and the directors have agreed to meet the Council's representatives to discuss the matter.

Woolwich.—New Mains.—The B.C. has decided to expend £1,107 on an E.L. main from Bowling Green Row to Frances Street, and an additional main to the Royal Military Repository.

Maidenhead.—Year's Working.—The E.L. Committee reports that a profit of £370 was made on the past year's working of the T.C.'s electricity undertaking. £560 was paid out of revenue for works, which might have been charged to capital, and £1,800 was absorbed by loan charges.

Middlesex.—A letter was read at the County Council meeting on the subject of the electricity supply in bulk. The L.C.C. asked that the Council would appoint representatives to a conference, to include representatives of Surrey, Essex and Herts. The chairman (Mr. W. Regester) said the proposal they made was to deal with the matter in the same way as they did the trams. Alderman Burt said about £90,000 was spent by them on energy for the trams. They therefore would have to consider the question of the trams and the supply of current. The Council ought to make direct nomination to the conference. A member thought the whole matter ought to be considered by a Committee first, and then, after they had reported, to consider who should go to the conference, if anyone. Mr. Dobson asked if the Council could get out of their contract with the company. The Council appointed the chairman, vice-chairman, Alderman Vintsham and Mr. Marlow Reed to attend the conference and report.

Newport.—Proposed Loan.—The Electricity and Tramways Committee has recommended the T.C. to obtain a loan of £16,000 for new mains.

Norwich.—Annual Report.—According to the report of the Electricity Committee for the year ended March 31st last, the output was 7,784,695 units, an increase of 1,312,309 units over the preceding year. The total includes 4,285,242 units for power, an increase of 799,055; 2,737,075 for private lighting, an increase of 262,773 and 762,378 for public lighting, an increase of 250,481. During the year £8,004 was expended on the undertaking, including £4,063 for the completion of the public lighting. The surplus of £4,473 has been placed to the depreciation fund, from which £9,800 was written off on account of obsolete machinery, and which now stands at £9,663. The consumers number 6,221, of whom 3,878 are supplied on the free wiring system. During the year a contract for a 3,000-kw. 6,600-volt turbo-alternator was placed with Messrs. Parsons.

Plymouth.—School Lighting.—The Education Committee has decided to have electric lighting installed at Cattedown Road and Oxford Street Schools.

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Penyfford.—PROPOSED E.L.—It is proposed to form a company for the purpose of supplying electricity to the parish, but before definite action is taken, the ratepayers have decided to ascertain whether the Hawarden R.D.C. intends taking any steps for lighting the parish.

Rochester.—STREET LIGHTING.—The T.C. has accepted a scheme submitted by the Kent E.P. Co. for lighting the High Street. The details are:—70 lamps; capital expenditure, £570; annual cost, £548; annual cost if certain lamps are turned out at midnight, £495. A competing scheme was submitted by the Gas Co., with 53 lamps; capital expenditure, £500; annual cost, £522; annual cost if certain lamps are turned out at midnight, £473.

Ross (Herefordshire).—STREET LIGHTING.—The U.D.C. has invited the E.L. Co. to compete with the Gas Co. for the lighting of 172 public lamps for three years from September 29th next.

South Africa.—The Mossel Bay (Cape Province) Municipality proposes to borrow £11,593 for an electric lighting scheme. —*Board of Trade Journal.*

St. Annes-on-Sea. — PROMENADE LIGHTING. — The U.D.C. has decided to proceed immediately with a scheme of electrical illuminations for the Promenade, extending over half a mile.

Street.—PROV. ORDER.—Messrs. Christy Bros. & Co., of Chelmsford, have informed the U.D.C. that they intend applying for a prov. order for E.L. in its area.

Sutton.—BULK SUPPLY.—The B. of T. has intimated its intention to authorise the County of London E.S. Co. to supply electricity in bulk to the South Metropolitan Tramways and Lighting Co.

Wallasey. — PROMENADE LIGHTING. — The borough engineer has been instructed to report upon the question of lighting the promenade.

Walsall.—NEW GENERATING STATION.—A report on this matter has been presented to a special meeting of the T.C. The scheme has received Government sanction, and on the advice of the L.G.B. it is intended to complete by next summer the second part of the scheme which it was originally intended to defer till 1916. Considerable mains extensions were recommended.

Warrington.—YEAR'S WORKING.—On the past year's working of the Corporation electricity undertaking, a net profit of £2,935 was made. The income from lighting supply and power supply increased by £714 and £3,283 respectively. The average price per unit for lighting was 3·47d., and for power 0·968d.

Watford.—METER LOAN REFUSED.—In sanctioning a loan by the U.D.C. for electricity purposes, the L.G.B. has refused to allow a sum for meters, suggesting that the cost should be met out of revenue. The electrical engineer and the chairman are to interview the L.G.B. officials with a view to the meter loan being sanctioned. Current for heating and cooking at hotels, &c., is to be supplied, subject to circumstances, at 1d. per unit.

Wednesbury.—YEAR'S WORKING.—The loss on the working of the Corporation electricity undertaking last year was £552, as compared with £96 the year before. The report stated that considerable repairs were carried out during the year owing to breakdowns of gas engines, pumps and boosters. The units sold increased by 152,944. In order to meet next winter's load, it is proposed to obtain a 300-KW. converter, transformer and switchgear, at a cost of £1,086.

Whitehaven.—The General Purposes Committee has decided to light with electricity the new roads on the colliery company's housing estate, on the understanding that electricity is adopted for the domestic lighting of the houses.

Windermere.—GARDEN LIGHTING.—The U.D.C. has decided to have the Victoria Gardens illuminated by electricity.

Wrexham.—YEAR'S WORKING.—The income of the T.C.'s electricity undertaking for the past year was £9,203, the gross profit was £3,651 and the net profit was £455. The output was 846,264 units.

York.—OVERHEAD WIRES.—The T.C. has applied to the B. of T. for consent to erect overhead mains from the river Ouse to the Fulford pumping station, for the transmission of electricity at 3,000 volts.

TRAMWAY and RAILWAY NOTES.

Argentina.—The plans presented by the Buenos Ayres Western Railway Co. relative to the erection of an electric power station have been approved by the Government. This station is to supply the energy required for the electrification of the company's suburban service between Plaza Once and Moreno, and the tunnel route to the Port of Buenos Ayres.—*Review of the River Plate.*

Baildon (Yorks.).—LOAN SANCTION.—The B. of T. has sanctioned the U.D.C.'s application for powers to borrow £21,500 for constructing a tramway from the terminus at Baildon Bridge to Lane End, Baildon. The Bradford Corporation will construct the tramway on behalf of the Council, and will lease the running powers. Electricity will be supplied by the Shipley U.D.C.

Birkenhead.—ANNUAL REPORT.—The annual report of the tramways manager states that the total receipts for the past year were £68,607, an increase of £6,534 over the previous year; working expenses were £41,391; capital charges amounted to £21,503; and there was a balance of £5,712, which has been placed to the renewals fund, which now amounts to £22,655. The net profit shows an increase of £1,411, and working expenses increased by over £5,000. The number of passengers carried increased by 1,545,597.

Cardiff.—ANNUAL REPORT.—The report of the borough treasurer on the working of the Corporation tramways department for the year ended March 31st last states that the traffic receipts were £142,040, an increase over the previous year of £12,776. The expenditure amounted to £99,563, an increase of £15,270. Loan charges amounted to £46,955, and the surplus was £18,594, a decrease of £1,732. Of the surplus, £6,946 was placed to the depreciation fund, and £4,800 to the relief of the rates. The depreciation fund now stands at £70,118. The passengers carried during the year numbered 31,122,962, an increase of 2,757,685, and the car-mileage was 2,966,230, against 2,614,901.

Continental Notes.—AUSTRIA.—The State Railway Administration has been experimenting with the lighting of railway carriages, with a view to the general introduction of electric lighting. Some 350 electric lighting equipments have been installed, and as a result of the experiments a printed instruction has been issued for the guidance of prospective tenderers for this class of material. It is to be obtained on application to the Nordbahndirektion, Vienna.

East Ham.—ANNUAL REPORT.—The total tramway income for the year ended March 31st last was £55,747, a decrease of £2 222. The gross profit for the year was £6,741, against £12,161 for 1912-13, a decrease of £5,420. After charging interest on, and repayment of loans, and also the sum of £573 in respect of outstanding debt, there remains a deficiency of £6,238, which with the accumulated deficiency at the commencement of the year makes a total deficiency of £7,455. The Council is not, apparently, entitled to call upon the ratepayers to provide any deficiency except to the extent to which the deficiency exceeds the amount standing to the credit of the reserve or depreciation and renewals account, *i.e.*, £4,002.

Edinburgh.—NEW TRAMWAY.—The T.C. is to take steps to obtain power to construct a tramway to Colinton, *via* Craiglockhart.

Gloucester.—ANNUAL REPORT.—The general manager, Mr. F. H. Corson, reporting on the working of the Corporation tramways undertaking during the past year, states that the passengers carried numbered 4,415,555, and the car mileage totalled 638,646. The total revenue was £18,018, an increase of £670 over the previous year, and the working expenses were £13,881, an increase of £100. Capital expenditure amounted to £5,246, and £4,370 was tranferred to the tramways account from the rates, to meet loan charges.

London.—L.C.C.—The Southwark B.C. Works Committee has no objection to the proposal to connect the Blackfriars Road tramway with the tramway terminus at Waterloo Station, *via* New Cut and Great Charlotte Street. The Westminster City Council has agreed to interview the Highways Committee of the L.C.C. in regard to the proposal to connect up the tramways at Victoria and Westminster Bridge *via* Victoria Street, Parliament Square, &c., although no support can be relied on from it.

On Monday evening an L.C.C. tramcar coll ded with a stationary car in King William Street, Greenwich. Nineteen passengers were slightly injured, and both cars were considerably damaged.

Manchester. — TRAFFIC REPORT.—The question of traffic congestion in Manchester, which recently formed the subject of an exhaustive report by Mr. J. M. McElroy, the tramway manager, is now dealt with in an equally full report by Mr. J. H. Thewlis, chairman of the Watch Committee, and Mr. Robert Peacock, chief constable, who have visited London, Paris, Berlin, Dresden, Munich, Hamburg, Vienna, New York, Chicago, Philadelphia, Boston, Toronto and Montreal. In regard to the tramways, the report states that the effect of the withdrawal from the central area of two-thirds of the cars using the tracks therein, would at once considerably relieve the normal street traffic. The time has arrived when the Watch Committee must seriously consider the extent of the tram service in the central area, the obstruction caused to general traffic, and also the public convenience.

Oldham.—A REPORT.—The Tramways Committee of the Oldham Corporation on July 30th considered and revised the draft report on the chairman's inquiry into the administration of the tramways department, and it is understood that the Committee finds that the charges against the administration are for the most part groundless, and no blame is attached to the manager.

Salford.—NEW LOANS.—The T.C. proposes to borrow £28,073 for new tramcars, of which £7,640 is for 12 car bodies without covered tops, but with vestibule ends, and £9,560 for 12 car bodies with covered tops and vestibule ends. The

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Electricity and Tramways Committee has also recommended the Council to borrow £1,398 for an A.C.-D.C. switchboard, and £914 for a three-phase extra high-pressure switchboard.

South Shields.—Electric 'Buses.—A service of electric omnibuses, to work in conjunction with the tramways, was inaugurated last week by the T.C. The vehicles, constructed by Messrs. Edison Accumulators, Ltd., were described recently in our pages, and are to maintain a 15 minutes' service over a route of 1¼ miles. At the opening ceremony, Mr. Robson, the tramways manager, stated that the power cost would be very little more than 1d. per mile, while a similar vehicle driven by petrol would cost 3d. per mile. They would also obtain quieter and smoother running, and would open a new source of revenue for the electricity and tramways departments.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—The Government of the Province of Buenos Ayres has received an offer for the renting of the provincial telegraphs by a company to be formed, with a capital of $5,000,000. The profits would be divided between the Government and the shareholders.—*Review of the River Plate.*

Atlantic Cables Cut.—The cutting of the cables of the Commercial and German Atlantic Cable Companies at the Azores is announced at the offices of the Commercial Cable Co. The cutting of the cables between the Azores and the Continent in no way affects the main body of the commercial cables, and communication between the United States and England is still intact. The Commercial Cable officials state that the cutting was done by British vessels.

Automobile Wireless Telegraph Stations.—What is claimed to be a notable advance in the construction of portable wireless sets for army field service has recently been made by the Signal Corps of the United States Army. For the next field operations of the Army, there is now available a motor wagon equipped with wireless telegraph apparatus which can be set up for use in 12 minutes, and can send messages within a radius of no less than 800 miles under favourable conditions. The vehicle was built specially for the Signal Corps, by the White Co., of Cleveland. In tests that have already been made, the set is stated to have received messages from points 2,500 miles distant. The great range of the equipment and the speed with which it can be brought into action, are said to be due to the employment of a powerful electric generator driven through a train of gears by the 30-H.P. petrol engine of the vehicle. The antennæ are of the umbrella type, mounted at the top of an 85-ft. mast, which is built in nine sections. The first, or top section, is raised by hand, but the others are lifted by a block and tackle suspended from struts mounted on a platform on the roof of the vehicle, which can be quickly detached when not in use. When disassembled the nine sections of the mast are carried in long compartments built along both sides of the motor-wagon. The counterpoise or artificial earth consists of heavy insulated wires radiating from a common centre, to which is attached the earth wire of the wireless set. Preliminary tests with a wireless receiving equipment installed by the Marconi Wireless Telegraph Co. have also recently been made between the American Building Wireless Station in Baltimore, and a motor-wagon used by the Electrical Commission for pumping water from manholes throughout the city. Wireless signals were received by the equipment as far as seven miles in the suburbs, also while the car was running, or standing at the manholes in the city limits. The equipment consists of a standard Marconi receiving apparatus, similar in detail to the equipment used on board merchant vessels. The receiving antenna consists of about 95 insulated wires hung in the roof of the car. The frame of the vehicle acts as the earth connection, although it is insulated from the ground by the rubber tires. The Fire Brigade Authorities of Baltimore are interesting themselves in the tests, as it will probably be possible to equip fire engines and other apparatus with the receiving instruments, so that when sent out, they could be instantly recalled, saving time and trouble and increasing fire protection to the city by reason of the engines always being in touch with headquarters.

Experimental Wireless Stations.—The Postmaster-General has issued instructions for the closing of all experimental wireless telegraph stations in this country, and will be glad to receive from any quarter information of any wireless station which may be observed to be kept up in contravention of his orders.

The formation of a volunteer corps of the 2,000 holders of licences for experiments in wireless telegraphy has been suggested by Mr. W. Le Queux to the Postmaster-General.

Foreign Telegrams.—Ordinary telegrams for places abroad and radio-telegrams, however addressed, are now only accepted if written in plain English or French, and at sender's risk. They will be subject to censorship.

Telegraphs and Telephones on the Continent.—Telephonic communication was stopped between the various Continental nations involved in the war towards the end of last week, to prevent the leakage of news. Communication by telephone between London and Paris ceased on Monday, and delays in telegrams to the Continent and to the Far East were announced on Saturday.

Wireless in Warfare.—It is reported that the German wireless station at Swakopmund has increased its power and is sending out signals intended to "jam" those issued from British stations.

Wireless Telegraph Regulations.—The Government has assumed control of all wireless telegraph stations in the British Isles, and the Board of Admiralty has prohibited the use of wireless telegraphy by merchant vessels in the territorial waters of the United Kingdom and the Channel Isles. The wireless apparatus is to be dismantled on any ship entering a port or harbour. Similar precautions have been taken by the Governments of British Dominions and Colonies.

CONTRACTS OPEN and CLOSED.

OPEN.

Argentina.—Rauch.—The City Council has authorised the Mayor to call for tenders for the construction of electricity works.

Australia.—Sydney.—August 31st. Sydney Harbour Trust. Four electrically-operated semi-portable travelling cranes. Forms of tender from Mr. H. F. Norrie, Secretary to the Trust, Sydney.

September 14th. Municipal Council. 22,500 yd. of 33,000-volt, three-core, paper-insulated, lead-covered cable. Deposit £200. Specification, 10s. 6d., from the City Electrical Engineer; a copy may be seen at the B. of T. Commercial Intelligence Dept., London.

Richmond.—Nov. 30th. Refuse destructor and auxiliary plant. Specification, &c., from Mr. C. C. Blazey, Town Clerk, Richmond, Victoria.

Brisbane.—September 2nd. Measuring instruments, protectors and parts, telephone and telegraph instruments, for the Postmaster-General. See "Official Notices" July 31st.

Adelaide.—Sept. 9th and 23rd. Telephone material, microphones, protectors, &c., switchboards, bells and cells, for the Postmaster-General. See "Official Notices" July 31st and to-day.

Adelaide Tramways Trust.—September 1st. One booster set, with cables and spares.—*Australian Mining Standard.*

Melbourne.—August 18th. Electricity recording meters and carbon brushes, for the Melbourne City Council. See "Official Notices" July 31st.

September 23rd. 102 electric motors, starters, switchboards and wiring for installing electrical drive at Messrs. Sands & McDougall, printers. Mr. M. C. Coates, consulting engineer.—*Tenders.*

Victorian Railways Department.—October 7th. Motors and switchgear, and motor-driven air compressors for the Ballarat and Bendigo workshops.

Belfast.—August 24th. Corporation. One electric motor tower-wagon. See "Official Notices" July 31st.

Birkenhead.—August 10th. Corporation. Cooling tower. See "Official Notices" July 24th.

Bulgaria.—The Bulgarian Administration of Finances, in Sofia, is inviting tenders until the 13th inst. for the installation and equipment of a central station for lighting and power purposes at the port of Bourgas.

Earsdon (Northumberland).—August 15th. U.D.C. For the supply of poles, cables, lamps, &c., in connection with the extension of public lighting. Particulars from Mr. J. R. MacMillen, Surveyor, Council Offices, Shiremoor.

Eastbourne.—August 18th. Corporation. Main machine and feeder switchboard for the electricity works See "Official Notices" July 24th.

Edinburgh.—August 17th. Corporation. Extensions to the electric lighting installation at the City Museum. Specification from the Engineer's office, Dewar Place.

France.—The French State Railway Authorities (Bureaux du Service Electrique, 3me. Division) in Paris (72, Rue de Rome) are inviting tenders until the 25th inst. for the installation of the principal and secondary mains required in connection with the electric lighting and power installation at the car-sheds at Auteuil and La Garenne, near Paris.

Kingston-upon-Hull.—August 22nd. Corporation. Electrical fittings for the Guildhall Council Chamber, &c. See "Official Notices" July 24th.

Lisnakea.—August 15th. Wiring the workhouse and auxiliary buildings with necessary fittings, &c., for the B. of G. Specifications from Mr. J. O'R. Hoey, Clerk.

London.—August 12th. Office of Works. Supply of electric clocks on a rental basis in the London districts, for the Commissioners of His Majesty's Works. Particulars from the Controller of Supplies, H.M. Office of Works, 18, Queen Anne's Gate, S.W.

L.C.C.—September 8th. Cables, H.T. and L.T., and laying stoneware ducts (tramways). See "Official Notices" to-day.

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Matlock.—August 8th. U.D.C. 1,967 yards of patent steel wire tramway cable. Specifications, &c., from C. P. Foster, Esq., Tramway Manager, Town Hall.

Newport (Mon.).—August 17th. Corporation. Converting plant, &c. See "Official Notices" July 31st.

Nuneaton.—August 11th. Corporation. Underground cables. See "Official Notices" July 31st.

Oldham.—August 16th. Corporation. D.C. motor-generator and extension to E.H.T. switchboard. See "Official Notices" July 24th.

August 24th. Corporation. Three economisers and three induced-draught fans and motors. See "Official Notices" July 31st.

August 24th. Corporation. Storage battery, reversible booster and switchgear. See "Official Notices" to-day.

Palmas (Majorca).—Tenders are invited by the Compañia General de Tranvias Electricos Interurbanos de Palma de Mallorca, for the rolling stock and permanent way material required for the whole of their line.

Rugby.—August 12th. Electric light installation at the Harborough Magna Hospital, for the Joint Hospital Board. Mr. M. E. T. Wratislaw, Clerk, 16, Church Street.

Spain.—Tenders have been invited by the municipal authorities of Bustaviejo (province of Madrid) for the concession for the electric lighting of the town.

The Spanish Ministry of Public Works (Ministerio de Fomento) in Madrid, is inviting tenders until September 9th for the concession for the construction and working of an electric tramway between Ferrol and Santa Maria de Neds.

Stockton (N.S.W.).—August 15th. Corporation. Electric lighting for a period of 10 years. The Municipality of Stockton. About 80 lights. Specifications from Mr. J. W. Oldham, Town Clerk.

Sunderland.—August 18th. Corporation. Two 1,500-KW. motor-generators or rotaries. See "Official Notices" July 31st.

Swinton and Pendlebury.—August 19th. U.D.C. Cables, fittings, &c. See "Official Notices" July 31st.

Walsall.—August 11th. Corporation. Coal conveyer and measuring apparatus, jib coaling crane, ash-handling plant, travelling crane. See "Official Notices" July 17th.

August 12th. Corporation. 7,000 tons of rough slack coal for the electricity works. Particulars from Mr. H. A. Howie, Engineer and Manager, Wolverhampton Street.

Walthamstow.—August 19th. U.D.C. Supply and delivery of tramway rails, castings, fishplates, &c. Forms of tender from Mr. E. Morley, Surveyor to the Council.

West Hartlepool.—August 17th. Corporation. Machine tools for tramways depôt workshops. See "Official Notices" July 31st.

CLOSED.

Aylesbury.—The U.D.C. has received the following tenders for accumulators :—

	Batteries of		
	About 500 amps.	About 800 amps.	About 560 amps., installed with cells to enable additional plates to be added to increase the capacity to 800 amps.
E. T. Mackrill & Sons	£988	£1,415	£1,142 (accepted)
Premier Accumulator Co., Ltd. ..	969	1,434	1,190
Pritchett & Gold, Ltd.	996	1,478	1,151
Chloride Electrical Storage Co. ..	998	1,425	1,152
D P. Battery Co.	1,010	1,411	1,150
Electrical Power Storage Co., Ltd.	1,015	1,527	11,179
Hart Accumulator Co., Ltd. ..	1,031	1,486	1,185
Tudor Accumulator Co., Ltd. ..	1,098	1,545	1,250

The Council has also accepted the tender of Messrs. Johnson and Phillips, Ltd., for a switchboard, at £408 15s., including £24 for additional voltmeters. Tenders for cables are deferred pending definite agreements with firms requiring large supplies of current for power.

The tender of Messrs. Broom & Wade, Ltd., has been accepted for pumping machinery, with a 4-KW. electric dynamo, &c., at £4,292.

Bexley.—The U.D.C. has provisionally accepted the tender of the British Insulated & Helsby Cables, Ltd., for 3,500 yards of feeder cable for the Foot's Cray district, at £1,200.

Birkenhead.—The T.C. has accepted the following tenders for coal for the generating station :—

Hulton Colliery Co., Ltd.—10,000 tons.
Mr. C. Wass.—1,000 tons.
W. B. Dobill & Co., Ltd.—1,000 tons.

Bolton.—The Electricity Committee has accepted the tender of Messrs. J. B. Scholes & Sons for 15,000 tons of coal, and provisionally accepted the following tenders :—

British Westinghouse Co., Ltd.—Two 1,000-KW. and two 600-KW. rotary converters, for Spa Road works and Bradshawgate sub-station.
British Thomson-Houston Co.—Extra high-tension three-phase switchgear.
Johnson & Phillips.—High-tension single-phase switchgear, for Back o'th' Bank generating station and Bradshawgate sub-station.

Canterbury.—The T.C. has accepted the following tenders for coal for the electricity works :—

Wm. Cory & Son.—1,800 tons of Rochester house screenings, 17s. 10d. per ton.
J. Eveson Coal & Coke Co., Ltd.—400 tons of Glyc Merther Welsh steam coal, £1 7s. per ton.

Colne.—Messrs. Hartley & Leek have received contracts for the installation work at the New Hippodrome (288 points), and for lighting and bells at the Commercial Hotel.

Croydon.—The T.C. has accepted the offer of Edison Accumulators, Ltd., at £516, for the supply of an Arrol-Johnston chassis for a motor vehicle for the Electricity Department. The tender of Wm. Cory & Sons, Ltd., has also been accepted for 15,000 tons of either Muirfield peas at 16/3 per ton, or Hill House washed peas at 15/11 per ton, at the Electricity Committee's option.

Derby.—The T.C. has accepted the tender of the Rees Roturbo Co., at £193, for a boiler feed pump; and that of Messrs. Mossay & Co., at £297, for an electric vehicle. The E.L. Committee recommends that the tender of Messrs. Aiton & Co., at £387 10s., for pipework, be accepted.

Eccles.—The Electricity Committee has accepted the tender of the Earl of Ellesmere for 12 months' supply of slack, at 10s. 9d. per ton.

Erith.—The U.D.C. has accepted the following tenders for coal for the electricity works :—

Beadle Bros., Ltd.—South Hetton coal for a year, 14s. 6d. per ton.
H. W. Clarke & Co.—Best wharf screenings for a year, 14s. 5d. per ton.

Lancaster.—The T.C. has accepted the tender of the Lune Valley Engineering Co., for a dynamo, battery, &c., for the motor fire engine, at £32.

Leeds.—The Corporation has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for a 13,000-KW. turbo-alternator with condensing plant, for the Whitehall Road generating station, at a cost of £34,160, subject to borrowing powers being obtained. Considerable discussion took place on the proposal, Mr. Foster objecting to part of the contract (for the turbine) being let to a Swiss instead of a British firm, but it was finally carried by a large majority.

Leyton.—The U.D.C. has accepted the tender of Mr. A. C. Brown, for £32, for a fire-alarm indicator, switchboard and accessories.

London.—WANDSWORTH.—The B.C. has provisionally accepted the tender of Messrs. J. A. Henderson & Co., at £103, for installing electric light at the Balham Baths.

Luton.—The Electricity Committee has accepted the tender of Messrs. Mechan & Sons, Ltd., for £746, for a coal elevator and conveyer.

Salford.—The T.C. has accepted the following tenders for the supply of materials and stores during the period ending March 31st next :—

Stern Sonneborn Oil Co., Ltd.—Russian white oil, £50.
G. Painter & Co.—Rubber insertion, ditto rings, and brass joint-rings, £21 6s. 11d.
H. G. Mabbs.—Motor starters, £375 18s.
Le Carbone.—Motor carbon brushes, £95.
Ferranti, Ltd., General Electric Co., Ltd.—Alternating-current meters, £182 14s.
Chamberlain & Hookham, Ltd.—Continuous-current meters, £810 12s.
W. T. Henley's Telegraph Works Co., Ltd.—Rubber strip, £48 10s.
G. Hattersley & Sons, Ltd.—Plain white tape, £16.
Pirelli, Ltd.—Rubber gloves and rubber caps for cables, £11.
Electrical Engineering and Equipment Co., Ltd., and W. T. Glover & Co., Ltd.—Twin and multiple-core cable, £81; concentric cable for working pressure up to 660 volts, £143; ditto, up to 3,300 volts, £80; extra-high-tension three-core cable, £1,515.
W. T. Glover & Co., Ltd.—Rubber-covered cable for working pressure not exceeding 660 volts, £78; ditto, not exceeding 250 volts, £70; twin flexible cable, £20; rubber-covered cable for working pressure not exceeding 3,300 volts, and ditto for working pressure not exceeding 6,600 volts, at schedule prices.
Brush Electrical Eng. Co., Ltd.—12 car bodies without covered tops but with vestibule ends, £7,641; 12 car bodies with covered tops and vestibule ends, £9,561.
The J. G. Brill Co.—48 trucks, £3,262.
British Westinghouse Elec. and Mfg. Co., Ltd.—12 car electrical equipment sets, £3,048.
Dick, Kerr & Co., Ltd.—10 car electrical equipment sets, £2,720; 44 controllers, £1,474.
Siemens Bros. Dynamo Works, Ltd.—Two car electrical equipment sets, £441; four controllers, £127.
F. M. Prockter & Co., Ltd.—Supply and erection of three suspended iron gangways at the central car depôt, £307.
British Westinghouse Elec. and Mfg. Co., Ltd.—Extension of high-tension switchgear and supply of control panels in connection with 5,000-KW. turbo-alternator, £807.
J. Peach.—Three 170-KW. motor-alternators, with switchgear, £270.
Bertram Thomas.—Three-phase continuous-current switchboard (including £30 for instruments), £1,898.
British Westinghouse Elec. and Mfg. Co., Ltd.—Three-phase extra-high-pressure switchboard, £914.
R. H. Carlisle & Co., Ltd.—16-H.P. Darracq motor-car, £318 15s.

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The following tenders have been accepted for coal for the Electricity Department :—

Clifton and Kersley Coal Co., Ltd., 1,800 tons of No. 2 best washed slack 12s. per ton; A. Knowles & Sons, Ltd., 8,000 tons of best washed slack 12s. per ton; Earl of Ellesmere, 3,000 tons of Bridgewater coal, 12s. per ton, and 4,500 tons of best washed slack, 12s. 3d. per ton.

Swansea.—The B.C. has accepted the following tenders :

British Westinghouse Co.—Main generating station switchgear, £1,377.
Ferguson, Pailin & Co.—Sub-station switchgear, £547.

Wallasey.—The tender of the Brush Electrical Engineering Co. has been accepted by the Corporation for the supply of six double-deck cars with top covers, complete with trucks and electrical equipment.

Walsall.—In connection with the new generating station the Electricity Committee has accepted the following tenders :—

W. Kendrick & Son, Walsall.—Buildings, £9,214.
Belliss & Morcom, Birmingham.—Turbines, alternators, &c., £17,448.
Babcock & Wilcox.—Boiler-house plant, £20,124.

Worthing.—The T.C. has received the following tenders for the supply of cables and accessories :—

W. T. Glover & Co., Ltd.	£480
Union Cable Co., Ltd.	421
Siemens Bros. & Co., Ltd.	419
W. T. Henley's Telegraph Works Co., Ltd.	415
Callender's Cable & Construction Co., Ltd. (accepted)	406

The tender of the Main Colliery Co., Ltd., for 300 tons of Dynevor Duffryn (60 per cent. large) coal, at 21s. 8d. per ton, has been accepted.

York.—The T.C. has accepted the following tenders :—

Rotary converter and transformers, £2,794.—General Electric Co.
Switchgear, £175.—B.T.H. Co.
Erection of sub-station, £571.—H. E. Turner & Son.

INDUCTION REGULATORS AS PHASE DISPLACERS.

For the testing and calibration of A.C. watt-hour meters, and also for other laboratory purposes, it is frequently necessary to obtain an electromotive force which, whilst synchronous with that of the generator or supply, can be caused to have any desired phase relation to the latter. It should be of the same order of magnitude as the supply voltage, and its value should be unaffected by alterations in its phase.

By means of choking coils and static condensers, it is possible to cause the E.M.F. impressed upon any apparatus to lead or lag respectively in relation to the supply, but the method has the following serious limitations where any considerable range of phase variation is necessary :—

(*a*) A large number of expensive choking coils, condensers and resistances are necessary.

(*b*) The connections often become complicated.

(*c*) The voltage impressed upon the apparatus is much below that of the supply.

(*d*) Every adjustment of the phase alters the impressed voltage, and in order to obtain any given combination of phase and voltage a highly complicated calculation is necessary, involving serious loss of time.

(*e*) Fine adjustment is difficult.

To overcome these difficulties, a small polyphase induction regulator may be used consisting of a standard slip-ring induction motor without brush-lifting and short-circuiting gear. The "rotor" never performs a complete revolution, but its position in relation to the stator must be accurately adjustable by means of a hand-lever. It is then possible to obtain any desired phase relation, and with an infinite number of gradations. The adjustment is simple in the extreme, and involves no alteration of any of the electrical connections, or any calculation whatever; the impressed voltage is independent of the phase, and is only slightly affected by variations of the load, whilst the secondary can be wound for any desired voltage. The efficiency is very high, as the regulator is practically nothing but a three-phase transformer with means for moving one of the windings. As a rule the "rotor" constitutes the primary winding, and it can be wound either two-phase or three-phase, although the former is seldom required. (As pointed out below, a single-phase induction regulator has different characteristics to a polyphase one.) The secondary can, however, be wound single-phase, two-phase, three-phase, or six-phase, three-phase being by far the most usual type of winding.

That is to say, the rotor may be either single-phase or polyphase, but that if phase-displacement is to be effected, the primary must be wound polyphase, in order that a rotary field may be produced.

Three-phase stators can be provided with six terminals to enable the windings to be connected either in star or in delta; it is then possible to obtain the full K.V.A. output of the regulator at either of two voltages. It is also possible to provide tappings on the secondary windings so that reduced voltages may be available. The machine may, therefore, if suitably constructed, be made when necessary to perform four distinct functions, viz. :—

(*a*) Phase displacement between primary and secondary.

(*b*) Phase conversion if, say, the primary be wound three-phase and the secondary two-phase or single-phase.

(*c*) Voltage transformation, if the secondary be wound for a different pressure to that of the supply.

(*d*) Voltage regulation, by means of star-delta connections and tappings.

An induction regulator for laboratory purposes is, however, usually provided with three-phase windings of equal voltage on both primary and secondary, and with only three terminals for the rotor and three for the stator; its sole function is thus that of phase displacement. There is no "copper" connection between the primary and secondary sides.

In order to appreciate the principle and characteristics of the induction regulator when used as a displacer, it is

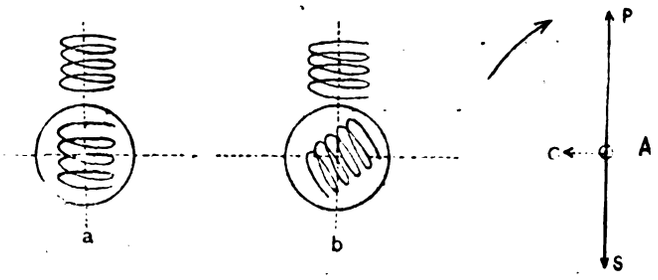

Fig. 1.

necessary to distinguish clearly between such phase-shifters and—

1. The three-phase induction regulator when applied as a booster.

2. The single-phase induction regulator.

In the appended figs. 1a and 1b a single-phase induction regulator is depicted diagrammatically, whilst fig. 1A represents the vector diagram with open secondary. When, as in fig. 1a, the axes of the primary and secondary are coincident, the maximum voltage will be induced in the secondary, the system resembling that of an ordinary static transformer. O P represents primary impressed E.M.F., O C, the magnetising current, lags approximately 90° behind this, and the magnetic flux is also in phase with O C. As the secondary E.M.F. lags 90° behind the flux it will be represented by O S, which is 180° behind O P, and by transposition of the connections can be brought into phase with O P. The primary and secondary voltages may, therefore, as in an ordinary transformer, be regarded as coincident in phase. The flux being alternating in magnitude and fixed in position (*i.e.*, not a constant rotating field), any angular displacement of the rotor as in fig. 1b, will not affect this phase relation, but the whole of the flux produced by the primary will then no longer pass through the secondary, and the magnitude of the voltage O S induced in the latter will be reduced in proportion to this reduction of effective secondary flux. If the rotor be moved round until its axis is horizontal, no flux will pass through the secondary, and no E.M.F. will be induced.

The functions of the single-phase induction regulator are therefore limited to that of producing a voltage variable at will from zero to a maximum, but always in phase with that impressed upon the primary.

Fig. 2a represents a three-phase induction regulator with the axes of the three primary phase-windings coincident

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with those of the secondary. If any one phase be regarded separately, fig. 1A will still represent its vector diagram, and fig. 2A can be drawn for the complete three-phase system.

There is, however, the essential difference between the single-phase and three-phase machines that whereas the field of the former is alternating in magnitude and fixed in position, that of the latter is approximately constant in magnitude, but rotates in space. It follows that, into

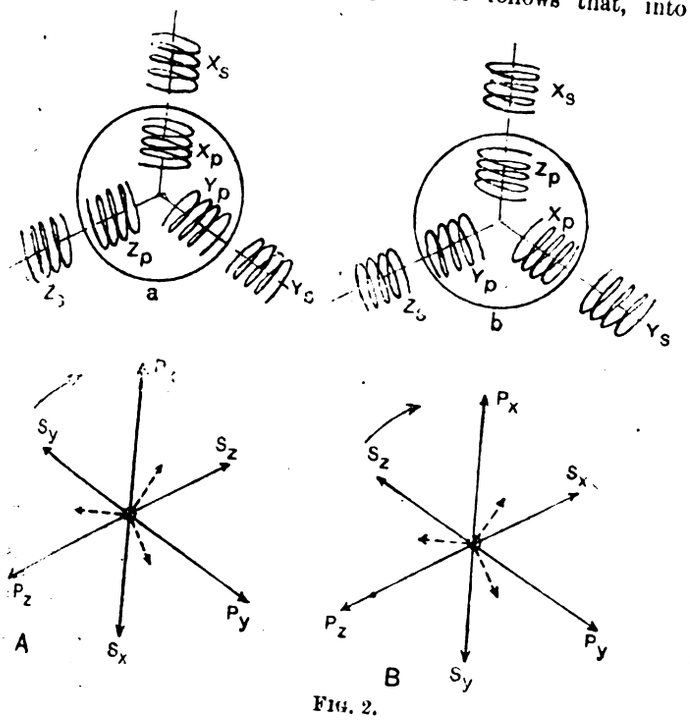

FIG. 2.

whatever position the rotor may be turned, the secondary will never escape being cut by the full magnetic flux as this revolves. Consequently the E.M.F. induced in the secondary will be independent of the rotor position, and will in effect be constant.

On the other hand, angular displacement of the rotor will alter the phase of the secondary E.M.F. Assume, for instance, that the rotor is moved through an angle of 120° as in fig. 2b. Secondary X_s will now be opposite primary Z_P, and its E.M.F. will, therefore, be 180° behind that impressed upon Z_P, instead of 180° behind that impressed upon X_P; that is to say, that it is 120° later in phase than before the rotor

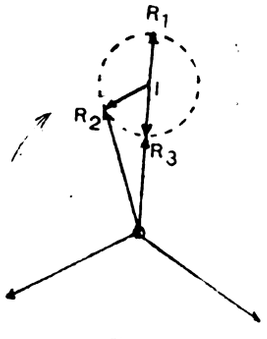

FIG. 3.

was moved. Similarly, each of the other secondary phases is retarded 120° by the movement, and the vector diagram, fig. 2B, now represents the altered relations.

It is clear also that for any other or intermediate position the phase of the secondary E.M.F. is determined by the position of the rotor in relation to the stator, its magnitude remaining constant.

Misconception is sometimes caused by the fact that three-phase induction regulators are in common use as voltage regulators on feeders, rotary converters, &c., and that single-phase induction regulators are used for this purpose on electric locomotives. It should be pointed out, however, that the voltage in the secondary of a three-phase induction regulator when used for pressure regulation, does not vary. The secondary is wound only for the difference between the minimum and maximum voltages required and is connected in series with the circuit which is to be controlled, whereas there is no copper connection between the primary and secondary of a phase displacer.

With the secondary connected in series with the line, the vector diagram of one-phase is as shown in fig. 3, where O I represents impressed voltage, I R represents secondary voltage or boost, and O R represents resultant voltage impressed on feeder or converter. The boost remains constant, but by altering its phase in relation to the primary E. M. F. the resultant voltage can be varied between O R_1 and O R_3.

The two applications of the induction regulator are therefore in no wise inconsistent.

THE PREMIUM WAGES SYSTEM.

THE premium or bonus mode of remunerating industrial labour has met with much favour, and its adoption is often urged as one of the panaceas for mitigating the antagonism that exists between capital and labour. The principle of the premium method as generally practised is that standard times and rates, which are imposed by the rate-fixing department of the particular industry, are set for various descriptions of work or output, and that if the work be completed satisfactorily in less than the standard period, the workman receives a premium or bonus, which is computed in different ways according to the conditions adopted, he, in any case, always receiving his fixed hourly rate of wages. Let us notice some of the conditions, and suppose that the standard time fixed for a certain line is 100 hours, that the work is completed in 90 hours, and passed by the inspector, that the hourly rate is 9d. and that the premium payable is one-third of any saving :—

90 hours at 9d.	810d. time work.
100 hours' standard time	
90 hours' actual time	
10 hours' saving, one-third of which is 3⅓ hours at 9d.	30d. premium.
	840d. total

which is equivalent to ($\frac{840}{90}$), 9·33d. per hour.

On similar data, except that half of the saving be payable, we have—

90 hours at 9d.	810d. time work.
10 hours' saving, half of which is 5 at 9d.	45d. premium.
	855d. total

which is equivalent to ($\frac{855}{90}$) 9·50d. per hour.

In the third instance we shall assume that the amount of the premium to which the workman is entitled bears the same ratio to the fixed rate as the actual time occupied bears to the standard period—

90 hours at 9d.	810d. time work.
10 hours' saving, which is 10 per cent. standard time, and 10 per cent. of 810d. is	81d. premium.
	891d. total

which is equivalent to ($\frac{891}{90}$), 9·90d. per hour.

Here the value of the increased exertion or intensity of labour of the workman is in the first and second instances assessed at ¼ or ½ of the saving of time, which is calculated at the time rate, whilst in the third illustration he receives a premium on the basis indicated of $\frac{1}{10}$th of the value of the time work.

In what is usually termed the fixed premium system, the premium rate is fixed, and the workman is paid for the actual number of hours saved computed at that rate. If this rate be 7d. in the foregoing circumstances, he would receive :—

90 hours at 9d.	810d. time work.
10 hours at 7d.	70d. premium.
	880d. total

which is equivalent to 9·77d. per hour.

The opposition to the premium scheme in many instances is due, among other causes, to the difference of opinion that manifests itself in relation to the apportionment of the saving as between employer and employé, the workman often declaring that what he saves he should be paid for in full, the bonus, otherwise, being more of the nature of a sop.

The object of the premium system is, of course, to obtain increased production at less manufacturing cost, and naturally with a less ratio of on-cost to production.

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NOTES.

Copper.—Copper having been declared contraband by the British Government, its export is forbidden; cargoes of the metal destined for home ports have been transferred from the ships to barges by the Government, and prices have gone up rapidly, dealers on Wednesday asking £70 a ton, whereas the price was under £60 a week ago. Very little copper is available, and there is a prospect of shortage due to the exodus of foreign labour from the United States.

Underwriters' Label Service.—The label service of the Underwriters' Laboratories of Chicago was recently explained by Mr. A. R. Small, superintendent of the label service of the laboratories. The labels are furnished to manufacturers of various classes of goods, electrical and otherwise, as the result of factory inspection. The service now covers over 70 devices and materials, of which 25 are electrical. The label service started with rubber-covered wire, rigid conduit being the next fitting to be provided with labels. The label means the actual examination of the device at the factory of the maker, and implies from 95 to 99 per cent. of compliance with standard specifications.

In the case of rigid conduit, an inspector from the Underwriters' Laboratories visits the factory four times a week in busy times. He may stay from half an hour to six hours. All inspectors are governed by very explicit instructions as to their duties. In the line of rubber-covered wire, 35 factories in the United States and Canada subscribe to the label service of the Underwriters' Laboratories. All of these produce new code wire. The rubber-covered wire factories are inspected about five times in two weeks. Manufacturers are required to make tests themselves, and the inspector has authority to re-test any new code wire in the factory. Many tests are made by inspectors, and in ways that the manufacturer cannot anticipate. If the manufacturer is found to be weak on any point, he is required to improve his material in that respect.

The message of the label to dealers and contractors is that competitors are complying at least with the minimum requirements. The manufacturers will note that all inspection work is done at the factory, which is desirable in a number of ways. In other respects the label conveys to the manufacturers a message of distinct business advantage.

Last year the number of Underwriters' Laboratories labels increased 33 per cent. over the year before. The service has justified itself. The electrical fraternity has been more active than the other industries in supporting the work of the Underwriters' Laboratories, and in turn the laboratories seek to co-operate with the electrical industry.

The expense of conducting the Underwriters' Laboratories is borne by the insurance companies, so far as the building and equipment are concerned. The pay roll is met out of the receipts from the clients of the laboratories. No charge is made to manufacturers for the overhead expense of the laboratories. Labels are furnished at a flat rate, there being no discount for quantity. Rebates are made at the end of the year if it is found that service to any particular line has been rendered at a less expense than had been anticipated. The idea is to charge for the labels what the inspection service actually costs to each line of an industry, as rubber-covered wire, conduit, snap switches, &c., the different lines being figured separately. In any event, it is not planned that the label service shall cost more than 1 per cent. of the manufacturing cost.—*Electrical World.*

Hydroelectric Plant Operated without an Attendant.—The Greenfield (Mass.) Electric Light and Power Co. has a 3,000-KW. steam plant situated on the bank of a small stream. Water from this stream is used for boiler-feed and condensing purposes, a pond being formed by a dam. During the year 1913 it became apparent that the dam (an ancient log structure) would have to be renewed. It was therefore decided to build a concrete gravity type of dam primarily for securing the water supply of the steam plant.

Investigation seemed to show that a small amount of power could be generated in connection with the dam, provided the operating expense could be kept at a low value. After due deliberation a 24-in. double-runner horizontal waterwheel was installed and belted to a 100-H.P. three-phase, 2 300-volt squirrel-cage induction motor, the motor being driven above synchronous speed so as to operate as an induction generator.

The waterwheel is controlled by a governor which holds the no-load speed about 15 per cent. above normal, so that while normally the wheel runs at full gate opening, if the load drops off for any reason, the set will not run away.

The motor is connected through an automatic switch and meter to the 2,300-volt distribution line of the company right at the plant. Ordinarily there is sufficient load on this line to absorb the output of the induction generator. At times of light load the output of the generator is fed back into the main station bus.

If the switch on this feeder at the main station should open for any reason, the induction generator loses its excitation but keeps right on running. When the switch is closed the generator becomes energised and immediately picks up its portion of the load. The process of starting up is simplicity itself; the wheel being started and the machine brought up to approximately synchronous speed, the switch is closed and the operation is complete. Provision is made for operating one runner of the wheel separately in times of low water.

The normal attendance of this plant is limited to a visit three times a day, at shift changes in the main plant. The operator stops at the plant on his way to work, reads the meters, feels the bearings and observes the general condition of the machinery, racks, &c. The plant was placed in operation on January 1st, and is fulfilling all expectations as to reliability and low operating costs.

The dam has a height of 11½ ft., including flashboards, and a spillway of 160 ft. The wheel chamber is built integral with it at one end and the generator is housed in a brick building adjacent to the wheel chamber, the wheel shaft running through a stuffing-box into the generator room.

The dam and building were built under the direction of Mr. H. A. Moody, hydraulic engineer on the staff of the company.—*Electrical World.*

Centrifugal Effects in Belting.—Referring in *Power* to the tradition that belts, to operate properly, must be given initial tension, Mr. W. F. Schaphorst admits that hard, stiff, uncared-for belts need initial tension, but belts should not be stiff; in the pliable state belts grip the pulleys to such an extent that extremely slack running is often possible. The chief advantages of slack belts are increase of arc of belt contact, and decrease in bearing friction.

Fig. 1 shows a proportion commonly observed in practice, namely, a 4-ft. driving pulley, a 1-ft. driven pulley and 20 to 25 ft. between centres. The lower half of the belt is the pulling half. Where the non-pulling side is permitted to run slack, about, as

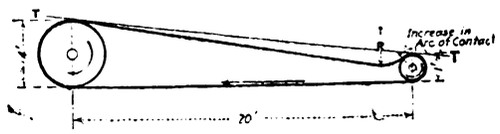

FIG. 1.

shown in fig. 1, the weight of the belt alone, hanging in the form of a catenary, will compensate for the centrifugal force up to a considerable speed in most cases. The weight of the belt alone is enough to pull it down below the tangent line T T, in which case a curve concave upward is formed between the pulleys, inertia causing the sharpest curvature to form close to the small pulley, thus increasing the arc of contact considerably more than when the belt is not in motion, and creating a counter centrifugal force that can be accurately computed as soon as we know the curvature at the sharpest turn. If this "slack curvature" is equal to the curvature of the small pulley we are justified in assuming that the ill effects of centrifugal tension are eliminated.

Sparking Distances in Electrical Installations.—A mass of reliable data is now available concerning sparking distance between electrodes of simple geometrical form (needle points, disks, spheres, &c.), under various conditions, but little information has hitherto been available concerning sparking distances between metallic conductors and walls in workshops and on switchboards, &c. This problem, which is obviously of great practical importance, was recently investigated by Gino Rebora (See also Atti dell' Associazione Elettrot. Italiana No. 31,913), and the first result deduced was the fact that a grain of dust or a fine hair or fibre would often suffice to start discharge from a high-tension conductor. A point or angularity in a conductor may cause a discharge to occur which would otherwise require 30 per cent. higher pressure than that actually operative; it is therefore very desirable that all metal subject to high-tension current should be as free as possible from points and angularities of any kind. The black lines frequently seen on switchboards and walls behind high-tension conductors reveal the presence of sustained feeble discharges which bombard the surface near the conductor with particles of dust.

From observations made in 30 installations, working at pressures between 3,000 and 110,000 volts, Rebora derives a curve showing the minimum safe distance between conductor and earthed walls or metal covers, &c. As shown by the following data, his limits are rather less stringent than those recommended (but not always observed) by the G.E.C.:—

	P.D.	20	40	60	80	100	Kilovolts.
Minimum distance between conductor and earth	Rebora	100	200	330	450	590	mm.
	G.E.C.	150	300	450	620	770	mm.

As regards the effective height of porcelain insulators of pylon form, used as intermediate insulators on distribution boards, &c., this height increases almost linearly at the rate of 5 or 5½ mm. per KV. for pressures up to 80 KV., and then increases more rapidly, to a total of 580 mm. for 100 KV. and 930 mm. for 130 KV. In deriving these data, Magrini, A.E.G., and Richard Ginori insulators were tested.

In the course of investigations conducted in the Ecole Polytechnique de Milan with a view to determining the laws of discharge between conductor and masonry, &c., copper wires, 2, 4, 5, 6 and 8 mm. in diameter, a bar 3 × 10 mm., and a brass tube 23/22 mm. in external and internal diameter were used. As second electrodes were employed in turn walls of cement, stone, hollow brick, eternite, and metal frameworks. The maximum testing pressure available was 100 KV. at 42 cycles per second. When the conductor under test was pointed straight at the wall, breakdown occurred at 20 per cent.—25 per cent. lower P.D. (for separations of 100 to 250 mm.) than would be required to produce discharge between needle points the same distance apart. This is a result of great practical importance, since live metal parts are frequently so arranged in high tension installations as to produce such reductions in the factor of safety.

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In the case of conductors running parallel to walls or bent round in a semicircle at the end abutting the wall, breakdown follows much the same law as that between needle points; this applies also to discharge between conductors and metal frameworks. Using brass tubes about 1 in. in diameter, a higher P.D. was required than with wires to produce breakdown across a given gap.

Data collected from a number of diverse installations concerning the minimum safe height of intermediate insulators and the minimum safe distance between conductors and walls are unexpectedly consistent, and lead to the conclusion that the minimum distance between conductor and earth should correspond to a breakdown pressure 1·8 or 2 × normal line pressure. In a balanced and insulated three-phase system, this rule leads to a factor of safety (= minimum breakdown voltage / actual P.D. between conductors and earth) of 3·0 or 3·5. In conclusion, emphasis may again be laid on the desirability of avoiding sharp points and edges which, if present, facilitate brush discharge and subsequent "heavy current" or "power" breakdown accompanied by extensive damage.

American Station Proof Against Fire.—The electric service of the famous old city of Salem is furnished by the Salem Electric Lighting Co. That the people of Salem are not without central station service to-day is due to a wise engineering foresight which not long ago resulted in carrying out a scheme of plant reconstruction along fireproof lines which splendidly met the test when it came. The fire started in a distant part of the city. Fanned by a strong wind, the blaze carried everything before it, laying more than 1,000 buildings in ruins before its course was finally stayed. Some six hours after the conflagration started, the flames swept down upon the lighting company's station, surrounded it, beat against its brick walls and wire-glass windows with a fury which only those on the spot can appreciate, and then passed on, leaving every other structure in the vicinity a heap of smoking ashes and *débris*. Some damage was done to the coal conveyer, but the five employés who remained in the station during its ordeal of fire kept steam on the boilers and ran an exciter at normal voltage. There was nothing for the main generating units to do, as the outgoing lines in the vicinity of the plant were gone; but during the night following the conflagration street lighting service was resumed through a considerable portion of the city, and commercial lighting and power began to be supplied. Within 48 hours of the start of the fire the company was supplying electricity to nearly everyone in town who was in a position to receive service through temporary mains. The manager of the company and a number of other employés lost their homes, but with dauntless courage every man attacked the problem of restoring the service at the earliest possible moment.—*American Electrical Review.*

Half-Watt Lamps for Lighthouses.—The use of half-watt lamps in lighthouses has proved very satisfactory, as the light emitted by these lamps is very penetrating, and, since the filament is concentrated in a small space, focusing is particularly easy, and therefore the obtaining of a good beam is readily accomplished. A 3,000-C.P. Osram half-watt lamp has been installed in a lighthouse on the end of the Port Talbot Dock and Railway Co.'s pier. A 1,000-watt 1,000-C.P. Osram drawn-wire lamp was first installed, and the pilots were able to pick up the light when off the Mumbles Head, a distance of between 4½ and 5 miles; this lamp was superseded by the 1,500-watt 3,000-C.P. Osram half-watt lamp, and the pilots are now able to pick up the light when much farther down the Channel, the estimated distance being 7 miles.

An Osram half-watt lamp has also been installed on the pier head at Dunoon, without any protection whatever from the weather, and has had to withstand the very severe vibration of the pier head, but no trouble has been experienced.

Fatalities.—BOLSOVER.—At the adjourned inquest on the body of Josiah Hunter, who was found dead in front of an electric coal-cutter at Oxcroft Colliery, Bolsover, on July 7th, Mr. Elliot Smith, representing the Midland Coalowners' Indemnity Association, took exception to a rider being put into the mouths of the jury by Mr. Nelson, H.M. Inspector. Evidence was given showing that the trailing cable insulation was faulty and that it was tested at least once a week. Mr. Nelson considered that a daily test was a necessary precaution, and the Coroner, in recommending a verdict of accidental death, said the jury could add a rider, which Mr. Nelson had suggested should be "that more effective arrangements should be made to test the continuity of the earth conductor." Mr. Elliot Smith contended that any recommendation should come spontaneously from the jury, adding that the suggestion of the Inspector would receive the greatest consideration, and that it was unnecessary to add it as a rider. For the company it was intimated that all such trailing cables had been replaced, and that so soon as apparatus was available, the suggestions made would be carried out.

EALING.—On Friday last, an emery wheel in the Ealing Common Works of the District Railway burst; two employés were seriously injured, one of whom subsequently died.

Lead Poisoning.—The electrolytic treatment of lead poisoning was discussed at the Public Health Congress at Edinburgh University on Saturday last. Dr. William H. F. Oxley, London, said that he had experimented with the electrolytic treatment, and had not been able to confirm the results of Sir Thomas Oliver or that any lead was extracted from the body by means of the treatment. Sir Thomas Oliver said that their experience in Newcastle was extremely favourable to the treatment. As to the extraction of lead from the body, he thought there was no doubt.—*Chemical Trade Journal.*

Denatured Electricity.—An interesting method of preventing the improper use of electric current has been devised by an Italian engineer. The practice of making especially low rates for energy to be used in electric power, heating and cooking devices is becoming more and more general, but with the ordinary constant-pressure supply, it is difficult to prevent the use of lighting devices on circuits intended only for power and heating purposes.

This engineer advocates the use of special circuits on which the current is subject to extreme fluctuation of voltage at rapidly-recurring intervals, which would make it practically impossible to use lamps, because of the flicker in the light. As the current is not entirely interrupted and the normal voltage is almost immediately restored the proper operation of power or heating apparatus is not interfered with, and the rightful use of the circuits for their respective purposes is assured. At the same time, it should be noted that this system would be fatal to the use of luminous radiators.

Mercury-Vapour Light for Inspecting Translucent Products.—Cube sugar and ivory piano keys are inspected under artificial illumination produced by mercury-vapour lamps with greater speed and accuracy than can be attained in ordinary daylight. Raw sugar is a brown substance, while the refined product is pure white, its whiteness being due to the same cause as the whiteness of snow, since both are made up of small transparent crystals. Any impurity in sugar manifests itself by changing the white to a shade of yellow. To detect impurities, plates of the crystallised sugar 1 in. thick are examined by a man looking through them towards a mercury-vapour lamp. When thus viewed, yellow impurities stand out clearly in the bluish-green light. The colour of ivory varies from the outside to the centre of the tusk to such an extent that manufacturers sort the pieces into 16 different shades. Formerly this sorting could be done only in bright daylight, but with the light of the mercury-vapour lamp grading can be done without limitation at any hour out of the entire 24.—*Electrical World.*

An American Visit.—Mr. R. Stuart Pilcher, general manager of the Aberdeen Tramways, who has returned from a visit to the United States and Canada, says in the last 14 years there has been not merely a great change there, but a complete transformation of both the operating conditions and the type of cars which are used to cope with the heavy traffic conditions. The "Pay-As-You-Enter" system worked very smoothly even when the traffic was greatest. Tramway managers will be amused to hear that in one city the leading newspaper devoted one column of the daily paper to "Tramway Breakdowns"—then followed in tabulated form the breakdowns in detail of the previous day, showing the place, time, and length of delay. For the size of the city, which was at present discussing municipalisation, the breakdowns were certainly numerous. The speed on the American systems was much greater than on this side, in spite of the fact that they had very few fixed stopping stations; the permanent way and general road-bed were very bad, so bad that such a condition would not be tolerated by the authorities on this side. The trailer-cars in use in the city of Montreal were exceptionally fine, and seemed to be about the last word in safe operation. The New York surface systems were disappointing, being rather behind the times, and there was a lack of co-operation between the different companies operating—one company would not receive the transfers of another company—and the poor stranger got little assistance from the companies, who had no maps or guides such as one would expect on any large system. His impression, after seeing seven representative systems, was that the street railways were not run with as much regard to public convenience and safety as were the tramways on this side; and, further, the employés did not seem to consider it any part of their duty to be attentive to the passengers.

Cancer Treated by Heat.—At the Clinical Congress of Surgeons of North America, held in London last week, Dr. J. F. Percy read a paper on the treatment of cancer by heat. The apparatus used was a most efficient electric heating iron, which could be perfectly regulated when applied to the involved tissue. With this apparatus and his water-cooled speculum, a maximum penetration and dissemination of heat was obtained. The degree of heat which was necessary did not burn up the cancerous mass, but merely made it so hot that the hand of the surgeon, encased in a medium-weight rubber glove, could not hold it. When this degree of heat was reached and maintained for from 10 to 20 minutes, the cancer cells were absolutely killed, while the normal tissue cells were not injured. The basic idea of this treatment was not cauterisation, but the production and dissemination of heat in the gross primary mass of cancer.—*The Times.*

Army and Navy Service Vacancies.—The War Office has issued notices inviting the services of artificers, coppersmiths, electricians, pattern-makers, and other classes of skilled workmen, as well as of motor-cyclists.

The Royal Naval Volunteer Reserve wants recruits, especially men with a knowledge of Morse signalling and wireless telegraphy, fitters, electricians and metal workers.

Radium.—According to the *Chemical Trade Journal*, the new works of the British Radium Corporation, Ltd., at Elmers End, near Beckenham, are now in operation, and the extraction of radium and uranium by the company's special process, on a much larger scale than at the former works at Limehouse, is now proceeding.

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Appointments Vacant.—Plumber-jointer for Singapore Municipality (£23); assistant telegraph engineers for the Gold Coast (£400); laboratory steward for physics and electrical engineering (£65), for Huddersfield Technical College. Particulars are given in our advertisement pages.

Educational Notes.—Royal Technical College, Glasgow.—Session 1914-15 begins on September 23rd. Particulars are given in our advertisement pages.

City and Guilds of London Institute.—The programme for 1914-5 has been issued.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. Geoffrey Porter, who has been associated for some years with Edmundsons' Electricity Corporation, has now been appointed to the post of assistant chief engineer to the British Columbia Electric Railway Co. On Tuesday, July 28th, a number of resident engineers connected with the Edmundsons' supply stations attended a farewell luncheon at which Mr. Porter was the guest. The rendezvous was very appropriately the Brompton and Kensington Restaurant, where the cooking is all carried out electrically. After the luncheon a number of speeches were made congratulating Mr. Porter upon his appointment, and wishing him good luck in his new position. As a memento of the occasion and as a connecting link with the Edmundsons' stations, Mr. Brandreth, of High Wycombe, who was chairman, presented Mr. Porter with a gold albert, on behalf of the engineers. Many, who through holidays or business were unable to be present, sent letters of congratulation and good wishes.

The Wimbledon Corporation is recommended to increase the salary of Mr. W. J. Oswald, an engineer-in-charge at the electricity works, from £156 to £182 per annum.

The Torquay T.C. has increased the salary of Mr. Salt, the electrical engineer, from £350 to £400 per annum at Midsummer this year, and to £450 at Midsummer, 1915, on condition that he undertakes to remain with the T.C. until the works now contemplated are completed.

The York T.C. has decided to increase the salary of Mr. L. A. Thain, charge engineer at the electricity works, from £100 to £110 per annum from October 1st next, with a further increase to £120 on October 1st, 1915.

Mr. Alec Sinclair, son of the chairman, has been appointed charge engineer by the Swansea Electric Lighting and Tramways Committee.

Mr. Edgar F. Kent, of Sunderland, has been appointed to the position of superintendent of the meter and electrical testing department of the Salford electricity works, at a salary of £150, rising to £200 per annum.

Mr. G. C. Milnes, electrical engineer for the Lancaster Corporation, has been called out with the 5th King's Own Royal Lancaster Regiment, of which he is a lieutenant. He left Lancaster with the battalion on Wednesday.

Tramway Officials.—The Brighton T.C. has, on the recommendation of the Tramways Committee, increased the salary of the engineer and manager, Mr. W. Marsh, from £400 to £500 per annum.

General.—Alderman Robinson, for 10 years chairman of the Bradford Electricity Committee, has been asked to accept the Lord Mayoralty of the city for the next corporation year.

The marriage took place at St. Peter's and St. Paul's Church, Wangford, on Saturday last, of Mr. Thomas Arthur Pond, A.M.I.E.E, of Hatcham Park, and Miss A. C. Clatten, of Church House, Wangford.

The Barnsley Education Committee has appointed Mr. C. H. Matthews as instructor in electrical wireman's work, and Mr. J. E. Jackson as instructor in electrical engineering at the Technical School.

At the Whitehall Club on Tuesday, July 28th, some 40 friends and well-wishers of Mr. Mark H. Robinson met, under the chairmanship of Sir Frederick Donaldson, to present him and Mrs. Robinson with a memento of the anniversary of their golden wedding, which they had reached on the previous day. In all some hundred friends had subscribed towards the memento, which was presented in conjunction with an album containing their signatures. The movement was organised by a Committee consisting of Captain Sankey, Mr. J. C. Peache, Mr. G F. Clayton East, Mr. P. A. Low and Mr. E. J. Fox, the last of whom acted as honorary secretary.

Obituary.—We regret to record the death of Mr. J. Eaton Shore, shops superintendent at Messrs. Siemens Bros. Dynamo Works, Stafford, who passed away on July 23rd. According to the *Staffordshire Advertiser*, Mr. Eaton-Shore had been with Messrs. Siemens since 1908, and previously served with Messrs. Willans & Robinson for 22 years.

The death is announced of ex-Provost Brownlee, of Dundee. It was largely through his efforts that the Corporation electrical undertaking was started and the tramway system electrified and municipalised.

NEW COMPANIES REGISTERED.

Loughrea Electric Power and Lighting Co., Ltd. (4,178).—This company was registered in Dublin on July 24th, with a capital of £2,500 in £1 shares, to carry on the business indicated by the title. The subscribers are:—F. A. Sweeny, Loughrea, Co. Galway, merchant, 50 shares; A. D. Comyn, Loughrea, Co. Galway, solicitor, 50 shares; Wm. J. Duffy, Loughrea, Co. Galway, M.P., 40 shares; Ed. C. Dea, Loughrea, Co. Galway, hotel proprietor, 50 shares; P. K. Kennedy, Loughrea, Co. Galway, victualler, 30 shares; J. Staunton, Loughrea, Co. Galway, draper, 50 shares; J. Geraghty, Loughrea, Co. Galway, medical doctor, 50 shares; C. S. Graham, Loughrea, Co. Galway, solicitor, 50 shares; D. Crowley, Loughrea, Co. Galway, medical doctor, 40 shares. Private company. The directors are A. D. Comyn, J. Geraghty, P. Kennedy, F. A. Sweeny, D. Crowley, C. S. Graham, J. Staunton, E. O'Dea and W. J. Duffy; qualification, 30 shares. Registered office, Loughrea, Co. Galway.

International Bleachers' Corporation (1914), Ltd. (137,234).—Registered July 28th by P. G. G. Shaw, 4, Clement's Inn, Strand, W.C. Capital, £120,000 in £1 shares. Objects: To take over the undertaking and all or any of the assets and liabilities of the International Bleachers' Corporation, Ltd. (incorporated in 1912), and to carry on the same and business of mechanical and electrical engineers, manufacturers of and dealers in all apparatus and things required for or capable of being used in connection with electric, electrolytic or chemical bleaching or like appliances and apparatus, &c., and to enter into an agreement with the said old company. Purchase consideration, £98,678 15s, payable as to £988 15s. in cash and £97,685 in shares. The signatories (with one share each) are:—P. G. G. Shaw, 4, Clement's Inn, W.C., solicitor; W. T. Pollard, 4, Clement's Inn, W.C., clerk; H. Hackett, 44, Bedford Row, W.C., chartered accountant; R. Andrews, 169, Southampton Street, Camberwell, S.E., clerk; A. G. Emblow, 24 Lymington Road, West Hampstead, clerk; R. C. Miller, Seeburg Park Avenue, Hulton, clerk; M. Daborn, 18, Freshford Street, Earlsfield, S.W., clerk. Minimum cash subscription, seven shares. The first directors (to number not less than two or more than seven) are A. Fraser, Offley, near Hitchin; A. T. Masterman, 46, Gillingham Street, Eccleston Square, S.W.; J. L. Kerpen, Hyde Park Hotel, Knightsbridge, S.W.; E. Chapman, 4, Bedford Chambers, Covent Garden, W.C.; O. Sumner, 4, Bedford Chambers, Covent Garden, W.C.; and Col. W. M. Hodder, Holdene, near Cobham. The directors, with the exception of Col. W. M. Hodder, are directors of the vendor company, and they are all shareholders therein; A. Fraser, holding 150 ordinary and 300 founders'; A. T. Masterman, 400 ordinary and 700 founders'; J. L. Kerpen, 101 ordinary and 210 founders'; E. Chapman, 1,605 founders'; O. Sumner, 100 founders'; Col. W. M. Hodder, 400 ordinary and 297 founders'; qualification, 100 shares; remuneration not less than £50 each per annum and 2½ per cent. each of the surplus profits set aside for distribution as dividend in each year. Registered office, 4, Bedford Chambers, Covent Garden, W.C.

"Dac" Accumulator Syndicate, Ltd. (137,206).—This company was registered on July 27th, with capital of £1,000 in £1 shares, to adopt an agreement with the "Dac" Accumulator Syndicate, Ltd., and H. C. Bound, the liquidator thereof, for the acquisition of certain patents and other property, to carry on the business of electrical engineers and contractors, manufacturers of cells and batteries, suppliers of electricity, &c. The subscribers (with one share each) are:—J. S. Parker, 198, Holborn, E.C., merchant; S. W. Simpson, 72, Janson Road, Stratford, E., clerk; B. McKinna, 88, Guilford Street, W.C., clerk; J. C. Eastaugh, 39, Holmwood Road, Seven Kings, clerk; W. T. Letts, 61, Cartwright Gardens, Russell Square, W.C., clerk; A. F. Newberry, Stafford House, Broxbourne, stockbroker; H. E. Hughes, 90, Goswell Road, E.C., merchant. Minimum cash subscription, seven shares. The number of directors is not to be less than two or more than seven; the first are J. S. Parker, A. F. Newbery, and H. E. Hughes; remuneration for first year, £50 per annum (subsequent years, £100 each per annum, chairman £25 extra), and a percentage of the profits. Registered office, Cheshunt Wharf, Cheshunt, Herts.

Chemico-Electric Co., Ltd. (137,349).—Registered July 29th, by Loughborough, Gedge & Co., 23, Austin Friars, E.C. Capital, £85,000 in 50,000 preference shares of £1 each and 140,000 ordinary shares of 5s. each. Objects: To carry on the business of miners, quarrymen, manufacturers of chemicals and products, engineers, chemists, manufacturers of nitric acid, cyanide, paraffin wax, lubricating oils, petrol and by-products of coal, storekeepers, shippers, charterers of ships and other vessels. To deal with shares and other securities of any company formed for the purpose of carrying on or developing the business of chemicals and manufacture of chemical products of all kinds and the development and supply of power in the form of gas, electricity or otherwise. The signatories (with one preference share each) are:—Sir William H. Marling, Bt., Stanley Park, Stroud, Glos.; F. Winterbotham, Stroud, Glos., solicitor; W. E. J. Hallett, Green Hook, Selsley, Glos., gentleman; O. D. Lucas, 39, Victoria Street, S.W., engineer; W. A. Harper, 3, Deanery Street, Park Lane, W., engineer; J. A. Millington, 39, Upper Montagu Street, E.C., civil engineer; H. R. Hogg, 23, Hornton Street, Kensington, W., merchant. Private company. The first directors (to number not less than two or more than ten), are to be appointed by the signatories; qualification, £100; remuneration as fixed by the company. Registered office, 13, St. Helen's Place, E.C.

Harry Tattersall, Ltd. (137,279).—This company was registered on July 30th, with a capital of £3,000 in £10 shares (100 preference), to take over the business of a plumber and glazier, carried on by H. Tattersall at Spotland Bridge, Rochdale, and to carry on the same and the business of incandescent dealers, electric bell and telephone fitters, gas, ventilating and general engineers, &c. The subscribers (with one share each) are:—Hy. Tattersall, 272, Spotland Bridge, Rochdale, plumber and glazier; G. W. McIndoe, 312, Edenfield Road, Passmonds, Rochdale, company secretary. Private company. Table "A" mainly applies. Registered office, Spotland Bridge, Rochdale.

Electromobile (Leeds), Ltd. (137,251).—This company was registered on July 29th, with a capital of £1,000 in £1 shares, to carry on the business of electrical and general engineers, manufacturers of, and dealers in, motor and electric machinery, &c., in Leeds and elsewhere. The subscribers (with 50 shares each) are:—W. Popplewell, Avondale, Stanks, Leeds, grocer; J. A. Popplewell, Graveley, Thorpe, Halton, near Leeds, grocer; F. E. Popplewell, Avondale, Stanks, Leeds, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are W. Popplewell, J. A. Popplewell and F. E. Popplewell; qualification, £50; remuneration of chairman, £5 per annum; of other directors, £1 per annum. Registered office, 80, Bath Road, Holbeck, Leeds.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Ackroyd & Best, Ltd.—Issue on June 29th, 1914, of £7,050 "A" debentures, part of a series of which particulars have already been filed.

Naylorgraph, Ltd.—Debenture dated July 17th, 1914, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Subject to prior debentures. Holder: J. M. Hunt, Fairlawn, Park Road, Southborough, Kent.

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Dudley, Stourbridge and District Electric Traction Co., Ltd. (14,768).—Capital, £200,000 in £5 shares (20,000 ord. and 20,000 pref.); return dated May 25th, 1914; all shares taken up; £200,000 paid. Mortgages and charges: £100,000.

British Thomson-Houston Co., Ltd. (47,982).—Capital*, £800,000 in 40,000 ord. and 40,000 pref. shares of £10 each; return dated June 4th, 1914; all shares taken up; £10 per share called up on 32,631 ord. and 40,000 pref.; £725,810 paid; £74,690 considered as paid on 7,469 ord. Mortgages and charges: £226,215. *Original capital, £240,000 in £10 shares. Increased to £400,000 in 1898, and to present amount in 1902.

Helsby Wireless Telegraph Co., Ltd.—Assignment dated July 9th, 1914, to secure £895, charged on certain moneys receivable from L.N.W.R. for wireless equipment on three ships. Holders: Automatic Telephone Manufacturing Co., Ltd., Milton Road, Edge Lane, Liverpool.

Spensers, Ltd.—Issue on July 17th, 1914, of £500 debs., part of a series of which particulars have already been filed.

CITY NOTES.

Kalgoorlie Electric Tramways, Ltd.

The report of the directors, for the year to 31st December, 1913, shows gross receipts amounting to £34,643 against £37,917 for the previous year, while the net profits earned were £9,549 against £10,099. The directors regret that the depressed condition of affairs at Kalgoorlie, which has prevailed for the past few years, continues to have a serious effect on the traffic receipts. A new and adverse feature has been the keen competition from motor cars owned by private individuals, which can be brought out and operated at only the busiest periods of the day, and on special occasions. Although the gross earnings have fallen over £3,000, the net receipts are only some £500 less than last year. This has been brought about by a rigid reduction in unprofitable car mileage and in expenses wherever possible. Reference was made in the last report to the action by the company's employés then before the arbitration courts for improved wages and conditions. The additional wages obtained by the men as a result of this action amounted to some £600 per annum; this extra expenditure has been almost balanced by reductions in staff, and the directors are glad to say that the relations between the company and its men are in every way satisfactory.

The engineer reports that during the year the cars travelled 568,500 car miles, as against 619,170 car miles in the year 1912, and carried 2,266,361 passengers, as against 2,489,833 in the year 1912. The earnings per car mile in 1913 were 14.57d., as against 14.65d. in 1912, with an expense of 9.91d. per car mile, as against 10.27d. in 1912. The expenses per cent. of earnings in 1913 were 67.99, as against 70.08 in 1912. The number of units consumed in 1913 was 610,370, as against 697,015 in 1912.

The "A" debenture stock has been further reduced by a sum of £6,598 in respect of the year under review, and during the current year an additional sum of £6,980 has also been bought for redemption. This has reduced the stock outstanding to the date of this report to £49,800, thus materially improving the position of the "B" debenture stock, although it has not been possible to resume the payment of the interest on the "B" stock.

The tenth ordinary general meeting of the shareholders of this company was held on Thursday last week at the offices of the London Chamber of Commerce, Cannon Street, Mr. Allen H. P. Stoneham, the Chairman, presiding.

In proposing the adoption of the above report, the Chairman said that unfortunately the accounts were not as satisfactory as they could have wished. With regard to the tramways, they had run about 3,000 less car miles and had carried some 200,000 less passengers. The reason for the reduction in the car mileage was that they had cut off some of the unprofitable mileage which they had been running in the past, and that had helped them to keep down expenditure. It was satisfactory to note that although the gross receipts had fallen off by £3,000, the net receipts were only about £500 below those of the previous year. Their hearty thanks were due to Mr. Stanley (their manager in Australia) for the extraordinary efforts he had made to reduce the expenditure. By reason of arbitration awards they were compelled to pay their men about £600 a year increased wages, but, notwithstanding that, the net receipts, as he had before pointed out, were only down £500. The great trouble they had had to deal with was the very unfair competition which the local councils had thought proper to allow to be brought against them by the owners of private motor cars. The company had to pay 3 per cent. of their gross takings to the councils; they had to keep their track in order, and they found that the councils allowed their roads to get into such a bad state that practically the whole of the traffic used the tramway track. In spite of all that, the Boulder and Kalgoorlie Councils had allowed these privately owned motor cars to compete against them. He was sorry to say that although they had appealed to the councils on the subject, they had not been able to get any redress. To an extent it was satisfactory that they were able to earn sufficient profit to pay interest on the debenture stock and to keep up the sinking fund. They had reduced the debentures to less than £50,000, and if they kept on at the present rate in about seven years' time they would have paid off the whole of the "A" debentures.

Mr. O. Wethered seconded the motion.

Replying to shareholders, the Chairman said that the amount to be set aside annually for interest and sinking fund was a fixed sum of £9,000. Of course, as years went on the amount payable for interest would decrease, and by so much would they be able to increase the amount paid off the sinking fund. With regard to the company itself running a motor 'bus service, he was convinced it would never pay. As to whether there was any prospect of the Government buying the company, he could only say that there had been plenty of suggestions to that end, but at the present time there was no probability of anything being done. They found that the Australian Government wanted to buy something when it was very prosperous and when they could get it cheap, but when it was not prosperous, they were not anxious to buy.

The report was adopted.

Yorkshire Electric Power Co.

The directors report that during the past six months there has been an increase in the revenue from the sale of electricity. The net profits (after payment of mortgage interest) for the three corresponding half-yearly periods are:—To 30th June, 1914, £10,414; to 30th June, 1913, £6,972; to 30th June, 1912, £3,349. Including the sum of £4,188 brought from 1913 there is a balance of £14,602, from which has to be set aside £2,250 to provide for the bonus on the repayment of the second mortgages (£45,000), leaving £12,352 to deal with. The directors consider that the balance available justifies a distribution to the ordinary shareholders, and they have decided to declare an interim dividend for the half-year ending 30th June, 1914, at the rate of 2 per cent. per annum, which with the preference dividend at the rate of 6 per cent. per annum will absorb £6,944, and leave £5,408 to carry forward. The "Yorkshire Electric Power Act, 1914," which was approved by the shareholders on February 17th, 1914, now awaits the Royal Assent. This Act renders unnecessary the holding of the usual meeting in September, and authorises the directors to declare an interim dividend, which they have now done. The company has now completed arrangements for the supply of electricity in the eastern portion of its area, and since the 9th July has been giving a supply in Goole for railway, dock and general purposes in addition to a supply to the Goole undertaking of the Distribution Co. The second turbine (3,000 kw.) in the waste heat station at Barugh has been put on load and is a valuable addition to the company's generating plant. Mains are being laid for supply to power users, and to the Distribution Co., in Ardsley, Wombwell and Worsborough, and an agreement has been entered into with that company for supply in Birstall, Greetland and Rothwell, where the company's mains are already laid. Applications have been made by holders of second mortgages for £35,405 of the issue of preference shares in exchange for their holdings and the bonus payable thereon, and in addition £19,265 of these shares have been applied for, making a total of £54,670 taken up since the beginning of the year. The total issues of preference capital authorised amount to £200,000 of which £184,575 has now been taken up, and the directors anticipate that the remaining £15,425 will soon be absorbed.

Swiss Brown-Boveri Co.—The report for 1913-14 of the A.G. Brown-Boveri Co., of Baden, states that, despite the slackening in the general situation of trade during the past year, the electrical industry remained well employed on the whole, although indications of a weakening were manifested by the prevalence of quieter conditions, but these did not lead to a scarcity of work. Under these circumstances, it was possible for the general extension of business to proceed, and the turnover in all departments experienced an increase, which amounted to 20 per cent. on a value of £1,240,000 for the Swiss works alone. The works at Munchenstein, which were acquired from another company, were conducted as the company's branch for the first time in the past year. Particulars are contained in the report of the working results of the concern in which the company is financially interested. These include the Brown-Boveri Co., of Mannheim, the Isaria Meter Works, of Munich, the Insulation Co., of Mannheim-Neckarau, and the Austrian Brown-Boveri Works, whilst the Rhenish Wire and Cable Works has been formed, and has acquired the new factory of J. Wahlen, of Cologne, for the manufacture of insulated wires, a new cable factory being there on the point of being brought into operation. The gross profits earned in 1913-14 amounted to £475,000, as compared with £379,000 in 1912-13, and £383,000 and £298,000 of these totals were realised from manufacturing in the two years respectively, the balance being profits on investments. After meeting general expenses and writing off £104,000 for depreciation, as compared with £60,000 in the previous year, the accounts indicate net profits of £163,000, as compared with £109,000 in 1912-13. It is proposed to pay a dividend of 9 per cent. on share capital of £1,120,000 out of total share capital of £1,280,000, this comparing with 8 per cent. on the former capital in the previous year.

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Continental.—Norway.—The Norske Aktieselskab for Elektrokemisk Industry, which is a kind of banking and promoting company for the development of the electrochemical industry in Norway, has invited the public to subscribe a series of 5 per cent. bonds for a total amount of nearly £300,000. The larger portion of the bonds had already been subscribed by various banks before the prospectus was published. The company increased its capital twice during the last half of 1913, and the capital now is £400,000 fully paid. The dividend for 1913 was 8 per cent. Including the new issue the total amount of the funds at disposal will be nearly £700,000. As security for the new issue the company has given a mortgage on the properties of the Arendals Fossekompani and the A/S Björlvefas, which have been valued at £630,000.

Charing Cross, West End and City Electricity Supply Co., Ltd.—The directors have declared an interim dividend on the ordinary shares of the West End undertakings for the half-year ended June 30th, 1914, at the rate of 5 per cent. per annum. Warrants will be posted on August 15th. An interim dividend of 5 per cent. on the ordinary shares of the West End undertakings for the past half-year has been declared.

National Boiler and General Insurance Co., Ltd.—The directors propose to pay a dividend at the rate of 11s. per share, free of tax, for the half-year to June 30th last; bonus of 3s. per share; to add to current risk and reserve fund, £8,000; forward, £6,964. It is also proposed to alter the date of the termination of the financial year from June 30th to December 31st, and to change the date of the annual meeting from August to February.

United Alkali Co.—The directors state that, in the interests of the company, it is inadvisable to declare the usual interim preference share dividend at the present time. The result of the company's operations during the six months to June 30th last has been by no means unsatisfactory, the preference dividend for the half-year having been practically earned.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—The directors have declared an interim dividend on the ordinary shares for the half-year ending June 30th last at the rate of 8 per cent. per annum.

Oldham, Ashton and Hyde Electric Tramway, Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum, less income-tax, on the ordinary shares for the half-year to June 30th.

Brush Electrical Engineering Co., Ltd., and reduced.—A petition for the confirmation of the reduction of capital from £489,512 to £253,780 has been presented, and will be heard on October 16th.

City of London Electric Lighting Co., Ltd.—The directors have declared a dividend of 6s. per share, less tax, for the year ended December 31st last, this being the same rate as a year ago.

Bank Rate.—Since our last issue appeared the Bank Rate has been raised to 8 and 10 per cent.; yesterday, however, it was reduced to 6 per cent.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange was closed last Friday morning—for the first time in its history—for fear of the consequences that would arise out of the European war. For several days previously, the House had ceased to be a market in the true sense of the word. What buying and selling went on was by the process of negotiation only; and on Tuesday in this week Stock Exchange business had come to a complete full stop.

It has been a matter of some debate whether, in the circumstances, the Electrical Review should publish its usual price lists of stocks and shares. The quotations themselves are nominal. It is impossible to deal, either at the figures given or even upon the basis of them. So many brokers, members of the Stock Exchange, have orders in hand to buy for their clients, however, that it was decided to print the lists as usual. Those readers who are fortunate enough to be amongst the bargain-hunters will no doubt scan prices with more than ordinary attention, because there is nothing to prevent brokers from accepting orders which they may be able to execute with their fellow-members, at values probably more tempting to the buyer than to the seller.

For instance, it may be quite possible to pick up a bond, quoted in our lists in the neighbourhood of 90, at ten points or so below this nominal valuation. We do not say that this is the case, but the probability of it is at least inherent. For there are many anxious sellers about; while, on the other hand, during the past few days we have met quite a number of brokers whose clients want to buy exceptionally cheap stock if it is to be secured, and, moreover, to pay for their purchases on the spot, in notes or bank drafts.

To attempt indications of the direction in which bargains should be sought is, for the time being, outside the scope of these notes; but those who follow the prices carefully from week to week will be able to fix some figure at which they regard certain securities as thorough bargains, and if they are prepared to take the risks incidental to Stock Exchange securities in time of war, they need have no hesitation in endeavouring to carry out their wishes through the medium of the Stock Exchange.

Some small proportion of the prices in the lists over-leaf were altered before the House was closed and before business came to a conclusion, so far as an actual market was concerned. Certain sections round the House, however, declined to vary the previous nominal quotations of the preceding week, contending that, as there were no real prices, to mark down figures in the Stock Exchange Official List was superfluous, and that lowered prices would be equally as misleading as those then standing.

To what extent commercial undertakings will be affected by the hostilities, it is, of course, impossible to say. In every direction the ordinary spending of the public will be materially curtailed, and this can hardly fail of its effect upon industrial profits. But such an influence must be ruled largely by the period of time over which the war extends; and as all the electric supply companies, for example, are doing well, their interim dividend statements showing this, it is conceivable that the net result may not reach any magnitude of loss. As to this, however, everything is mere guess-work. One of the halfpenny evening papers, by the way, in its excitement of last week, announced the failure of three members of the Stock Exchange who had not been hammered; while, on the same day, it paid the Metropolitan District Railway the barren compliment of quoting its Ordinary stock *ex* dividend!

Such firms as Babcock & Wilcox, Armstrongs, Vickers and other such engaged in kindred businesses are likely to gain substantially, while some of the engineering and stamping companies had peremptory orders last week-end to hasten all Admiralty work. In one case that came under our notice, a certain small company was instructed to rush forward at all speed some work required in connection with the Navy, and with the instructions came a notification that there would be no inspection before delivery.

The cable companies in times of past wars have derived mixed benefits. A boom in the number of messages may be counteracted by damage done to lines, to stations, and so on. At the present time the absence of all Stock Exchange business is a serious consideration to the Anglo-American concerns, but there is war traffic to help in filling the gap. How the Marconi Company is likely to fare is a matter for conjecture; after the war when peace breaks out, the orders will probably pour in if the system should have been demonstrated as invaluable in times of strife as in those of peace. But there is also possible competition to be considered.

In the matter of gilt-edged securities, examples of which are so numerous in our price lists, the lowering of credit caused by the sudden national demand for cash, and by the abnormal Bank Rate, tends naturally to reduce prices, because if people can get sound Government stocks to yield 5 per cent., they are not going to buy industrial debentures which return 4 to 4½ per cent. This, however, is another problem set for prophecy, and its reply must depend upon the answer to the patriotic prayer that it may not be long before the British Navy and our allies give such an account of themselves as will leave their enemies nursing very sore heads for half a century or two.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	Inc.
		£	£		£	£		
Bath	July 29	5,177	+ 256	29	29,256	+ 2,162	..	..
Blackpool-Fleetw'd	,, 25	5,983	— 81	29	19,898	+ 514	8	..
Bristol	,, 31	39,779	+2,903	31	259,748	+20,892	80·5	..
Brit. Elec. Trac. Co.	,, 24	247,536	·3',076	..	..	..	429·8	..
Chatham and Dist.	,, 28	4,311	+ 177	29	26,660	+ 536	14·96	..
Cork	,, 30	1,946	+ 127	30	17,317	+ 745	9·89	..
Dublin	,, 24	27,588	+ 756	30	171,404	— 2,667	54·26	..
Hastings	,, 22	4,995	+ 267	29	..	+ 572	19·3	..
Lancashire United	,, 29	6,776	+ 2·9	30	49,731	+ 5,001	43	..
Llandudno-Col. Bay	,, 24	2,207	— 56	34	9,124	..	6·5	..
London United ..	,, 24	28,405	— 185	30	184,589	+ 2,412	..	..
Tyneside	,, 24	1,838	+ 79	4	1,838	+ 79	11	..
Anglo-Argentine ..	,, 29	111,114	—7,868	30	1,668,858	— 1,910	25·42	1·05
Auckland	,, 5	20,919	+ 912	48	247,311	+ 6,881	..	..
Calcutta	,, 25	18,614	+ 1,110	..	..	+ 7,615	20·5	..
Kalgoorlie, W.A. ..	June	2,692	..	26	15,522	..	15·25	..
Madras	June 15	3,718	+ 2·5	23	21,199	+ 1,691	..	..
Montevideo ..	July	26,417	2,772	31	285,668	— 3,989	..	..
Cen. London Rly.	July 25	18,403	+ 294	30	148,856	— 2,496	6·78	·4
City & S. Lon. Rly.	,, 25	9,871	— 876	30	2,425	— 228	7·26	..
Dublin-Lucan Rly.	,, 31	771	— 62	4½	773	— 59	7	..
L'pool Overh'd Rly.	,, 26	6,939	— 966	30	51,396	— 523	6·6	..
London Elec. Ry. Co.	,, 25	51,225	—1,060	30	420,515	+ 1,440	21·25	..
Mersey Railway ..	,, 25	8,466	— 574	30	66,956	— 299	4·5	3·5
Metropolitan Rly.	Aug. 2	75,081	+ 856	31	568,081	+ 42,280	29·25	..
Met. District Rly.	July 25	51,574	— 394	30	398,909	+ 190	25	..

Market Quotations.—Owing to the markets being closed on account of the outbreak of war, we are informed that no official quotations can be given. Our last statement appeared on July 24th; the prices must be regarded as at present purely nominal.

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SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Aug. 4th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	7/8 — 15/16	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	16½ — 18½	..	..
Do. Do. Deferred	100	..	..	10 — 12	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	85 — 89	..	6 11 2
Do. 7 % Non-Cum. Pr'f.	100	8	8½	54 — 57	..	6 2 10
Do. 5 % Perp. Deb.	100	5	5	91 — 93	..	5 7 5
Do. 4½ % 2nd Deb.	100	4½	4½	75 — 78	..	5 15 5
Central London Railway, Ord.	100	8	8	55 — 60 xd	..	5 0 0
Do. Gtd. Assented	100	..	4	80 — 82	—2	4 17 7
Do. Pref.	100	4	4	66 — 71 xd	..	5 12 7
Do. Gtd. Assented	100	..	4	84 — 86	..	4 18 0
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	79 — 81	—1	4 18 7
Do. 4 % Deb.	100	4	4	95 — 97	..	4 2 6
City & S. London, 5 % Pref., 1891	100	5	5	92 — 95 xd	..	5 5 0
Do. Do. 1896	100	5	5	88 — 91 xd	..	5 10 0
Do. Do. 1901	100	5	5	86 — 89 xd	— ½	5 12 4
Do. Do. 1908	100	5	5	86 — 89 xd	— ½	5 12 4
Do. 4 % Deb.	100	4	4	86 — 88	..	4 11 0
Hastings Trams, 6 % Pref.	1	6	6†	13/16 — 15/16	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	84½ — 86½	..	5 15 4
London and Suburban, Ord.	1	..	1	7/16 — 9/16	..	3 10 10
Do. Do. 5 % Cum. Pref.	1	..	5†	9/16 — 11/16	..	8 0 0
Do. Do. 4½ % 1st Deb.	100	4½	4½	73 — 78	..	5 15 5
London Elec. Railways, 4 % Deb.	* 100	1912. 4	1913. 4	87 — 90	..	£ s. d. 4 9 0
London United Trams, 4 % Deb.	100	4	4	53 — 57	..	7 0 4
Metropolitan Railway Consol.	100	1⅞	1⅞	31½ — 31¾ xd	—2½	5 2 4
Do. Surplus Lands	100	2⅜	2⅜	58 — 60 xd	— ½	4 11 9
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Pref.	100	3½	3½	79 — 82 xd	..	4 5 4
Do. 3½ % Con. Pref.	100	3½	3½	72 — 79 xd	..	4 8 7
Metropolitan District Ord.	100	Nil	..	19⅜ — 19½	—1½	Nil
Do. 6 % Deb.	100	6	6	134 —138	—1½	4 7 0
Do. 4 % Deb.	100	4	4	90 — 93	..	4 6 0
Do. 4 % Prior Lien	100	4	4	94 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	78 — 80 xd	—2½	5 12 6
Do. 3½ % Gtd.	100	3½	3½	72 — 74 xd	..	4 14 7
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
Do. 5 % Deb.	100	5	5	85½ — 88½	..	5 13 0
Potteries, Ord.	1	3½	3½	9/32 — 13/32	..	8 12 10
Do. 5 % Pref.	1	5	5	27/32 — 29/32	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	81½ — 84½	..	5 6 2
South Metro. Trams, 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Underground Elec. Railways	10	..	..	2 — 2¼	— ⅛	Nil
Do. "A"	1/-	..	..	9/32 — 11/32	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	112 —114	—1	5 5 4
Do. 4½ % Bonds	100	4½	4½	97 — 99	—1	4 11 0
Do. 6 % Income	100	6	6	82 — 84	—4½	7 2 10
Yorkshire (West Riding), Ord.	5	Nil	Nil	1/32 — 3/32	..	Nil
Do. 6 % Pref.	5	3	4	4½ — 4⅝	..	4 6 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4¼ — 4⅜	..	5 17 4
Do. 2nd Pref.	5	5½	5½	4⅜ — 4½	..	6 5 9
Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Do. 4½ % Deb.	100	4½	4½	97 —103 xd	..	4 10 0
Do. 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Auckland Trams, 5 % Deb.	100	5	5	101 —104	..	4 16 8
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅞ — 11¼ xd	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	96 — 97	..	4 12 9
Do. 5 % 2nd Deb.	100	5	5	99 —101	..	4 19 0
Brazilian Traction, Light and Power	$100	6	6†	56 — 60 xd	—1½	10 0 0
Brisbane Trams Invt., Ord.	5	8	8	7¾ — 7¾	..	5 8 8
Do. 5 % Pref.	5	5	5	4¼ — 4½	..	4 15 8
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	8†	104 —108	..	7 8 2
Do. Pref. Ord.	100	6	6	100 —104 xd	..	5 15 5
Do. 5 % Pref.	100	5	5	101 —104	..	4 16 2
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 0
Do. 4½ % Vancouver Deb.	100	4½	4½	92 — 96	..	4 13 9
Do. 4½ % Con. Deb.	100	4½	4½	95 — 97	..	4 7 9
Calcutta Trams, Ord.	5	7⅜	9⅜	7 — 7¼	..	6 6 9
Do. 5 % Pref.	5	5	5	4 15/16 — 5 1/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	96 —101	..	4 9 0
Cape Electric Trams	1	5	5	⅜ — ½	..	6 18 4
City Buenos Aires Trams (1904)	5	5	5	5⅜ — 5⅝	..	4 9 0
Do. 6 % Deb.	100	4	4	95 —100	..	4 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 8 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	91 — 95	..	5 5 8
Kalgoorlie El. Trams 5% A Deb.	100	5	5	82 — 87	..	5 15 0
Do. 6% B Deb.	100	3	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord.	1	..	..	1/32 — 3/32	..	..
Do. Pref.	1	4½d.	6	3/32 — 5/32	..	6 5 0
Lisbon Elec. Trams, Ord.	1	6	6	1 5/16 — 1 7/16	..	4 9 8
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	92½ — 97½	..	5 2 6
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4⅜ — 5½	..	5 14 8
" Elec. Tr. (1904), Deb.	100	5	5	99 —101	..	4 19 0
Manaos Trams & Lt., 1st Deb.	100	5	5	75½ — 78½	..	6 7 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100 —102	..	4 18 0
Mexico Trams Com	$100	7	7	60 — 65	—2½	..
Do. Gen. Con. 5 % Bonds	..	5	5	82 — 86	..	5 16 8
Do. 6 % Bonds	100	6	6	74 — 78	..	7 13 10
Para Elec. Rlys. & Lt., Ord.	5	10	10	4 — 4½	..	11 2 2
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	88 — 91	..	5 10 ..
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	94 — 96	..	4 13 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	96 — 98	..	5 1 0
Do. 5 % Mort. Bonds	100	5	5	88½ — 90½	..	5 10 6
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	97 —101	..	4 19 0
Singapore Trams, 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	99 —102	..	4 18 0
Un. Elec. Trams Monte Video	5	7	7	4½ — 4¾	..	7 7 4
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛	..	5 17 8
Do. 5 % 1st Deb.	100	5	5	95 — 97	..	5 8 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 96½	..	4 14 8

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9½ — 10½	..	4 5 9
Do. Second 6 % Pref.	10	6	6	10½ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96	..	4 13 9
Brompton & Kensington, Ord.	5	10	10	8⅞ — 9⅜	..	5 6 8
Do. 7 % Cum. Pref.	5	7	7	8⅜ — 8⅝	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91 — 94	..	4 5 1
Charing Cross, West End & City	5	5	6	5 — 5½	..	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4¼ — 4½	..	5 0 0
Do. Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Chelsea, Ord.	5	5	5	4⅜ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	95 — 98	..	4 11 0
City of London, Ord.	10	9	10	15½ — 16½	..	6 1 4
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	115 —118	..	4 4 9
Do. 4½ % Second Deb.	100	4½	4½	99 —102	..	4 8 1
County of London, Ord.	10	6	7	11⅜ — 12¼	..	5 14 8
Do. 6 % Pref.	10	6	6	11⅜ — 12¼	..	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	101 —104	..	4 6 7
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 1
Edmundson's, Ord.	£3	..	..	5/16 — ½	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3¾ — 4	..	7 10 0
Do. 6 % Non-Cum. Pref.	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	82 — 85	..	5 6 0
Folkestone	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % First Deb.	100	4½	4½	91 — 95 xd	..	4 16 9
Hove	5	8	9	8¼ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7½ — 7¾	..	5 16 8
Do. 4 % Deb.	Stock	4	4	90 — 92 xd	+1	4 7 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	74 — 78	..	5 15 0
London Electric, Ord.	8	2½	3	1¾ — 1⅞	..	5 10 0
Do. 6 % Pref.	5	6	6	4½ — 5½	..	5 14 8
Do. 4 % First Mort. Deb.	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	4½	4½	8¼ — 8¾	..	6 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 5/16 — 4 7/16	..	4 18 8
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 99	..	4 11 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	82 — 84	..	4 3 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¼ — 10½	..	5 17 8
Oxford	5	7	7	5⅞ — 6⅜	..	5 10 0
St. James' and Pall Mall, Ord.	5	10	12	9⅛ — 9⅜ xd	..	6 4 6
Do. 7 % Pref.	5	7	7	6⅜ — 7⅛ xd	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 4
South London, Ord.	4	5½	5½	2⅞ — 3¼	..	6 15 4
Do. 5 % First Mort. Deb.	100	5	5	93 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1 3/16 — 1 5/16	..	5 6 8
Do. 4½ % First Deb. Stock	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£3	Nil	..	5/16 — 9/16	..	..
Do. 5 % Cum Pref.	5	3½	4	2¾ — 3	..	6 18 4
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 8 8
Westminster, Ord.	5	10	10	8⅝ — 8¾	..	5 12 8
Do. 4½ % Cum Pref.	5	4½	4½	5 — 5¼	..	4 5 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Funded Certs.

Continued on next page.

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SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Aug. 4th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	£	6	6	5⅛ — 5⅜	..	5 11 7
Calcutta, Ord.	£	8½	9	7¼ — 7⅜	..	5 16 2
Do. 5 % Pref.	£	5	5	4 15/16 — 5 1/16	—1/16	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	86 — 88	.	5 13 8
Canadian Gen. El. Com.	$100	7	8	95 —100	—2	8 0 0
Do. 7 % Pref.	$100	7	7	116 —121	..	5 15 10
Cordoba Lt., Power and T., Ord.	1	5	..	⅞ — ⅞	..	7 12 0
Do. 5 % Deb.	100	5	5	81 — 86	..	5 16 8
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	80 — 85	—1½	7 1 2
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	95 — 98	..	5 2 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93 — 95	..	5 5 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/16 — 3/8	..	Nil
Do. 6 % Pref.	£	6	4	¼ — ⅜	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	99 —102	..	4 18 0
Madras, Ord.	£	Nil	..	1½ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	104 —107	..	4 13 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	61 — 66	..	7 11 8
Mexican Lt. & Power, Common	$100	4	4†	44 — 47	..	..
Do. 7 % Cum. Pref.	$100	7	7	69 — 74	..	9 9 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	79 — 84	..	5 19 1
Do. 5 % 2nd Mort. Bonds	100	5	5	60 — 65	..	7 13 10
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	* 100	1912. 5	1913. 5	48 — 53	..	£ s. d. .. ..
Montreal, Lt., H. and Power	$100	9	10†	225 —235 xd	—2½	4 5 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	10	235 —245	..	4 1 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	97 —103	..	5 16 6
Do. 5 % Deb. Stock	Do.	5	5	99 —101	..	4 19 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water. Capital	$100	5½	6	120 —130	—10	4 12 4
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	103 —106	..	4 14 4
Do. 4½ % Per. Deb.	Stock	4½	4½	100 —102	..	4 8 3
Toronto Power, 4½ % 1st Deb.	Do.	4½	4½	98 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	82½ - 84½	..	5 18 4
Victoria Falls Power, Pref.	1	6	6	⅜ - ½	..	8 0 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 3

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Aug. 4th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	£	7	7	11/16 — 12/16	..	8 12 4
Do. 6 % Pref.	£	6	6	9/16 — 10/16	..	7 2 3
Babcock & Wilcox	£	16	16	2⅝ — 2¾	..	5 11 4
Do. Pref.	£	6	6	1 15/16 — 1 17/16	..	4 8 6
British Aluminium, Ord.	£	..	5	1 15/16 — 1 17/16	..	4 14 1
Do. 6 % Cum. Pref.	£	6	6	65/8 — 67/8	..	6 9 0
Do. 5 % Prior Liens Debs.	100	5	5	95 — 98	..	5 2 0
Do. Deb. Stk.	100	5	5	88 — 93 xd	..	5 7 6
B.I. & Helsby Cables	£	10	13	10½ — 10⅝	..	6 1 0
Do. Pref.	£	6	6	5⅞ — 6⅜ xd	..	4 12 4
Do. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref.	£	Nil	5	1 1/16 — 1 1/16	—1/16	5 11 8
Do. Deb.	100	4	4	72 — 75	..	5 6 8
Do. 6 % Prior Lien	100	6	6	101 —104	..	5 16 6
Browett, Lindley, Ord.	£	..	..	2/- —8/-	..	Nil
Do. Pref.	£	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	£	Nil	..	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 — 85	..	5 17 8
Lo 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb.	100	4½	4½	29 — 33	..	13 12 8
Callender's Cable	£	15	15	11¼ — 12½	..	6 2 5
Do. Pref.	£	5	5	5 — 5½	..	4 15 3
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	£	20	22½	2¼ — 2½	— ⅛	9 0 0
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Dick, Kerr	£	Nil	..	⅜ — ⅝	..	..
Do. Pref.	£	6	6	⅜ — ⅝	..	6 17 2
Edison & Swan, A, £2 paid	£	Nil	..	1/16 — 3/16	..	Nil
Do. fully paid	£	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	57 — 61	..	6 11 1
Do. 5 % Second Deb.	100	5	5	61 — 66	..	7 11 6
Electric Construction	£	5	5	15/32 — 17/32	..	8 8 6
Do. Pref.	£	7	7	1 — 1⅛	..	6 4 5
Greenwood & Batley, Pref.	£	7	7	6½ — 7½	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	£	6	6	10⅓ — 11	..	5 9 1
Do. Deb.	100	4	4	88 — 92	..	4 7 0
Henley's, Ord.	£	15	20	14½ — 15½	..	6 9 0
Do. Pref.	£	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	99½ —101½	..	4 8 8
India-Rubber, G. & T.	£	7½	7½	8⅝ — 9⅛	..	7 18 0
Do. Pref.	£	5	5	9 — 9⅜	..	5 2 7
Telegraph Construction	£	20	20	37½ — 39½	..	6 1 7
Do. Deb.	100	4	4	97 — 99	..	4 0 10
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	..	63 — 67	..	5 19 3
Do. B 4 % Cum. Pref.	100	..	£4	37 — 41	..	9 15 1

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Aug. 4th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	£	10	4½	4½	5⅜ — 6½	..	7 4 0
Do. 5 % Deb. Red.	£	Stock	5	5	95 — 98	..	5 2 0
American Telep. & Teleg., Cap.	$	100	8	8	119 —124	..	6 9 0
Do. Collat. Trust	$	1000	4	4	90 — 93	..	4 6 0
Anglo-American Telegraph	£	Stock	8	8	64 — 67	..	4 9 7
Do. 6 % Pref.	£	Do.	6	6	107 —109	..	5 10 7
Do. Def.	£	80/-	80/-	22½ — 23½	..	6 9 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	£	100	5	5	102 —104	..	4 16 2
Chili Telephone	£	5	8	8†	7 — 7½ xd	..	5 10 4
Commercial Cable, Stlg. 4 % Deb.	£	Stock	4	4	80 — 82	..	4 17 7
Cuba Telegraph	£	10	6	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	£	10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	£	5	4	4	3¾ — 4	..	5 0 0
Do. 10 % Cum. Pref.	£	5	10	10	7¼ — 7⅝	..	6 9 0
Direct United States Cable	£	10	4	4	6⅜ — 6⅝ xd	— ⅛	5 16 3
Direct W. India Cable, 4½ % Reg. Deb.	£	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	£	Stock	7	7	129 —132	..	5 6 8
Do. 8½ % Pref. Stock	£	Do.	8½	8½	76½ — 78½	..	4 9 2
Do. 4 % Mort. Deb.	£	Do.	4	4	95½ — 97½	..	4 2 1
Eastern Extension	£	10	7	7	12½ — 13	..	5 7 9
Do. 4 % Deb.	£	Stock	4	4	96 — 98 xd	..	4 2 0
Globe Telegraph and Trust	£	10	6	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	£	10	6	6	12⅝ — 13⅛	..	4 11 4
Great Northern Telegraph	£	10	20	20	81 — 88	..	6 1 3
Indo-European Telegraph	£	25	13	13	57 — 60	..	5 8 4
Mackay Companies Common	$	100	5	5	80 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$	100	4	4	67 — 72	..	5 10 1
Marconi's Wireless Telegraph	£	1	20	20	1⅜ — 1⅝ xd	— 3/32	12 3 0
Do. 7 % Cum. Partic. Pref.	£	1	17	17	1¼ — 1½ xd	..	11 6 8
Monte Video Telephone, Ord.	£	1	6	6	1/32 — 1/16	..	6 8 0
Do. 5 % Pref.	£	1	5	5	25/32 — 27/32	..	5 18 6
New York Telep., 4½ % Gen. Bnds.	£	100	4½	4½	98 —100	—2	4 10 0
Oriental Telep. and Elec.	£	1	10	10	2 1/16 — 2 3/32	..	4 7 6
Do. 6 % Cum. Pref.	£	1	6	6	1 29/32 — 1 31/32	..	4 13 5
Do. 4 % Red. Deb.	£	Stock	4	4	86 — 88	..	4 11 0
Pacific and European Tel., 4 % Guar. Debs.	£	Do.	4	4	95 — 97	..	4 2 8
Reuter's	£	10	10	7	7 — 8	..	8 15 0
Submarine Cables Trust	£	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	£	Stock	4½	4½	97 — 99	..	4 11 0
United River Plate Telephone	£	5	8	6†	6⅛ — 6⅜	..	6 0 9
Do. 5 % Cum. Pref.	£	5	5	5	5 — 5⅛	..	4 11 0
West Coast of America	£	2½	2½	N	⅞ — 1⅛	..	Nil
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	£	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	£	10	1½	1½	1 — 1½	— ⅛	10 0 0
Do. 6 % Cum. 1st Pref.	£	10	6	6	8 — 9	— ¼	6 13 4
Do. 6 % Cum. 2nd Pref	£	10	6	6	8⅛ — 8¾	..	6 16 9
Do. 5 % Debs.	£	100	5	5	98 —101	..	4 19 0
Western Telegraph, Ltd.	£	10	7	7	13⅜ - 13⅞	..	5 0 11
Do. 4 % Debs.	£	Stock	4	4	95½ - 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$	1000	4½	4½	95 - 100	..	4 10 0

* Unless otherwise stated all shares are fully paid. † Interim dividend. a Paid in deferred interest warrants.

Bank rate of Discount 10 per cent., August 1st, 1914.

A German Electricity Monopoly.—As the Defence Tax has by no means resulted in the realisation of the expected amount of money, various proposals are under consideration in Germany for opening up new sources of State revenue. Apart from suggested Government monopolies in the manufacture of cigarettes, which would yield an estimated annual profit of £6,000,000, and in the production of potash salts, the question of legislation in regard to the supply of electricity, if not in regard to electrical manufacturing, is also held in prospect in the near future. As far as electricity supply is concerned, the fact may be recalled that the financial reform scheme of 1909 contained a proposal to impose a tax on the consumption of electrical energy, but the general opposition which was manifested caused the proposal either to be rejected by the Reichstag or to be abandoned by the Government. The Reichstag has, however, never considered the problem in the form of a suggested monopoly of electricity supply. Besides, there are serious difficulties in the way, inasmuch as certain States, as, for instance, Bavaria and Baden, have proceeded, or are in the act of proceeding, with the development of their own water powers, so that they would scarcely be disposed to agree to be included in any legislative scheme for the whole of the country. It would, however, be possible for these States to legislate independently, leaving the largest State—Prussia—to undertake a scheme of its own. On the other hand, the manufacturing firms stand on a different basis. At the most it is considered that legislative action might be expected to secure freedom of trading as between the smaller and large undertakings although it cannot be foreseen how the adoption of such a measure would contribute financially towards the Imperial exchequer.

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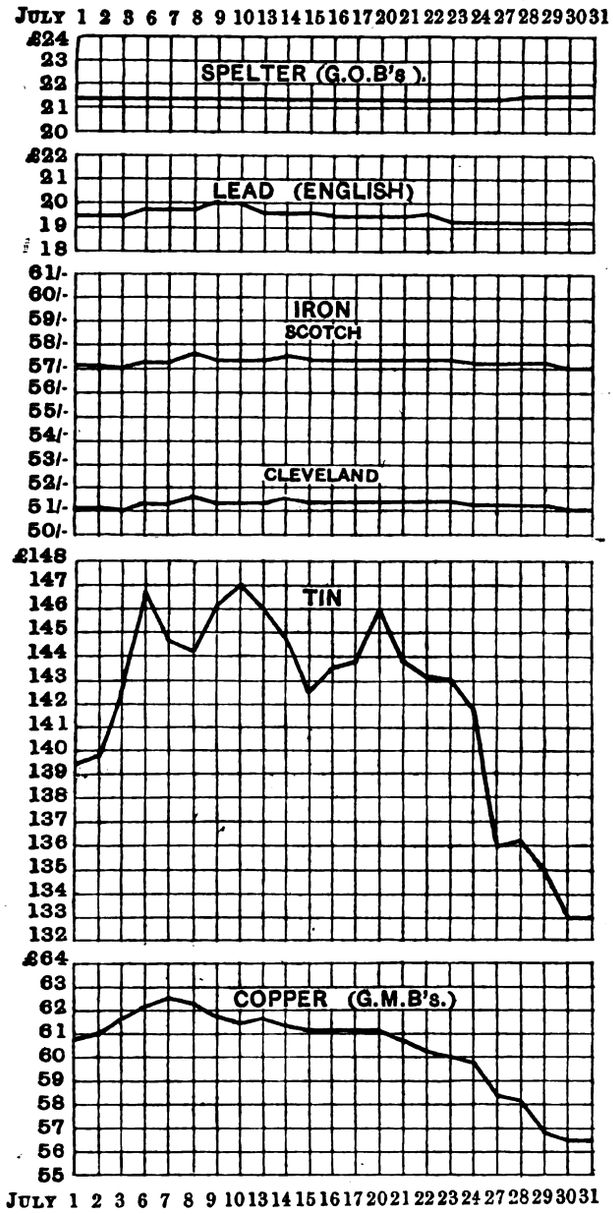
METAL MARKET.

Fluctuations in July.



Manufacture of Ammonia from the Nitrogen of the Air.—In the *Wissenschaften* Mr. Otto Serpek has given an interesting description of his new process for manufacturing ammonia from the nitrogen of the air. The first step consists in producing aluminium nitrite, which is decomposed by means of water into hydrate of alumina and ammonia. Serpek found that it was easier to produce the nitrite from an impure clay than from pure clay, because the impurities acted as catalytic agents. Iron, in particular, was an excellent catalyst, and bauxite was consequently a very good material. Of other catalysts might be mentioned nickel, manganese, silicic acid and titanic acid, which could be added to pure clay so that the material would act as well as bauxite. It would be possible to produce the nitrite at low temperatures (1,250-1,300°), but the process would then require considerably more time (5-6 hours), and other difficulties were met with. At a somewhat higher temperature the reaction required about half an hour, and at 1,900° only five minutes. The decomposition of the aluminium nitrite by means of water is effected by heating under a pressure of 2 to 3 atmospheres. The process requires from 3 to 4 hours, and may be described as follows:—

$$Al\,N + 3\,H_2O = Al(OH)_3 + N\,H_3.$$

After the distillation of the ammonia had taken place, a pure hydrate of alumina could be produced from the remainder. The Serpek process has up to the present time only been employed in an experimental plant at Saint Jean de Maurienne, in Savoy, but it is now going to be exploited commercially and on a large scale; there is under construction a large factory at Arendal, in Norway, and another in the United States, for this purpose

REVIEWS.

Electrical Photometry and Illumination. By Hermann Bohle. London: Charles Griffin & Co., Ltd. Price 10/6 net.

This work, which is of interest both to physicist and engineer, is by far the best book of its kind which we have yet seen, and contains much to recommend it to all who are interested in any way in the art of illumination.

In the first chapter photometric units and standards are very completely dealt with, and in this respect the opening pages will be of more than ordinary interest to the physicist and research student.

Radiation and its effects are treated in the chapter following, and most of the ordinary forms of apparatus used for the production of light by electrical means are very fully explained.

Photometric apparatus forms the theme of the third chapter, and this portion of the subject is more fully dealt with by Dr. Bohle than by any other author whom we have yet come across. In this chapter appears a table the use of which is not perfectly clear at first sight, and we think that a little further explanation would be desirable. One or two of the explanations could also be improved upon, in spite of the clear illustrations of the various instruments described. In the description of the Holophane lumeter the figure "o" appears instead of the word "zero," so that one, unless entirely familiar with the instrument, is liable to be led astray, owing to the "o" being a reference for a certain piece of apparatus shown in the diagram. The Ulbricht sphere is described very fully, together with the mathematics thereof, but we think that the chapter as a whole should be read with extreme care, otherwise confusion is likely to result.

Chapter four deals with light flux and distribution, and again the subject is splendidly treated, both from a mathematical and practical point of view. After a number of paragraphs on the arc lamp, the author dilates upon the flame arc; some striking figures are given showing the screening effect of lower carbons of arc lamps. A number of pages are devoted to illumination, and we can, with confidence, advise their perusal. The testing of lamps is next dealt with, and should be of service to those interested in lamp manufacture. The variation of candle-power with voltage is very fully treated, but we do not see any reference to the influence of the specific heat of the material composing the filament upon the candle-power when variations occur as in an alternating-current circuit. A number of paragraphs are devoted to the testing of arc lamps, and several opinions put forward by the author should be of service to those who have to deal with illumination. We think that the tables at the end of these paragraphs could, with advantage, be explained rather more fully. There is a great deal of information upon the Moore tube, which will be helpful to those considering its installation.

We must confess disappointment with the following chapter, which purports to deal with the "Design of Reflectors and Shades," and feel that this heading is somewhat unfortunate. We are also somewhat surprised that the credit for the Holophane should be given to Messrs. Blondel and Psaroudaki, since we were under the impression that they were merely the first persons to treat this material on a commercial basis.

We are pleased to see in the next chapter, which treats of illuminating engineering, many details usually overlooked by those planning installations brought well to the front, notably the question of shades. Though slightly out of date, the information regarding the illumination of various buildings, etc., is very useful, and many important points are

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emphasised. The tests given are interesting, but there is much room for improvement in the examples given, many of the features illustrated scarcely agreeing with the author's previous comments. The facts and figures regarding indirect illumination also require careful revision. The table, summarizing American and Continental varieties of standard specifications for street lighting, should be of service, as should also the examples worked out in the pages following. It is to be regretted that a few paragraphs further on the author, in comparing costs, bases his figures upon candle-power, and not upon illumination. The hygienic aspect of electric lighting is dealt with in the following paragraph, and is representative of the author's thoroughness in his work.

Following the text are a number of appendices, and also a very complete list giving the principal papers and communications which have appeared since 1906. This list, together with the foot-notes, increases the usefulness of the book to a very large extent.

Applications of Electricity. By A. Ogilvie. London: T. C. & E. C. Jack. Price 6d. net.

This is one of the few inexpensive books in which is presented a sufficiently accurate and detailed explanation of the chief everyday applications of electricity, in simple language and without extravagance of phrase or metaphor. Under Battery Current Applications, the author deals with electric bells and clocks, telegraphs and telephones, etc., and under Dynamo and Current Applications, he describes electric lamps, electric heating and power applications and electro-chemistry. No more than elementary facts are outlined, but by aid of the numerous diagrammatic illustrations, no reader should have any difficulty in understanding the *modus operandi* of the apparatus and applications described.

Questions and Solutions in Magnetism and Electricity. By W. J. White. London: S. Rentell & Co. Price 1s. 6d. net.

The author presents model answers (illustrated when necessary) to questions set by the Board of Education and City and Guilds of London Institute in Stage I of Magnetism and Electricity during the years 1907-1913. Where the answer to a certain question is identical with or a mere variation of that given for some earlier question, the author avoids repetition and waste of space (besides in many instances affording valuable insight into the correlation of various problems) by giving cross references. Any student giving these answers would be assured of a First-Class Certificate, and this excellent little treatise is to be recommended heartily to all students as showing how examination questions should be answered, sufficiently but tersely; as providing a convenient means of revising knowledge previously obtained; and as forming a catechistic text book of no mean order. A concise index increases materially the value of the work.

Slide Rule Notes. By H. C. Dunlop and C. S. Jackson. London: Longmans, Green & Co. Price 2s. 6d. net.

Based on an earlier and less complete pamphlet, this work represents a complete exposition of the uses to which may be placed an ordinary 25-cm. slide rule of the Mannheim type. It is safe to say that the ordinary engineer—who generally uses his rule for multiplication and division, and occasionally ventures to determine simple trigonometrical functions by its aid—will be amazed, not to say overawed by the diversity of operations to which the "guessing stick" may be applied. Full appreciation of these applications can only be obtained by practice, and some of them are rarely required by the average engineer. Nevertheless study of the treatise is to be commended to mathematical and engineering students, and the volume should certainly be taken for reference on any field work in the course of which unusual calculations may arise. Where special calculations have frequently to be made and high accuracy is essential, it is generally advisable to use a specially designed slide rule or, in some cases, to rely on tables. The authors show, however, that the scope and accuracy of the ordinary slide rule are much greater than generally realised. They explain clearly by words, illustrations and examples its use in simple multiplication and division; in evaluating square and cube roots and trigonometrical functions; the use of logologarithmic and central scales; and the solution of equations and plotting curves from equations. The effect on results of errors in working is discussed in Chap. IX, and a valuable collection of miscellaneous notes and mnemonics is presented in Chap. X. Anyone who has worked conscientiously through this book will be well aware of the exact capabilities and limitations of the ordinary slide rule, and will have no difficulty in understanding the theory and use of more elaborate instruments.

Handbook of Wireless Telegraphy. By J. Erskine-Murray, D.Sc. Fifth edition. London: Crosby Lockwood and Son. Price 10s. 6d.

Further additions and revisions have been made in this book of copious information on the mysteries of wireless telegraphy, which still preserves its bright and airy but irresponsible style of compilation. Considerable additions have been made under the headings of uniform alternating current and shock excitation systems, and new matter has been added in various parts in the endeavour to bring the work in line with modern advances. It would, however, be an advantage if, at the same time, some of the older chapters were excised. In spite of this disadvantage the book contains much useful and interesting information, and the illustrations throughout are specially good and well printed. The Reviewer must, however, again join issue with the Author on his imperfect and misleading treatment of the electrical properties of the atmosphere as given in Chapter XVI. He appears to regard conductivity as a normal condition of rarefied air instead of abnormal. An exhausted bulb is not, at any pressure, normally a conductor of electric currents. It must be ionised by some means before conductivity sets in. The Author does not appear to hold this view, or at any rate it would not be gathered from the statements he makes.

Chapter XVI also contains a useful *résumé* of Dr. Austin's long distance measurements and results in the United States. In an earlier chapter the Goldschmidt alternator receives an increased share of attention and certain particulars of working results are given.

ESTABLISHMENT CHARGES.

By T. B. L. NEWSTEAD, A.M.I.E.E.

Whilst the careful determination of the establishment charges incidental to a modern engineering manufacturing business, and the correct allocation of the same, is a matter of the greatest importance, it is, nevertheless, one that in the majority of cases does not receive nearly such close attention as it should; in many firms the question is practcially overlooked, and no effort is made to compare periodically the overall costs of the goods manufactured with the prices obtained, in order to see whether actual profits

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are being made or the work carried on at a loss. By some it is apparently considered sufficient to take a rough monthly balance from the value of the stock withdrawals and materials used, the total cost of supervision, labour, and all other expenses, and to set these against the value of the goods invoiced or turned into the finished-material stores, with a view to gauging the relative profits made; but, though this may give some idea of the position of affairs in small concerns, it cannot be deemed at all a satisfactory method of arriving at actual results or of showing what are the total costs of the various articles made.

If more careful attention were given to this subject from month to month, it would be much easier accurately to gauge the progress of the business without waiting for the annual stocktaking and balancing of accounts, and thus many business failures might be guarded against.

To make allowance for the cost of establishment charges in estimating the costs of manufacture, it is usual to calculate these as a percentage of the labour charges relating to the work in question, which percentage will vary considerably with the nature and size of the business and the extent of the organisation required to sell the goods manafactured, and it may amount to anything from 50 per cent. to 200 per cent. or more upon the actual cost of the productive labour involved. In some cases—though more rarely—a small percentage of 5 per cent. to 10 per cent. is also added to the cost of materials to cover interest, handling, and other expenses incidental thereto.

Although these allowances are made for estimating, and also in some cases for costing, purposes, it is very rarely indeed that any steps are taken to make a monthly comparison between the amount of the actual establishment or standing charges and the corresponding cost of the productive labour, with a view to finding out whether the calculated percentage allowed for is correct or not, and consequently whether the work is being carried on with a satisfactory margin of profit.

It should be a very simple matter, however, at the end of each month to calculate and total up all the standing charges for the month, comprising such items as rents, rates and taxes, lighting, heating, water and power supply; works supervision charges; designing and testing, in so far as it is not possible to have these charges actually booked up to the work in progress (which should be done as far as practicable); and any other incidental expenses involved. In addition to these there will be the head and branch office expenses, staff salaries, and the selling and advertising charges generally; and, on the other side, there will be the total productive wages bill for the month, so that a ratio can be arrived at each month between these two totals from which a more accurate covering figure for costing purposes can be arrived at. This should not vary very considerably from month to month, though naturally it will tend to go down during times of prosperity and as the volume of business increases, and to rise when trade is bad. It is in the latter case particularly that a more accurate knowledge of what is taking place is desired, as otherwise disaster may result owing to orders being accepted at too unremunerative prices.

The writer would therefore suggest that it would be found a good plan to open an establishment charges account in the books, which would be debited with all charges coming within this category; and that each manufacturing shop order, upon which work has been done during the month, should be debited at the end of the month with an amount for establishment charges, calculated at the proper percentage upon the total cost of the labour charged to that order during the month in question: this percentage would be arrived at in the manner already explained, and the nearest round figure would be taken above the actual ratio of the total establishment charges to the total cost of productive labour for the month. The establishment charges account would at the same time be credited with the various amounts debited to the shop orders, with the result that the account would always show a small balance upon the right side, which would be carried to the profit and loss account at the end of the financial year.

In this way each shop order would automatically bear its due share of standing charges, and it could be seen at any moment whether the work was being done at a profit. In cases where it might be necessary to make up the total cost of a completed shop order before the end of the month—for invoicing or other purposes—it would be permissible to calculate the establishment charge upon the basis of the previous month's percentage, and any discrepancy that might occur by doing so would no doubt be covered by the small credit balance allowed for in the establishment charges account.

In the case of such standing charges as rent, rates and taxes, and other items, which are usually only chargeable at intervals of three or six months, it would be quite a simple matter to split these up into equivalent monthly amounts and charge them to the account accordingly; and in businesses where the works and head offices are separate, either structurally or in organisation only, it may be convenient to separate the standing charges into two accounts, viz., works establishment and head office establishment—the latter including the whole selling organisation—with a view to being able to arrive at the works cost of the goods manufactured apart from the total company's cost.

ELECTRO-DEPOSITING NICKEL: ITS APPLICABILITY TO THE PRINTING TRADE.

By G. BASIL BARHAM, A.M.I.E.E.

In commercial electro-deposition, experience has shown that the amount of chemical deposition is directly proportional to time and strength of current. This is made use of in what is known as quick electroplating, in which a heavy current is used for a short time, a method largely employed in the making of electrotypes for illustration work. It is claimed that slow deposition gives the most satisfactory results. There are of course other conditions to be taken into account, such as the back E.M.F. of the plating bath and the total resistance of the electrolytic circuit. The distance apart, in commercial work, of the electrodes is not of much importance, and the current density and consequent rate of deposit is usually determined by financial considerations. With an expensive metal it is generally advisable to increase the difference of pressure applied, which results in a certain increased loss of energy, but a higher current density and quicker rate of deposit. This secures an increased works efficiency, as there is only a short time between the introduction and the withdrawal of the crude metal from the bath. Interest on capital, and time, are of far more value in a works than might be imagined by a man used to working under perfect laboratory conditions, and there is much done in practice which theoretically might be held to have certain drawbacks.

Recently the electro-deposition of nickel has received much more attention than was formerly the case. Printers have realised that it pays to nickel-plate electro- and stereotypes, and the result is that there is an increasing demand for small electro-depositing plants which is not at present adequately

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met. Further, a campaign directed towards exploiting the printing field would certainly have lucrative results. The big printer knows all about the new process which doubles and trebles the "runs" he can get from his blocks; in many cases he has his own plating plant, but in most instances he purchases nickel-faced stereos and electros from one or two of the makers who specialise in such goods. The smaller printer, once the advantages of nickel-facing are brought home to him, may well invest in a vat at a cost of a few pounds and carry out the work himself. Electrical contracting firms would probably find it profitable to lay down a plant and do work for printers in their vicinity, and in their case it would pay to undertake plating work of every description.

The advantages from the printers' point of view of nickel-plated blocks are that the metal is non-oxidisable, it is practically as hard as hardened steel, it takes ink well, and gives off, as it is termed, much better than copper. In many of the red and other inks used by the printer mercury occurs, and whilst this substance attacks copper it has no effect on nickel. Another advantage is that it sharpens up work. Every printer who has a knowledge of photogravure work and has examined closely prints of a plate before and after facing, will quite understand the difference nickel-plating can make to a good half-tone block or electro.

In connection with nickel-facing, it may be pointed out that in a commercially pure state, nickel is slightly stronger and harder than iron; cast nickel has a tensile strength of about 20 tons to the square inch, and when rolled this strength is increased to about 32 tons per square inch. If 11½ per cent. of nickel is added to steel the tensile strength of the alloy is roughly 90 tons per square inch, whilst that of the steel before treatment would be in the neighbourhood of 30 tons. This peculiarity is evidently at the bottom of the fact that nickel-faced printing surfaces stand the wear and hammer of a press so much better than stereos or electros of a comparatively soft metal like copper. The coating need not be heavy; in fact, at the present time the practice is to put a very light deposit of nickel on the printing face, although there is no doubt that for lasting work the coat might be made heavier with advantage. After all, the life of a block depends on the hardness, toughness and durability of the metal from which it is made, the hardness and surface of the paper used, the impression, the packing, the speed at which the press is worked, the condition of the machine and the composition of the ink, that is, as to whether it has an earthy base or not. So that, when these are taken into consideration, it would seem that there would be a certain advantage in giving the surface a fairly thick coating.

Everyone is familiar with the plant required; the nickelling vat, the low-voltage dynamo, the shunt regulator, resistance board and electrodes, connections and hooks. A cleaning vat in which lyco can be heated, a scouring bench and swilling trough, a hot-water tub and some brushes make up the equipment. An electro-coppering bath is also one of the necessities when dealing with stereos as well as electros. The size of the plant depends on the size of the stereos to be dealt with, and whether they are for a rotary or flat bed machine. Those for the latter pattern naturally require a larger bath than do those used on machines generally found on the premises of printers who do not carry out newspaper and similar large work.

The nickel-facing process only takes about twenty minutes, so there is little force in the argument that the process might delay work or keep presses standing. The stereo is first cleaned by washing in the lyco bath, after which it is scrubbed and swilled with clean water. It then goes to the coppering bath, and if it is left in for five minutes a sufficiently thick coating of copper to take the nickel will be deposited. A practised hand will save seconds if not minutes at this by lifting the stereo to see how the coating is progressing, and not leaving the stereo in the vat a moment after the surface is covered. As soon as it can be removed it is swilled with clean cold water and hung in the nickelling vat. When time presses, fifteen minutes with a fairly heavy current will give a surface sufficiently hard to add greatly to the life of the stereo, but a longer immersion gives better results. If the stereos are to have a very long run on the machine or the paper to be used is likely to cause heavy wear, extra time should be given, and a bath of half an hour's duration or even more will not be found too long. After the plate is lifted from the nickelling vat it only requires swilling, first in hot and then cold water, before it is locked up in the chase. It will be seen that the work is not complicated, and as other plates can be cast if required whilst the plating is going on, the addition of a plant to a printing office need not interfere with the ordinary routine of the work. If nickel-faced steroes are used time is often saved, as the plates will last throughout the run and there is no need to stop the press. This also results in an increased output of the machine, inasmuch as it is not necessary to stop it for renewals. Also less make-ready is required. An economy, which in the course of a year will amount to a large sum, is effected in stereo metal; with unfaced stereos it may be necessary to re-cast after 15,000 impressions, and remelting the metal impoverishes it and new metal and "revivers" have to be added. With nickel stereos a run of as many as 250,000 impressions may be given before it is necessary to melt up the plates and re-cast.

In practice it is found that less ink is required, a saving of about 25 per cent. being effected in this direction and a much denser colour is obtained, and with these and other advantages to be used as selling points it would seem that a market which should be by no means difficult to enter lies open to the electrical industry.

UNEMPLOYMENT INSURANCE AMENDMENTS.

By JOS. J. H. STANSFIELD.

It is nearly two years since the National Insurance Act, 1911, came into operation, and as the result of experience gained during that period it has been considered advisable to bring before the present Parliamentary session a Bill to amend that part of the Act dealing with Unemployment Insurance.

The main purpose of this measure is to remove administrative difficulties experienced by the Board of Trade, by employers and by workmen, to diminish the working cost and to amend some of the provisions of the original Act which have been found to cause delay. The Bill does not involve any considerable changes of policy, and is practically an agreed Bill representing the main views and agreements arrived at in conference between the Board of Trade and representatives of employers and workmen.

The Bill, which is now passing through the House of Commons, contains several provisions which only affect Board of Trade administration, but as some of the clauses directly concern most employers connected with the electrical industry it may be of advantage to explain these briefly.

The most important provision to employers is Clause 5, which is intended to simplify the conditions for refunds payable to employers under Section 94 of the principal Act. That section provides that the Board of Trade shall, on the application of any employer made within one month after the termination of a prescribed period of twelve months, refund to

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such employer out of the unemployment fund a sum equal to one-third of the contributions (exclusive of any contributions refunded to him under other provisions) paid by him on his own behalf during that period in respect of any workman who has been continuously in his service throughout the twelve months, and in respect of whom not less than forty-five contributions have been paid during that period.

The rigidity of the requirements of this section in respect of continuous employment, etc., has led to considerable inconvenience, some injustice to employers, and general irritation and unpleasantness, difficulties which the new clause appears to overcome, as it simply provides that "the Board of Trade shall, on the application of any employer made in the prescribed manner within two months after the termination of an insurance year, refund to such employer out of the unemployment fund the sum of three shillings in respect of each workman, in respect of whom he has paid not less than forty-five contributions during the insurance year."

The contribution payable by employers on their own behalf in respect of workmen in insured trades, aged 18 and over, is 2½d. per week, and for youths from 16 to 18 1d. per week. As the refund is one-third of the contributions paid it now entails an elaborate statement in order to arrive at the actual contributions made in respect of each workman, and if a workman has been unemployed for a single week during the year no repayment can be claimed.

The amounts at present claimable vary from 3s. 7⅓d. to 3s. 1½d. in respect of workmen of 18 and over, and 1s. 5⅓d. to 1s. 3d. in respect of youths, whereas the new clause fixes a definite amount of 3s. in all cases, only requiring such particulars as will prove that 45 contributions have been made each year.

The new clause also provides for an alteration in the ending date of the year, so that the present year-end of July 14th can be altered, and furthermore any contributions which may have been refunded under Section 96 of the principal Act, or from which an employer may be exempted under the provisions of Clause 6 of the Bill in respect of workmen working short time, shall be included in calculating the necessary 45 contributions, subject, however, to the 3s. per workman being proportionately reduced in respect of such refunded contributions or exemptions.

Under Clause 6 above referred to an alteration has been made in respect of Section 96 of the principal Act, the substituted clause providing that the Board of Trade may, where it appears to them that there is exceptional unemployment in any trade or branch of a trade, on application being made by any employer in that trade or branch, exempt both employer and workman from making any contributions, an amendment which will avoid a possible injustice to workmen who, in consequence of their having left the employment of the employer, cannot be repaid any refunded contributions.

Under Section 107 of the principal Act a workman is defined as a person other than an indentured apprentice of the age of 16 and over who has entered into "a contract of service with an employer. The words "contract of service" have resulted in exempting certain employés of a local or other public authority, and under Clause 10 of the Bill such employés will now be insurable.

Clause 10 also requires the insuring of a workman in an insured trade whilst he is following any other occupation from which he derives any remuneration or profit greater than that which he would derive from the receipt of employment benefit, unless such other occupation has ordinarily been followed by the workman in addition to his employment in an insured trade and outside the ordinary working hours of such trade, and the rate of remuneration received therefrom exceeds fifteen shillings per week.

An amendment is made in respect of meetings of Courts of Referees by which cases referred to them may, with the consent of the claimant, be proceeded with in the absence of one or more members of the Court other than the Chairman. The cases referred to Courts of Referees have been much fewer than was expected, and any cases arising out of arrangements made with associations of workmen in insured trades who make payments to members whilst unemployed may, under Clause 8 of the Bill, be referred to them as well as to the Umpire.

The principal Act provides that a contribution shall be made in each year out of moneys provided by Parliament equal to one-third of the total contributions received from employers and workmen during that year. Considerable time and expenditure must have been required to arrive at the amount payable, and the Bill provides that so long as the payment of contributions is made by means of stamps affixed or impressed upon books or cards, the sums received by the Postmaster-General during the year on account of such stamps after deducting any sums which may have been refunded shall be deemed to be the contributions of the year.

It is stated that the Bill will not increase the total charge on the Treasury, and at the same time will give relief to employers and workmen, the simplification of procedure enabling savings to be effected which can be devoted to the relief of administrative burdens and the removal of grievances. On the new basis of calculation referred to above it is anticipated that the State will pay into the funds £30,000 less per annum than at present.

The results of the principal Act are of much interest. On May 22nd last there was a balance in the hands of the National Debt Commissioners, the Postmaster-General and sub-accountants of £3,023,000, and as £30,000 per week is being paid over, a considerable sum should be in hand to tide over the next period of bad trade. On the 15th May 2,286,000 workmen were insured, and during 16 months 1,481,000 claims had been made and £700,000 paid out in benefits.

It is claimed that the Act has not only stimulated organisation amongst working men but has also induced numbers of employers to increase the stability of their employment and regularise their work. No one can reasonably object to a reduction in the curse of casual employment with its demoralising results.

Employers and workmen may look forward to the early inclusion of other trades as insured trades, and it is hoped that such savings may be effected as will enable benefits to be increased or contributions reduced. If the latter happens there will be much cause for thankfulness, but there will be diverse opinions on the proposal that the Act should be placed on a non-contributory basis. The powers that be do not consider that this is practicable at the present moment, but it is not denied that something of the sort may be ultimately adopted.

WATER-POWER IN FINLAND.

Some further information is forthcoming which supplements that which was given in this journal on May 22nd in regard to the proposed utilisation of water power in Finland, with special reference to the Imatra falls, in the Vuoxen river. Two separate schemes have been engaging attention for some time past. As was mentioned in the Review at the time, the three electric lighting companies in St. Petersburg, headed by the St. Petersburg Electric Lighting Co. of 1886, and supported by Russian and German banks, co-operated in the formation in November, 1912, of the Imatra, Société pour l'Exploitation et la Distribution d'Energie Electrique of Brussels, the share capital being £1,200,000. The second project was brought forward as a competitive proposal by Mr. Rattner, State Councillor, and resulted in the constitution of the St. Petersburg Electric Transmission of Power from Waterfalls Co., with a share capital of £600,000.

The river Vuoxen, which flows from the great Saisna lake, forms a number of successive falls and rapids at short dis-

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tances apart. The most important is the Great Imatra fall, which is owned by the Finnish State, whilst the other falls are in the possession of private individuals and are divided among numerous proprietors, so that exceptional difficulties stand in the way of uniform utilisation. After protracted preliminary labours the St. Petersburg Co. of 1886 succeeded in assuring itself of all the requisite sites and rights for the use of the Vallinkoski or Little Imatra fall, which is capable of yielding 60,000 horse power, and the before mentioned Belgian company, with the assistance of Belgian and Swiss institutions, was established to finance the scheme and also to finance a new station for the outskirts of St. Petersburg. This station is already in operation and is intended, later, to provide for the disposal of a portion of the power to be transmitted from the Little Imatra. As the St. Petersburg Co.'s rights are of a private nature they do not depend upon the grant of a State concession. It has, however, been necessary to apply to the Finnish Senate for sanction to close the "king's vein"—a water gate which is kept open for a portion of the year for the purposes of the fishing and timber floating trades—in order to obtain increased water power, and also for authority to expropriate sites for the erection of transmission lines to Viborg and St. Petersburg.

The St. Petersburg Electric Transmission of Power Co., which was constituted in the meantime with the co-operation of Belgian (Mottard Frères) and French (Hector Legru) capitalists and of various banks in the Russian capital, entered into competition by seeking to acquire possession of other portions of the water powers of the Vuoxen river. Full rights were obtained for the Siitola falls of about 25,000 horse power, and partial rights were secured for the Rouhiala falls, which are estimated at 40,000 horse power. It is, however, stated that owing to the technical conditions the former could only be utilised by incurring a disproportionately high expenditure and that the falls could therefore not be worked economically. On the other hand, in consequence of the great diversity of ownership and the complication of the water rights, the possession of the Rouhiala falls has not been sufficiently assured, and for this reason it is considered that many years would probably elapse before it would be possible to think of exploiting these falls.

It was under these circumstances that the Electric Transmission of Power Co. conceived the idea—which is said to have formerly been proposed by English promoters—of constructing an artificial canal for the diversion at another place in the lake of the whole, or nearly the whole, of the water now flowing into the Vuoxen river; the water would be diverted from the natural falls in the river and would be returned to the river after serving the purpose of the projected generating station. In this way, all the falls and the total power of the separate natural falls would be combined in one place to the extent of 300,000 horse power, but the water would be withdrawn from the present river and the individual falls in private ownership and the existing industrial establishments would be rendered of no value. The company, therefore, asked the Finnish State to sanction the construction of the canal, and, at the same time, to grant the right of expropriating all the water powers, rights and industrial establishments which would be ruined by the execution of the scheme.

The Finnish Senate thereupon appointed a commission, consisting of the leading technical and legal officials, to examine the canal scheme, leaving the other question out of consideration for the time being. According to the report which has recently been published, the Commission recommends the Senate to reject the scheme, both for technical and economic reasons. The report points out in the first place that the project would enable about the same amount of power to be utilised as in the case of the individual natural water powers being worked, but no more. On the other hand, the cost per horse power would be at least 60 per cent. greater, the safety of working would be materially lower, the concentration of the total power in one place and in one ownership would provide an undesirable monopoly without necessary occasion, and the water power owned by the State, and to be reserved for ultimate railway conversion, would be diverted without the scheme offering a single advantage in return. The Commission also considers the project to be an economic mistake, as an adequate market for the power to be won would neither be found in Finland nor in St. Petersburg. As compared with the steam power produced in St. Petersburg with coal cheaply conveyed by sea, the report submits that only that portion of the power from the suggested hydro-electric works could be profitably employed in St. Petersburg for which a continuous demand exists; that is to say, from 20 to 25 per cent. at the most of the total power required there. The remainder could be produced more cheaply by steam power, and the Commission suggests, therefore, that only the individual water powers in the Vuoxen river should be gradually utilised and increased according to the growth in the demands, whilst the company's scheme is recommended for complete rejection.

The Finnish Senate is on the point of taking the report into consideration, and there is said to be scarcely any doubt that the Assembly will endorse the opinion of the Commission. In this event the application made by the St. Petersburg Electric Lighting Co. of 1886, which had been provisionally postponed, will again be free for discussion, and it is thought that the Senate will give its sanction to the expropriation of sites for the transmission lines. On the other hand, the rejection of the Power Transmission Co.'s scheme would cause the latter to revert to the position held a year ago, which is represented by the possession, as previously mentioned, of the Siitola falls and the partial ownership of the Rouhiala falls. Apart, however, from this side of the question, it is stated that the Transmission Co. does not own any concession for the distribution of electrical energy, and has, therefore, no market for the power proposed to be utilised.

COMPRESSED AIR.

The use of compressed air is so common that more than ordinary notice may be taken of the new catalogue, already referred to, which has just been issued by Messrs. Alley & MacLellan, Ltd., of Glasgow, and which contains much useful information. There are points of merit and demerit in all machines, and he must be a good all-round expert who is alive to such points when buying.

The firm named rate their compressors by their actual delivery volume of free air and not by any calculated cylinder volume, and this is as it should be, for it compels makers' attention to the important point of minimum clearance. In the catalogue before us single-stage working is advised up to 40 pounds pressure, for there is not any net saving all round to be obtained by a two-stage machine. But at 100lb. the saving by the two-stage principle may be 15 per cent. if the machine is well designed, is fed with cool air, and has suitable cylinder and intermediate cooling. The air fed to a compressor should not be drawn out of an engine room but from a cold cellar, if possible through a wooden pipe, or better still from a deep well where the temperature will be about 52°F. And such cold air should be heated as little as possible on its way to the compressor cylinder. Compression to 100lb. will add about 450 degrees of temperature to the air, and this is not far short of being able to double its volume. Such a temperature is bad for the oil, which may be cracked by it, causing cylinder grit and friction.

One may save £50 per year on a 500ft. per minute compressor by adopting double-stage work for 100lb. delivery pressure.

It requires 1.31 H.P. to compress 10 cubic feet per minute to 100lb. isothermally, but 1.81 H.P. to do the work adiabatically, or 38 per cent. more. The heat which represents this ultimate loss is all dissipated when the air has made contact with 10 square feet of pipe surface for each indicated H.P. on the compressing cylinder. Undoubtedly there is much truth in the statements as to the general bad design of air compressors and the loss of volumetric efficiency they suffer. In water pumping there are all kinds of ridiculous statements made as to the advantage of the air-lift pump, but the one advantage which has a real foundation in fact is that, from a given bored tube well (especially of small diameter), the air lift will draw out more water than any other system, unless, perhaps, the Mather Reynolds pump would be equal or superior. But the air lift often demands an excessively deep borehole to get its necessary immersion depth, and the deeper the well the greater the inefficiency of the air lift. It is impossible to make independent water supply pay for itself under extreme circumstances as to life, supply, immersion, etc. And when it would pay with an efficient compressor, it may not pay with a poor and inefficient machine. This fact emphasises the need for high efficiency in such water pumping machines, for the air pump is so wasteful to drive that its use is only justified either for small lifts or in deep lifts where a maximum yield must be obtained. Air lifts have more than one reason for being uneconomical: the compression of air is never an efficient process; air is soluble in water and thus much of the compressed air is lost at once, especially in deep lifts, for air solubility increases with pressure. And there must be slip in the rising main which will cause loss.

Then again, oxygenized water is corrosive, and the air lift pump is not that simple thing that it may appear. But a good and efficient compressor should always be employed.

Engineers about to employ air compressors, who wish to use them at high elevation, should be fully alive to the fact that the loss of capacity is 3 per cent. for each 1,000 feet of elevation. Thus at 10,000 feet the output will be 30 per cent. less, but the power required only 16 per cent. less. At 10,000 feet elevation the normal barometer is only 20½ inches. In mine work with electrical transmission the engineer must decide whether to place his compressor at the surface, where it can draw in cold air, or down a deep mine where the air is dense and hot.

Strictly, at high elevations a third taker-in cylinder working on a small pressure rise only should be used to feed the ordinary two-stage compressor.

From this book much help may be obtained, for there are very good practical hints and some useful tables. Obviously compressed air is not for use as a power transmitter, but it is excellent for some portable tool driving and has not yet been beaten for working rock drills in the mine, where it serves the double purpose of a working and of a cooling and ventilating agent.

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FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

NEW ZEALAND.—The New Zealand Customs Authorities have issued the following decisions as to the duties to be levied on certain electrical and similar goods on importation into the Dominion; the duties in each case are those leviable under the preferential tariff on British goods:—Time switch for double tariff electric meters; electric motor cars (other than tramcars)—free: batteries imported with, and being part of, though detached from such car are to be treated as part of the chassis; steel shoes for joining rails by welding—free.

GRENADA.—The Government have decided that machinery, including engines for industries of any kind and all necessary parts and appliances for the erection and repair of such machinery are to be admitted free of duty.

ITALY.—The Italian Customs Authorities have decided that in the case of complex apparatus for lubricating machinery, consisting of a filter for purifying the oil, a refrigerator and pump, the pump is to be dutiable at the rate of 10 lire per 100 kg., and the filter and refrigerator at the rate of 18 lire per 100 kg (25 lire = £1; kg. = 2.204 lb.).

UNITED STATES.—The United States Customs Authorities have issued certain new regulations regarding the method of invoicing goods for importation into that country, by which it is laid down that merchandise purchased or agreed to be purchased for export to the United States must not be included in the same invoice with merchandise obtained otherwise than by purchase or agreement of purchase. An invoice shall include only one shipment of merchandise from the same consignor to the same consignee. Merchandise shipped to different consignees must not be included in the same invoice, but merchandise purchased or agreed to be purchased in the United States and shipped to a branch house or agent of the shipper for distribution or delivery to two or more ultimate consignees may be included in a single invoice. Merchandise purchased or manufactured in different consular districts in the same country and assembled for shipment for one consignee in the same vessel may be included in one consular invoice at the point of shipment. In such cases the certified invoice should have attached thereto the original bills or invoices, if there be any, or extracts therefrom, showing the price paid or to be paid for each purchase or consignment.

The shipper's declaration upon invoices of merchandise shipped in pursuance of a purchase or an agreement of purchase differs materially from the shipper's declaration on merchandise shipped otherwise than by purchase or agreement for its purchase. Two forms of declaration have therefore been prescribed for the use of the shipper:

1. The declaration to be endorsed upon invoices of merchandise which has been shipped in pursuance of a purchase or an agreement to purchase.

2. The declaration to be made on the shipment of merchandise otherwise than by purchase or agreement for its purchase.

Merchandise must be invoiced upon the purchase form of invoice when the price or amount to be paid or remitted therefor is fixed and determined at the time of or prior to the shipment of the merchandise, whether or not the merchandise is shipped directly to the purchaser or is shipped to an agent of the seller or to the seller's branch house in the United States for delivery. Such invoice must show the price paid or agreed to be paid for the merchandise, whether constituting the price for the merchandise delivered in the United States or otherwise. The shipper, may, however, indicate upon his invoice, by marginal notations, in parallel columns, or otherwise, what he considers to be the market value of such merchandise in the principal markets of the country from which it is exported at the time of exportation.

Consuls should satisfy themselves that the proper form of invoice is used, and may, if necessary, require documentary evidence of the nature of the transaction.

If the merchandise has been purchased or agreed to be purchased for export to the United States, the invoice must be made out in the currency paid or agreed to be paid therefor.

If the merchandise is consigned for sale in the United States and is not shipped pursuant to a contract of purchase, the invoice must state the market value in the standard coin currency of the country from which the merchandise is exported, although a depreciated currency may be in circulation there.

The invoice must contain a correct description of the merchandise, using in each item the name, if any, by which the particular variety is known to the trade in the country of production or exportation. The description should show its kind, quality, component parts, and such other characteristics as will enable a person not an expert to identify the merchandise as it is sold in the foreign market and will assist consular and appraising officers in detecting any departure from the actual market value thereof.

The contents and value of the case or package must be separately specified on the invoice. Attached to or included in the invoice must be a statement for statistical purposes specifying the merchandise in the terms of the detailed list or enumeration prescribed by the Secretary of the Treasury and the Secretary of Commerce. This specification must show the total quantity and value of each kind of article included in the invoice.

Vague and misleading specifications should be avoided, and if insisted upon, should be the occasion for a special inquiry and report by the consul. Such specifications may result in expensive complications to the importer and delay in passing the goods through the customs. Invoices must express the quantities of the merchandise in weights and measures of the country of exportation, and may be made out in English or in the language of that country.

If the merchandise is shipped in pursuance of a purchase or agreement to purchase, the invoice must be signed by the seller or purchaser, or by his duly authorised agent. If it is shipped on consignment for sale or otherwise than in pursuance of a purchase or agreement for its purchase, the invoice must be signed by the manufacturer or owner, or by his duly authorised agent.

The signature may be affixed to the invoice at the shipper's place of business, at the consular office, or elsewhere.

At or before the shipment of the merchandise the invoice must be produced (in person or through the mails or by messenger) to the consular officer of the United States for the consular district in which the merchandise was manufactured, purchased or agreed to be purchased, or assembled for shipment, as the case may be, for export to the United States; and shall have endorsed thereon when so produced, if shipped in pursuance of a purchase or agreement for purchase, a declaration signed by the purchaser, seller, or the duly authorised agent of either of them, in a prescribed form. If the merchandise is consigned a different form is required to be signed. If the goods have been purchased or agreed to be purchased, the invoice must set forth the sale price and separately specify all charges and whether or not included in the sale price.

The charges to be specified shall include:—

1. Insurance; commissions; brokerage; inland freight; packing charges, including boxing, tilloting, cartons, packing, and similar charges.

2. The amount of all duties remitted, drawback or bounties received or to be received upon the exportation of the goods.

3. When it is impracticable for the shippers to specify any of such charges because unascertained at the time of shipment, to be paid by the consignee, or for other reasons, such charges may be omitted and the cause of the omission stated.

In the case of goods shipped otherwise than on purchase or agreement to purchase, the invoice must set forth the actual market value in the usual wholesale quantities in the principal markets of the country of exportation at the time of exportation in their condition packed ready for shipment, and shall include or separately specify the cost of inland freight, if any, and packing charges, including boxing, tilloting, cartons, packing, and similar charges.

Electrical Exports from Germany.—The electrical manufacturing industry of Germany occupies the first position from the standpoint of the few industries in that country which have scarcely been detrimentally affected by the generally unfavourable reaction in trade during the past 12 months. This fact is illustrated by the value of the exports in the first half of the present year as compared with the equivalent periods in the preceding years. The figures are as follows, marks being assumed to be equal to shillings:—

	Value of electrical exports.
First half of 1910...	£5,077,000
" " 1911...	4,899,000
" " 1912...	5,119,000
" " 1913...	6,238,000
" " 1914...	7,311,000

As compared with the first half of 1913, the exports in the six months of this year show an increase of 18 per cent., whilst the advance as contrasted with the first half of 1912 is 44 per cent. The principal position of the augmentation applies to material for lighting and power installations, the value of which rose from £1,261,000 in the first half of 1913 to £2,128,000 in that of 1914. The chief customer was Russia, which imported material of twice the weight as compared with the period of 1913. In the case of dynamos of over 10 cwt. in weight, the exports advanced from a value of £749,000 in 1913 to £867,000 this year, Italy being the best customer. The exports of metal-filament lamps rose from 19,540,000 to 20,000,000 lamps, but the cheaper prices prevailing caused the value to decline from £980,000 to £961,000. On the other hand, the number of carbon-filament lamps receded from 4,210,000 to 2,580,000, of which Russia imported about one fourth. The only large reduction took place in cables, which decreased from £913,000 in the first half of 1913 to £845,000 in the corresponding period of the current year.

Railway Electrification and Engine Drivers.—Both the Brighton and South-Western Railway Companies have come to an arrangement with their steam locomotive staffs, whereby the latter will have the first chance of taking up positions as drivers in connection with the railway electrification now taking place on those lines.

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NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this Journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

17,120. "Electric sad-iron." E. A. Welch. July 20th.

17,131. "Methods for producing devices consisting of substances liable to changes in their ohmic resistance under the action of light-sensitive preparations and the like." S. Kahan. July 20th. (N. S. Yapolsky, Russia).

17,133. "Process for electrolytically depositing metal upon metal by means of high current density, specially applicable for coating printing-rollers, hydraulic rams, and other like purposes." T. R. Harris. July 20th.

17,160. "Electric telegraphy." J. Erskine-Murray, and Clark, Forde, Taylor, & Erskine-Murray. July 20th.

17,175. "Process and apparatus for electrically separating suspended bodies from electrically insulating fluids, especially gaseous fluids." E. Moller. July 20th. (Addition to 17,840/12. Convention date, July 22nd, 1913, Germany). (Complete).

17,179. "Regulating-devices for dynamo-electric machines." W. S. Jeal. July 20th.

17,184. "Electrically illuminated signs and the like." C. Roberts. July 20th.

17,246. "Transmission of electrical impulses over circuits of high electrostatic capacity." G. Musso. July 21st. (Complete).

17,256. "Manufacture of cartridge cases." S. O. Cowper-Coles. July 21st.

17,257. "Mandrels for use in the electrolytic production of metal tubes and the like." S. O. Cowper-Coles. July 21st.

17,258. "Means for removing metallic cylinders from mandrels on which they are electro-deposited." S. O. Cowper-Coles. July 21st.

17,259. "Process for the manufacture of hollow iron articles." S. O. Cowper-Coles. July 21st.

17,267. "Controlling devices for the ignition of internal combustion engines." F. H. Royce and Rolls-Royce, Ltd. July 21st. (Complete).

17,317. "Electrical measuring instruments." British Thomson-Houston Co., Ltd. July 21st. (General Electric Co., United States).

17,328. "Means for controlling the heating effect of electric heating apparatus." A. F. Berry. July 21st.

17,329. "Electrical heating apparatus." A. F. Berry. July 21st.

17,331. "Method of and apparatus for, generating high-frequency electric currents." A Heyland. July 21st. (Convention date, August 18th, 1913, Germany). (Complete).

17,332. "Filament for incandescent electric lamps." W. G. Hughes. July 21st. (Complete).

17,345. "Electric heaters." H. Wilson & Co., Ltd., and W. R. Fairbairn. July 22nd.

17,356. "Junction board for electric cables." W. G. Heys. July 22nd. (General Acoustic Co., United States). (Complete).

17,379. "Automatic protective devices or cut-outs for electric circuits." Siemens Schuckertwerke G.m.b.H. July 22nd. (Convention date, July 23rd, 1913, United States). (Complete).

17,391. "Electrical heating apparatus." G. H. Collins and H. F. Collins. July 22nd.

17,392. "Thermo-electric couple to be used for the improvement and cultivation of flowers, plants, shrubs, and the like." F. H. Norris. July 22nd.

17,399. "Telautographic apparatus." A. G. Bloxam. July 22nd. (Telepantograph G.m.b.H., Germany). (Complete).

17,414 "Ignition of internal combustion engines." E. Schulz. July 22nd. (Complete).

17,415. "Automatic or semi-automatic telephone exchange systems." G. A. Betulander and N. G. Palmgren. July 22nd. (Complete).

17,416. "Apparatus for receiving electric signals." Marconi's Wireless Telegraph Co., Ltd., and H. J. Round. July 22nd.

17,424. "Protecting device for the accessories of electric apparatus." W. E. Evans. July 22nd. (Allgemeine Elektricitäts Ges., Germany). (Complete).

17,425. "Furnace electrode." W. E. Evans. July 22nd. (Elektrochemische Werke G.m.b.H., Germany). (Complete).

17,426. "Method of and apparatus for producing flows in the molten masses of electrical furnaces." W. E. Evans. July 22nd. (Elektrochemische Werke G.m.b.H., Germany). (Complete).

17,437. "Junctions or connections for electrical conduits and other pipe connections." H. H. Longbottom and T. Farrar, trading as Steel Tubes and Conduits Co. July 23rd.

17,446. "Telephone systems." M. S. Conner and R. E. Robinson. July 23rd.

17,452. "Electric relays." Eastern Telegraph Co., Ltd., and B. Davies. July 23rd.

17,455. "Means for cooling electro-magnetic friction clutches, and more particularly reversing clutches." Vulcan Maschinenfabrik-Akt. Ges. July 23rd. (Convention date, August 16th, 1913, Austria). (Complete).

17,465. "Control systems for electric motors." N. W. Storer. July 23rd. (Convention date, July 29th, 1913, United States). (Complete).

17,487. "Receiving system for radio telegraphy or telephony." G. O. Squier. July 23rd. (Complete).

17,511. "Electrically-operated fastening for railway-carriage doors and the like." J. E. Crossley. July 24th. (Complete).

17,515. "Means for connecting electrical conduits to their fittings." A. Myers and L. Myers. July 24th.

17,528. "Tubular insulators for high-tension electricity." E. Haefely. July 24th. (Complete).

17,590. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. and A. B. Sperry. July 24th. (Divided Application on 1,970/14. January 24th).

17,593. "Electrical indicating or signalling apparatus." C. Campbell. July 24th.

17,596. "Switches for cinematograph arc lamps." William Butcher and Sons, Ltd., R. E. Gill, & A. A. Lippold. July 24th. (Complete).

17,597. "Packing envelopes and cases for electric batteries and cells." G. F. Hitzelberger and New British Ever Ready Co., Ltd. July 24th. (Complete).

17,600. "Electro-magnetic levitating apparatus." E. Bachelet. July 24th.

17,602. "Controlling devices especially applicable for use with electrically operated printing and stamping machines." M. Rockstroh. July 24th. (Addition to 4,678/10). (Complete).

17,603. "Apparatus for electrocuting animals." E. G. Fairholme and A. D. Clarke. July 24th. (Complete).

17,611. "Apparatus for closing or breaking an electrical current by rise of temperature." N. Bendixen. July 25th.

17,620. "Railway safe-running devices." A. R. Angus. July 25th.

17,628. "Electrical dust suction apparatus." Bunte and Remmler. July 25th. (Convention date, August 29th, 1913, Switzerland). (Complete).

17,646. "Improvements in electric gas lamps." A. Lederer. July 25th. (Addition to 17,036/14, Convention date, July 25th, 1913, Austria). (Complete).

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W. C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

7,545. Electric Switches for the Ignition Systems of Internal-combustion Engines. C. F. Kettering & W. A. Chryst. March 31st. (November 20th, 1912.

13,064. Electric Railway Signal Relay to be Operated by Alternating or Pulsating Currents. A. H. Johnson & W. J. Thorrowgood. June 5th.

15,199. Electric Systems of Ship Propulsion. British Thomson-Houston Co. (General Electric Co.). July 1st.

15,297. Manufacture of Tungsten Bodies, particularly for Electric Incandescent Lamps. F. Simpson. July 2nd. (Cognate Application, 2,612/14).

15,334. Means for Suspending Electric and other Motors for the purpose of Absorbing Vibration. F. S. Boerries. July 3rd.

15,469. Advertising Devices and the like. H. K. Harris. July 4th. (Patent of Addition not granted).

15,561. Telegraphy. R. Lopez & Creed, Bille & Co. July 5th.

15,636. Magnetos. H. Ford. July 7th.

15,675. Apparatus for Checking any Suitable Predetermined Number of Calls at a Telephone Call Box or other place. J. Pinter. July 7th. (July 13th, 1912).

15,783. Sound-transmitting Apparatus. W. H. Derriman. (Automatic Enunciator Co.). July 8th.

15,828. Telephony. S. G. Brown. July 9th.

16,015. Dynamo-electric Machines. H. Lucas & H. E. Moore. July 11th.

16,132. Electric Distant Control Systems. A. Petersen & Kemp and Lauritzen (Firm of). July 12th.

16,268. Means for Duplex Electric Signalling through Land Lines and Cables. A. Orling & Orling's Telegraph Instruments Syndicate, Ltd. July 15th.

16,435. Duplex Telegraphy and the like. H. G. Barwell & Eastern Telegraph Co. July 17th.

16,791. Lamp Hanger for High-tension Series Lighting. G. Barker (Thompson Electric Co.). July 22nd.

17,529. Apparatus for Electrically Igniting Miners' Safety Lamps. V. E. Joyce and Spagnoletti, Ltd. July 30th. (Cognate Application, 20,709/13).

17,712. Blow-outs for Electric Circuits. Siemens Bros. Dynamo Works, Ltd., and R. A. R. Bolton. August 1st.

19,524. Electrical Starters for Internal Combustion Engines. E. V. Hartford. August 28th.

19,985. Gas and Electric Lamps particularly for use on Vehicles. F. R. Swinburne. September 4th.

20,135. Electrical Winches with Continuously Working Motor. G. Garde & Koefoed, Hauberg, Marstrand & Helweg Aktiesekskabet Titan. September 5th.

22,765. Electrically Illuminated Fountains. H. P. Allison. October 8th.

23,498. Temperature Indicating or Recording Systems and Appliances. A. Barry. October 17th.

24,108. Apparatus for Automatically Exhibiting Letters, Signs and other Representations for Advertising and like purposes. J. Coudurier. October 24th.

26,075. Grapnels for Submarine Cables. H. L. Davis. November 13th.

26,340. Hydraulic or Electro-hydraulic Presses. Maschinenfabrik Oerlikon. November 17th. (December 19th, 1912).

27,225. Electric Telegraphs. E. Raymond-Barker. November 26th.

27,599. Method and Apparatus for the Regulation of Gas Pressure in Röntgen Tubes, Vacuum Tubes, and the like. F. A. Lindemann. (December 2nd, 1912). December 1st.

27,852. Method of Maintaining a Dynamo at a Constant Electromotive Force. J. F. J. Bethenod. December 3rd. (December 27th, 1912).

28,376. Telephone Relays and the like. W. Aitken. December 9th.

28,966. Collectors used in Connection with Dynamo-electric Machines. W. P. Thompson (Aktiebolaget Ljungstroms Angturbin). December 16th.

29,824. Current Indicating Devices. F. Smith & Ferranti, Ltd. December 27th.

1914.

389. Protective Arrangements for Electric Circuits. Siemens Schukertwerke Ges. January 6th. (May 10th, 1913).

1,248. Resistance Apparatus for Electric Motor Starters, Rheostats, and the like. W. Geipel & C. J. Margerison. January 16th.

1,548. Telegraphic Printing Receivers. J. B. Nigron. January 20th. (January 21st, 1913)

1,968. Telephonic Receivers. Western Electric Co. (Woodward, acting for Western Electric Co.). January 24th.

2,202. Machines for Winding Wire or other Material of like form. C. B. Snell. January 27th. (February 3rd, 1913).

2,409. Electric Alternating Current Commutator Machines. Siemens-Schuckertwerke Ges. January 29th. (January 30th, 1913).

3,150. High-tension Electric Insulators. A. Watkins. February 6th.

3,594. Current Collectors for Electric Traction Systems. Allgemeine Elektricitäts Ges. February 11th. (February 12th, 1913).

3,868. Bell Signal Indicators. G. J. Black & W. Foggo. February 14th.

4,230. Method of Lighting Intense Current Arcs by Means of Currents of Less Intensity and High Frequency. A. Korn. February 18th.

6,072. Electric Ignition Systems for Internal-combustion Engines. C. F. Kettering & W. A. Chryst. March 10th. (Divided Application on 7,545/13. March 31st. Patent of Addition not granted).

6,097. Telephone Systems. E. A. Graham & W. J. Rickets. March 10th.

6,104. Arc Light Carbons. H. Ayrton. March 10th (Addition to 1,775/13).

6,729. Ignition Timers for Gas Engines. J. T. Pedersen. March 17th.

6,731. Cooling Lower Electrodes for Electrical Smelting Furnaces. Fried Krupp Akt. Ges. March 17th. (December 13th, 1913).

7,938. Electric Installations, particularly applicable to Electric Lighting. R. Despessailles. March 28th. (March 29th, 1913).

9,175. Apparatus for Controlling the Lighting Power of an Electric Lighting Plant. Soc. Anon des Automobiles et Cycles Peugeot. April 11th. (April 10th, 1913).

10,004. Safety-devices for Electrical Circuits. P. Torchio & H. R Woodrow. April 22nd.

10,616. Galvanic Cells. E. Achenbach. April 29th.

11,516. Electric Control Apparatus for Signalling Systems. A. D. Cardwell. May 9th. (Divided Application on 17,439/13. July 29th).

11,644. Metallic Vapour Electric Lamps. Korting & Mathiesen Akt-Ges. May 12th. (May 21st, 1913).

11,937. Electric Heating-apparatus. A. F. Berry. May 14th. (Divided Application on 16,040/13. July 11th).

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THE

ELECTRICAL REVIEW.

VOL. LXXV. AUGUST 14, 1914. No. 1,916.

ELECTRICAL REVIEW.

Vol. LXXV.] CONTENTS: August 14, 1914. [No. 1,916.

	Page
British Overseas Trade and the War	237
Government Works	238
Trade Disputes Ended	238
The I.E.E. and the War	238
Rubber	238
Recent Extensions at Newport, Mon. (*illus.*)	239
The "Zig" Lightning and Surge Arrester (*illus.*)	241
Electrical Trades and the War (*illus.*)	242
Wireless Telephony in Railway Operation, by H. A. Tinson (*illus.*)	244
The Running and Maintenance Costs of Electrical Motor Fire Engines (*illus.*)	245
The Edison & Swan Co.'s New City Showroom (*illus.*)	247
Correspondence—	
The Electrical Trades Benevolent Institution	247
Engaging a Foreman	247
Electrical Engineers and the War	247
End of the London Wiremen's Strike	248
Mysterious Behaviour of a Generating Set	248
The Protection of Engineering Works	248
New Electrical Devices, Fittings and Plant (*illus.*)	248
Legal	249
Physical Society of London	249
Electric Cooking in Marine Service (*illus.*)	250
Individual Driving of Small and Medium Size Machine Tools, by A. R. Stelling	251
Business Notes	251
Notes	255
City Notes	258
Stocks and Shares	258
Reviews	259
The Present Condition of American Electrical Industry	260
All-Steel Dynamos and Motors	261
New Electro-Magnetic Hammer (*illus.*)	262
Auto-Regulator System for Direct Current Traction (*illus.*)	262
New Patents Applied For, 1914	264
Abstracts of Published Specifications	264
Contractors' Column	Advertisement page xviii

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1914 EDITION

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

BRITISH OVERSEAS TRADE AND THE WAR.

THE dislocation of the trade of a country which is taking part in a war of any magnitude is a foregone conclusion. Even if such a war is far removed from home, the withdrawal of both men and money from their normal employment is bound to have a far-reaching effect on the general industry and commerce of the country concerned.

The present European war in which Britain is participating bids fair to rival all previous conflagrations of the kind; not only has it closed the principal European markets, but its proximity to our shores threatens for the time being, at any rate, to interfere somewhat with our overseas trade to distant lands. Needless to add, no sane Britisher believes for one moment that British shipping to neutral or friendly ports will be subject to more than a very brief spell of dislocation from naval causes, but obviously some uncertainty must exist during the early days.

In any case, our insular position has much to recommend it from the point of view of commerce in a crisis such as the present one.

For our readers great interest naturally attaches to the probable course of events in the electrical trade, and while it is rather early to venture any forecast in a matter of this sort, we have ascertained the views of many leading electrical firms, of which we publish a summary on p. 242.

Moreover, so far as our export and import trade in electrical goods, &c., is concerned, the monthly tables which we publish may be studied with advantage.

These show that during the present year exports of British electrical goods have been somewhat in excess of half a million pounds a month, towards which amount European countries only contributed approximately £88,000 worth of purchases; this figure, of course, includes countries which are not directly engaged in war, and in any case it is not greatly in excess of our electrical trade with India alone.

The balance of our exports represents trade with countries far removed from the war; indeed, our best customers, as has frequently been pointed out, are found in India, Japan, Australia, Canada, and the South American Republics. The distribution of these customers is clearly shown in the map which we print on p. 243.

Our re-export trade of foreign and Colonial electrical goods has averaged in recent times some £26,000 a month; probably the greater part of such material originated on the Continent, and about £6,000 worth returned to European destinations each month.

When we turn to the imports into this country of electrical material, an entirely different state of affairs is found, as Germany's preponderating contribution to the total, which represents goods used in this country, will in future be missing, and this also applies to Austro-Hungarian business, which, however, only reaches small proportions.

In recent months we have imported, on the average, some £275,000 worth of foreign electrical material, and of this German imports into this country accounted for £156,000 a month on the average, and Austro-Hungarian for only £1,800 worth. France and Belgium contribute between £25,000 and £30,000 worth of electrical imports per month, and these will, doubtless, fall off greatly; the war, in fact, will affect all our serious competitors in the home market except the United States, which imported nearly £60,000 worth of electrical goods into this country in June. While the July imports, which we hope to publish in the course of a week or two, as usual, may not be appreciably affected, those for August, owing to the uncertainties of sea transport, are unlikely to reach more than diminutive proportions.

It is vitally important to ourselves that this country should emerge successfully from the present war, and it is

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difficult to overestimate the valuable assistance towards this end, which those engaged in the industries and commerce of the country can render to the cause by keeping business going wherever possible. The British electrical industry would seem to be most favourably situated in this respect, for as we have shown, less than 20 per cent. of its overseas trade is concerned with Europe, and obviously a much smaller proportion with Germany, Austria-Hungary and Russia, the countries which may be regarded as absolutely sealed by the war.

On the other hand, Germany's important overseas electrical trade has been ruined for the time being, and it would seem that a great opportunity is presented to our manufacturers to neutralise loss of European trade by extended operations at the expense of our former competitors. This applies particularly to Great Britain itself, which, as we have said, has absorbed over £150,000 worth of German electrical goods a month in recent times, the absence of which must offer scope for the expansion of the internal electrical trade of the home manufacturer, with effects which should be not merely temporary, but permanent in character. We published in our issue of February 13th last (page 287) the official figures for German electrical exports during 1913, perusal of which, as indicating the directions in which business may lie, should be of interest.

We are at war, and it should be recognised that our industries, such as can be kept going, represent the indispensable reserve force on which both combatants and non-combatants depend—in fact, the mainstay of our national existence.

It is incumbent on us to use this weapon of industrial warfare in a time of stress, no less skilfully than those of our brothers in arms will be used when occasion arises.

Government Works.

We have been asked by the First Commissioner of H.M. Works to give publicity to the following announcement:—It appears from various inquiries addressed to the Commissioners of Works that there exists some apprehension lest unemployment should be increased in the building and other trades by suspension during the present crisis of building and engineering operations provided for in the estimates of the Office of Works recently approved by Parliament. It is, therefore, desirable to state publicly at once that it is the intention of the Commissioners of Works to proceed with all services in their charge, to employ as many men as possible to carry out such services, and to develop and expedite their building programme in any way practicable.

As the Minister mainly responsible for Government building the First Commissioner of Works wishes to take this opportunity of expressing his sincere hope that private individuals, companies, firms and contractors will spare no effort to follow the policy of the Government in this matter, so far as circumstances admit.

Trade Disputes Ended.

An immediate benefit derived from the declaration of war has been the settlement or postponement of all the great industrial disputes which were in progress in this country. On Saturday last the *Times* published a lengthy list of them, the most important, from our point of view, being those which took place in the building trades and the London electrical wiremen's strike. Credit is due to the Trade Unions concerned, which patriotically lost no time in advising their members to return to work; the employers were no less anxious to hasten the restoration of harmonious relations and the resumption of work, with a view to strengthening the national position.

The I.E.E. and the War.

We desire to call attention to the arrangements which have been made, with commendable rapidity, by the Council of the Institution of Electrical Engineers to place the services of members at the disposal of the War Office and the Admiralty. Particulars are given in our "Notes" columns. That the technical knowledge, experience, and ability of this great body of engineers should be of the highest value to the authorities at this time goes without saying, and we have no doubt that many of the members will gladly volunteer to help.

But the appeal is not directed to them alone; all electrical men are invited to apply, and we have pleasure in bringing to the notice of our readers generally the facilities provided by the Institution for this purpose. At the same time, we suggest that duplication and waste of effort should be avoided, and while the promptitude with which Mr. Ellerd-Styles took action in the same direction is worthy of all praise, we think he would do well to unite his forces with those of the Institution.

Rubber.

Whatever hopes may have been entertained that the rubber market was on the eve of better times have been very rudely dispelled by the outbreak of the general European war, and it is at the moment impossible to foresee how things are going to turn out. Production in the East is of course proceeding as usual, and presumably shipments will be coming along without much interruption when once the Mediterranean is cleared of German warships, which period can hardly be delayed for long. The mastery of the seas assured again, trade movements will be resumed as before, but with the important exception that the state of war everywhere will enforce war conditions, the effects of which upon rubber will probably entail reduced consumption. The world's trade must necessarily be checked by what is going on, and the wholesale destruction of life and property can only in the long run inflict great injury upon national prosperity. The greatest sufferer will be Germany, of course, for on the Continent this is the greatest of the industrial nations, and it will under the most favourable conditions take years for the restoration of ante-war conditions as regards this Power.

There can hardly be any doubt that there is an ample supply of rubber available for all purposes, and with the money market as it has been, the cessation of dealings publicly was the inevitable result. To this extent rubber has merely shared the misfortunes with which other leading commodities have been assailed. Under the circumstances the demand has not been worth considering, either on European or American accounts, and it will require time before the position can undergo any material improvement. Not only has the stringency of money had an influence in shaking confidence, but the jump in rates of Eastern exchange has acted equally in a depressing way upon the price of the commodity while all shipping movements are out of gear. The auctions which should have been held in London this week have of course been postponed indefinitely, and the attitude of both buyers and sellers is one of aloofness.

That rubber is playing a by no means unimportant part in the war, is shown by the repeated reports of the movement of bodies of troops by means of motor cycles and motor cars, and by the fact, too, that France has forbidden the exportation and re-exportation of tires, while similar action has been taken by the German authorities.

For the first six months of the year the quantities which were offered for sale by auction at Singapore amounted to 1,512 tons, the total sales being 1,267 tons, compared with 1,508 tons last year. The total area under cultivation in the Malay Peninsula is given officially as 708,545 acres, compared with 621,621 acres in the previous year, of which the totals for the Federated Malay States were 433,324 acres and 399,197 acres respectively. The Malayan output of rubber last year was 28,169 tons, against 18,956 tons in 1912.

The visible supply of rubber at the end of July was 3,375 tons, compared with 4,739 tons a year ago, and 5,105 tons in 1912. The receipts at Para last month were 1,340 tons, making 23,990 tons for the seven months, as against 25,010 tons last year and 25,290 tons in 1912.

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RECENT EXTENSIONS AT NEWPORT, MON.

Additions to the generating plant at the East power station and to the converting plant at the Llanarth Street station, at Newport, have recently been carried out, of which the following particulars may be of interest. At the present time there is a single-phase supply at 2,000 volts, 87·5 periods, and the three-phase supply is at 6,000 volts 50 periods; the former is part of the original scheme put down in 1895, and consists for the most part of H.T. feeders with transformers on consumers' premises, which it is hoped at an early date to rearrange with a view to coupling it to the three-phase supply.

By careful rearrangement of the plant, room was made to install a 3,000-kw. turbo-alternator together with all its auxiliaries, the order being placed with A.E.G., which guaranteed early delivery.

The new turbo-alternator generates three-phase current at 6,000 volts, 50 periods, running at 3,000 r.p.m. The development of these high-speed sets for medium outputs has been carried out without sacrificing reliability of operation in any way; the rotating parts of the turbo-generators were subjected to a 50 per cent. excess speed test for half an hour with perfectly satisfactory results.

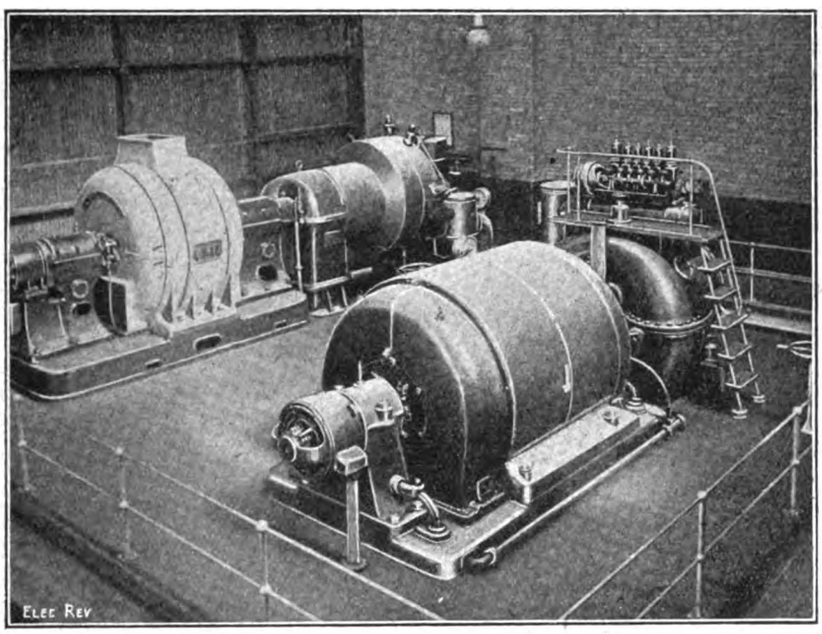

Fig. 1.—New 3,000-kw. Turbo-alternator, with 1,500-kw. Set in Background.

The turbine is of the Curtis horizontal type, with automatic governing at all loads and electric speed control from the switch galleries; it has only three bearings. The automatic nozzle regulation has the effect of securing the highest economy over a very wide range of load; the opening of the nozzles is effected by means of oil pressure supplied through a relay valve under the control of the main governor, which is driven direct off the main shaft. The excellent regulation of the set is one of its most interesting features, and even on rapidly varying traction loads practically no variation in voltage occurs.

The alternator is of the maker's usual type, and is coupled direct to the turbine by a rigid coupling; the exciter is at the outer end, coupled direct to the main shaft, and has no outboard bearing. Ventilation is provided by means of powerful fans fixed at either end of the rotor, the hot air being discharged down through the centre into the outgoing air ducts. The maximum load obtained under test was 4,113 kw. for one hour, and even at this load the temperature rise was much below the guaranteed figure.

The steam consumption ascertained at the official tests on site came out slightly below the guaranteed figures; the flatness of the steam consumption curve between ¾ load and 25 per cent. overload is shown in fig. 6. The figures given are those obtained after all corrections have been made for steam pressure, superheat and cooling water temperature, the guarantee being based on cooling water temperature and not on vacuum. As the superheat temperature was only 100° F., and the steam pressure at the stop valve 162 lb. per sq. in., the consumptions are very satisfactory.

Before the new plant could be installed an existing 300 kw. set had to be removed to another position in the power house, for which foundations had first to be provided, and then its existing foundations removed to make room for the foundations of the new plant; the latter consist of two main blocks resting on a concrete raft 6 ft. deep. These main blocks are laced together by a large number of 24-in. and 20-in. girders of heavy section, these again being laced together by cross girders riveted and bolted in position.

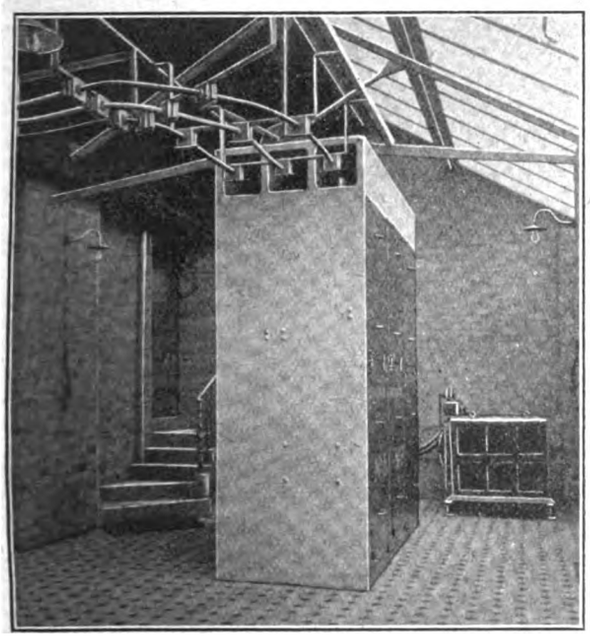

Fig. 2.—E.H.T. Switch-house, Motor-driven Rheostat, &c., Newport.

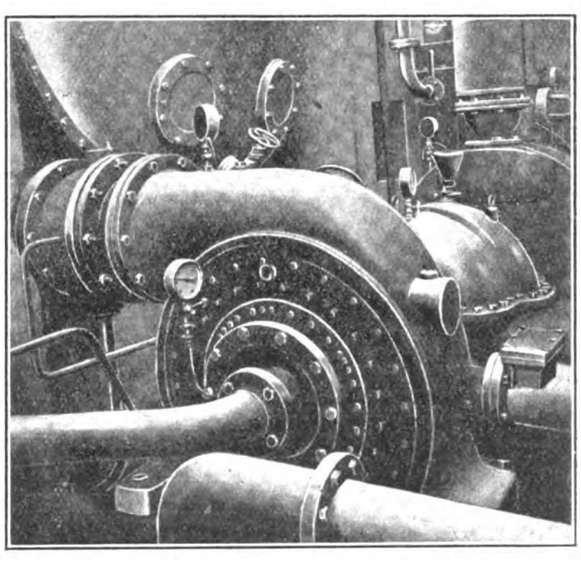

Fig. 3.—Turbine-driven Circulating, Air and Force Pumps.

There is no actual physical junction with the existing foundations of the 1,500-kw. turbo-alternator foundations nor with the foundations of the adjacent 500-kw. cross

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compound reciprocating set. The approximate total weight of concrete in the new foundations is 300 tons and the total weight of the girders used, 12 tons. The whole of the foundation work was carried out by the Corporation staff.

A 72-in. exhaust valve connects the main turbine exhaust and the condenser below. Beyond the condenser body at the alternator end is placed the air chamber, from which is drawn the cooling air for the alternator. A small turbine,

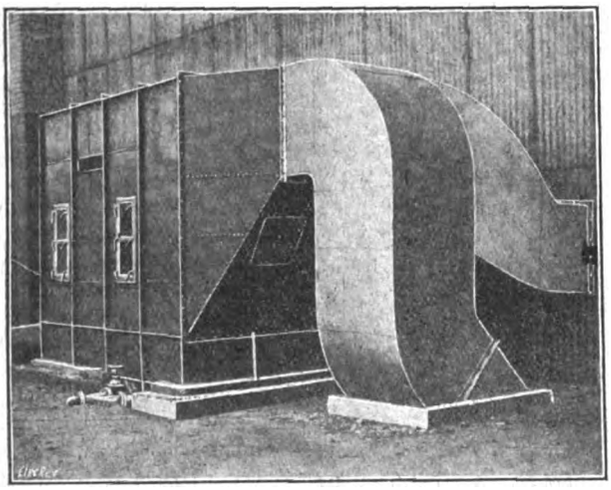

Fig. 4.—Wet-Air Filter Plant, Newport.

running at 1,500 R.P.M., drives direct the circulating and air pumps, the pumping set being placed on one bed plate. The necessary diffuser tank, &c., is sunk in the concrete raft of the foundations. The force pump is combined with the air pump, and lifts the condensate to a height of 53 ft. to the feed tanks, which are situated on the boiler house roof.

In connection with the steam-driven condensing plant is an automatic change-over valve, designed to overcome the

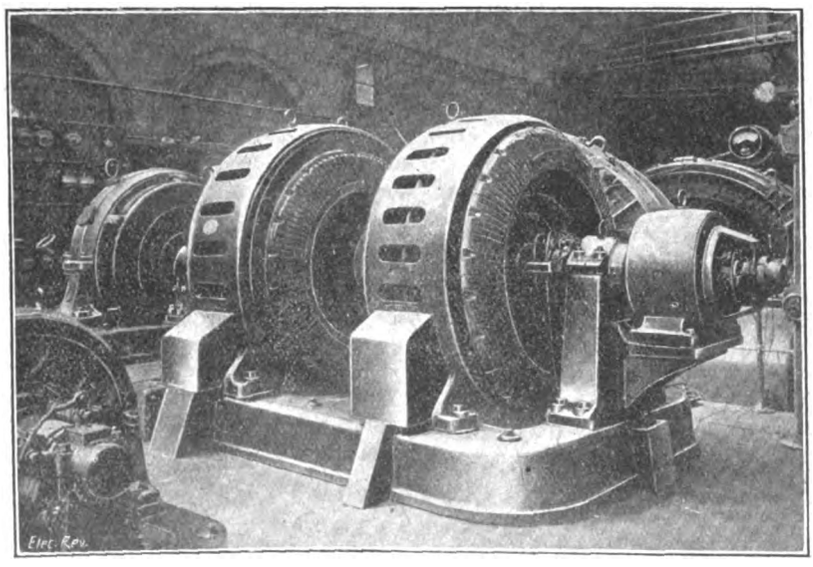

Fig. 5.—600-KW. A.C.-D.C. Motor Generator.

difficulty of controlling the speed of the main turbine at low loads. Formerly the exhaust from the auxiliary turbine was admitted to the main turbine through a quick closing stop valve, mechanically coupled to the automatic emergency gear on the main stop valve; with this arrangement the exhaust steam from the auxiliary turbine was not under the control of the governor in any way, and at low loads often gave rise to hunting, and might have become a source of danger to the main turbine in the event of the load being suddenly thrown off. The automatic change-over valve is placed in the exhaust pipe between the auxiliary turbine and the main turbine, and is provided with a connection to the condenser. The valve is controlled by the pressure which exists in the main turbine casing, and is so arranged that on a pre-determined fall of pressure taking place the exhaust steam of the auxiliary turbine is cut off from the main turbine and passed into the condenser, saving the condensate.

A well gives a full view of the condensing plant from the engine-room galleries, and the arrangement is such that one man can easily look after the entire plant.

A small auxiliary steam turbine-driven oil pump is provided for circulating the oil when first putting the turbine on load until the main turbine pump takes up the load. The water supplying the oil coolers is drawn from

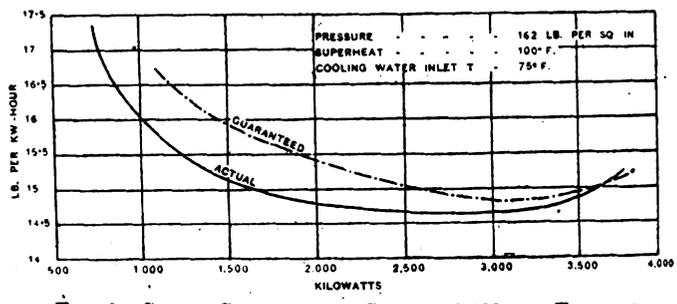

Fig. 6.—Steam Consumption Curves, 3,000-KW. Turbine, Newport.

the circulating water inlet, the town supply only being kept as a stand-by.

A large number of special recording instruments of the Fournier type have been installed and there is a special indicating alarm thermometer fixed to the oil supply which operates as soon as the oil temperature reaches a predetermined maximum.

The switchgear for the 3,000-KW. turbo-alternator is installed in stoneware cubicles erected in a fireproof switch-house which has been put up as an annexe to the main switch galleries. The extra high-tension switchgear was supplied by Messrs. Bertram Thomas; the transformers are isolated and the oil switches are of B.T.H. solenoid type and have a rupturing capacity of 20,000 KW.

The switchgear for the existing 1,500-KW. turbo-alternator has also been modernised, and a complete duplicate gear has been erected interchangeable with the 3,000-KW. swithchgear, the oil switch being of the same capacity as for the 3,000-KW. machine. The switchgear is operated from the gallery by means of a low-tension control panel, B.T.H. push-button switches being used. In the switchroom has also been installed the main field rheostat for the alternator, operated from the control panel by means of a small motor fixed above the rheostat, the starting switch for the same being placed on the control panel. Indicating lamps are arranged, and as the contact arm of the rheostat travels over the stops, alternate red and green lights show the attendant the number of stops it has travelled over.

A Sturtevant wet-air filter has been installed of 30,000 cb. ft. capacity.

The other extension consisted of a 600-KW. D.C. generator, manufactured by the Lancashire Dynamo and Motor Co., Ltd., which has been coupled to an existing 700-KW. three-phase to single-phase motor-generator. The latter machine was lightly loaded for a greater portion of the year during the daytime, and in order to provide additional load for the turbo-alternator, and make it possible to shut down some of the old plant, it was decided to install a new machine, so that during the daytime the 700-KW. three-phase motor driving the 600-KW. D.C. generator provided energy for D.C. lighting and power purposes. As the single-phase load increases towards the evening some of the D.C. load is eased off and the single-phase load taken up as required. Although somewhat unusual, the arrangement has fully justified itself. No direct connection is provided between the existing bed-plate and the new bed-plate of the 600-KW.

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generator, and the machines are coupled together with a Zodel-Voith coupling of ample design. On test the temperature rises were below guarantees, with absolutely sparkless running. The peripheral speed of the commutator is high, the revolutions being 750 per minute.

It has been so arranged that the machine can, if necessary, run as a motor driving the three-phase to single-phase motor-generator, so that it is possible to obtain a single-phase supply from the D.C. or alternatively to provide a three-phase E.H.T. supply to the main bus-bars.

The rapidity with which the extensions were carried out reflects considerable credit on the Newport staff; the official order for the new plant had hardly been given before the existing 1,500-KW. alternator burnt out, thus depriving the department of a three-phase supply. The re-winding occupied several months owing to unforeseen delays, but notwithstanding this the plant was completed and officially

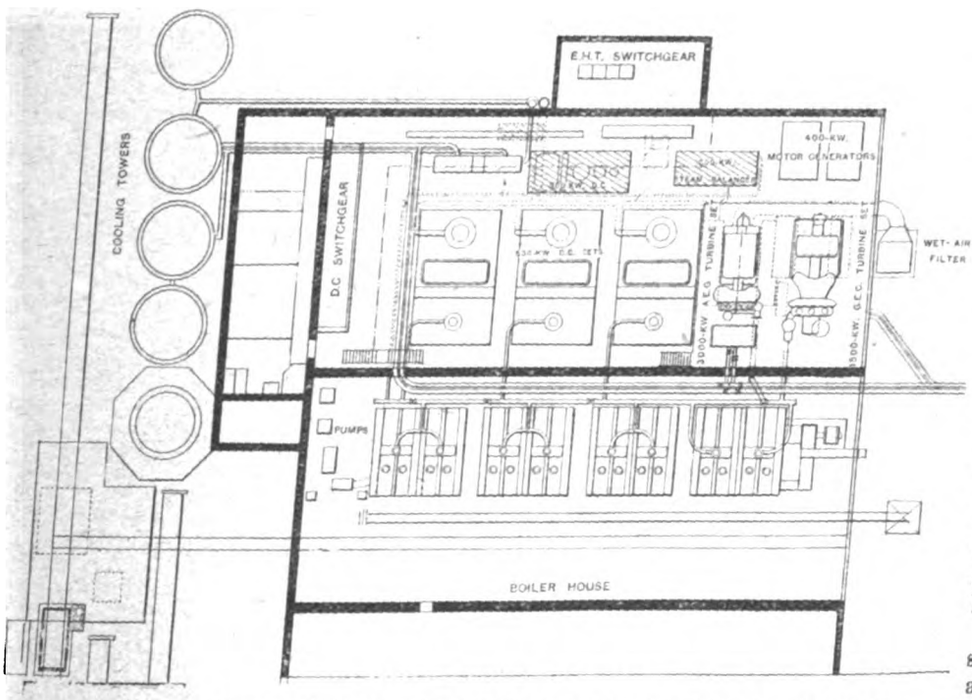

FIG. 7.—PLAN OF WORKS, SHOWING THE RELATIVE SPACE OCCUPIED BY THE PLANT.

placed in operation on December 17th, being a total of 169 working days. The official tests were carried out in the latter part of May, and the plant was taken over by the Corporation from the date of the tests.

We understand from Mr. Nichols Moore, the borough electrical engineer, to whom we are indebted for the foregoing particulars, that the capital cost per KW. installed, including foundations and switchgear, is £1 17s. 6d. per KW., and, including condensing plant, new building works, &c., the total figure is £2 15s. 6d.

THE "ZIG" LIGHTNING AND SURGE ARRESTER.

A NEW type of arrester, patented by Messrs. Pizzuti and Ferrari and manufactured by Messrs. Vedovelli, Priestley and Co., Paris, is being placed on the English market by Messrs. Laing, Wharton, Ltd. For the Zig arrester it is claimed that the principles involved in its design are such that surges will be discharged with certainty through the arrester to earth.

It is well known that in electrical installations, dangerous excess voltages may arise either from induction, due to atmospheric conditions, or from sudden load variations or due to resonance effects.

Arresters arranged to protect an installation are useless if situated in the neighbourhood of the nodal point of the pressure wave. To remedy this, Messrs. Pizzuti & Ferrari have introduced the Zig arrester, which has been designed from consideration of the laws by which oscillating disturbances are propagated in circuits.

The speed of an oscillatory wave along a circuit may be stated as $\sqrt{\frac{1}{C\,L}}$ where C and L are the capacity and inductance of the conductor respectively.

If the natural impedance has a constant value at every point of the line, the wave is propagated without deformation or appreciable alteration. When the wave arrives at a point after which a fall of impedance occurs, a partial reflection with change of sign and fall of potential takes place; the current phenomena are, however, the reverse of those for potential.

If, on the other hand, the wave arrives at a point where a rise of impedance occurs, a partial reflection without change of sign and a rise of potential takes place, the current phenomena being again the reverse of potential phenomena.

The rise or fall of potential is greater, the greater the variation of the natural impedance of the line. If the natural impedance of the circuit passes from a very small value to a very high one in consecutive sections, there occurs at the junction a total reflection of the wave.

The potential, however, does not change sign at the reflection, but the current changes sign and thus a nodal point is formed.

The contrary takes place in the case of passing from a very high natural impedance to a very low one. As, with aerial lines, the product of C and L has a nearly constant value, and the surges have a frequency of the order of 10^4 to 10^5, corresponding to a wave length of between ·3 and 3 km., it is sufficient to give to the protective apparatus a capacity and inductance equivalent to 1·5 km. of the line.

If an apparatus is inserted in series in the line, whose capacity and self-induction is equal to that of the part of the line between two successive nodes, all the values of the potential wave are distributed in the apparatus, and any surges will be discharged to earth if suitable arresters are installed. The Zig arrester shown diagrammatically in fig. 1 consists essentially of a capacity A B, one part of which is connected to earth, while the other is in series with the line and a self-induction B C.

A B has a very small natural impedance, and B C a very large one; a surge passing along the transmission line is partially reflected at A, and totally at B, and at this point the pressure rises above that of the line in consequence of the variation of impedance.

If a discharge path is provided at B the protection of the system is assured; the energy of the surge wave will dis-

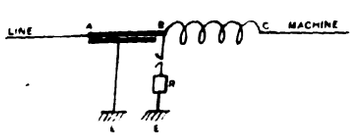

FIG. 1.

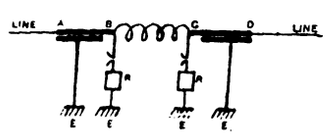

FIG. 2.

charge not only through the lightning arrester at B, but also through the dielectric of the capacity A B.

A B and B C are so proportioned that the time taken by the reflected wave to pass from B to C is equal to or greater than that required by the wave to pass from B to A, so that before the reflected part of the wave arrives at C, it is discharged by the arrester at B, the excess voltage having already attained its maximum at B.

In order to facilitate the discharge several arresters are placed in parallel, and these are connected to earth through a resistance in the usual way.

To protect an installation on both sides the arrangement C

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shown in fig. 2 is adopted, being a further development of fig. 1.

This method is reported to be very effective, not only for very high-frequency disturbances, but also for those of lower value such as might arise from the rapid breaking of a circuit; it can be applied to protect underground cables from surges.

The Zig arrester has been successfully employed in many important Italian installations, and is constructed in four types—for 12,000, 30,000, 50,000 and 90,000 volts.

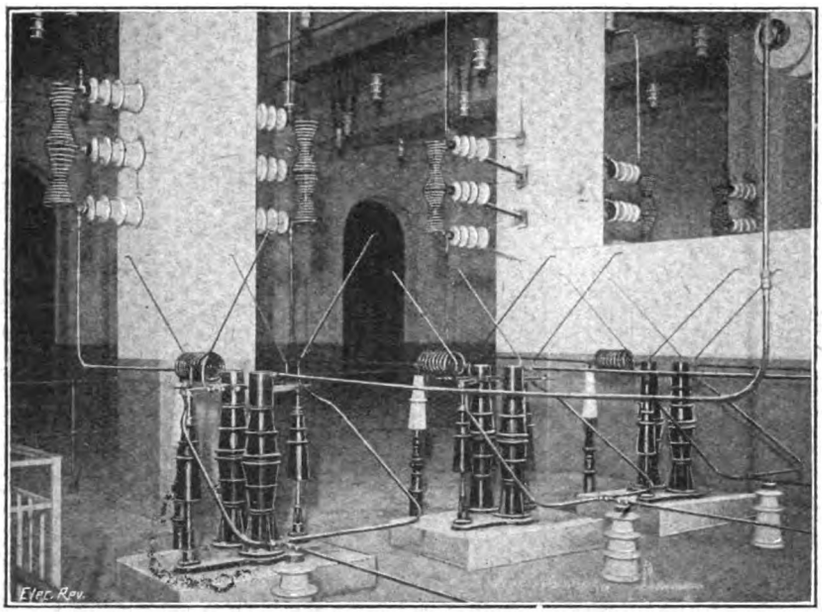

Fig. 3.—Installation of 90,000-volt Zig Arresters at Sescara.

It may be mentioned that amongst the installations in use, the Società Meridionale di Elettricità has applied them to its 30,000-volt transmissions, and is fitting them to its 90,000-volt lines.

THE ELECTRICAL TRADES AND THE WAR.

"Business as Usual"!

That the outbreak of war between seven European nations must necessarily exercise an immense effect upon British trade and industry is an obvious truism; our relations with our neighbours are so intimate and intricate, that even a strictly localised conflict must influence our commerce to an appreciable extent—how much more, then, a conflagration which has enveloped the Continent from end to end, and has already caused minor eruptions to flame forth in Africa, the Mediterranean and the Far East! The circumstances are utterly unprecedented in the world's history, and no man can foresee the outcome of the gigantic struggle, though we all in this country confidently look forward to the liberation of Europe from the burden of armaments which has been imposed upon it for nearly half a century by the overweening ambition and brutal arrogance of one nation, or rather of the military leaders of that nation, upon whose shoulders the consensus of opinion throughout the world lays the burden of responsibility for the frightful catastrophe which for the time has overwhelmed the Continent.

The closing of the Stock Exchange in itself was convincing evidence that a crisis of unexampled gravity had developed, for never before had so drastic a step been found necessary; to this was added the raising of the Bank Rate to 10 per cent., and the closing of the banks throughout the United Kingdom for three extra days, together with the issue of a moratorium permitting the postponement of payment of debts above £5 for a period of one month, and the issue of Government notes for £1 to take the place of gold in the national currency. All these factors combined to arouse anxiety in the minds of manufacturing and trading concerns of every description, as to the probable course of events in the immediate future, and the possible necessity of adopting special methods of transacting business under the changed circumstances. From information and inquiries which we received, we judged it advisable to ascertain as quickly as possible the views of leading men in the electrical industries with regard to the situation, and though our inquiries in the short time available naturally have not been exhaustive, we find the replies so closely in harmony with one another that we feel justified in concluding that the opinions held by the leaders are practically unanimous, and that they may safely be put forward in a summarised form for the information of our readers generally.

First we may refer to the profound relief and satisfaction everywhere felt with regard to the admirable manner in which the Government and the banking interests have grappled with and mastered a situation of unique difficulty and danger. The reopening of the banks on Friday last was awaited with anxiety and even trepidation; no one knew what to expect, and the crisis in men's minds was at this moment acute. Happily, however, what might have been Black Friday indeed passed off with a calmness and lack of incident which can only be described as astonishing. Instead of heavy withdrawals from the banks, gold was actually paid in in considerable amounts, and even the new £1 notes were hardly to be seen; in point of fact, in some cases it was difficult to obtain them instead of gold. We must pay a tribute of admiration to the banks for their peculiarly sagacious action with regard to the cashing of cheques for wages, so many of which were presented in the normal course at the week-end; these were cashed in gold, silver and £5 notes, the new £1 notes being withheld because their strange aspect—and certainly they have not the superficial but convincing qualities of appearance and crisp substance that characterise the £5 note—might excite the suspicion of the working men, and lead to trouble. As one gentleman remarked to us, they looked more like I O U's than bank notes, and the unsophisticated workman might well look askance at these substitutes for golden sovereigns at first sight. But now that all fear of a financial panic is removed, there should be little, if any, difficulty in introducing them for general use. That their appearance can be improved is admitted, and the ambiguous statement which each bears that it is "legal tender for any amount" will no doubt be rectified. The great fact remains that British finance rose to the occasion, and the national credit has passed through this most trying ordeal with triumphant success. That financial resources constitute perhaps the most powerful weapon in warfare is axiomatic, and we hope that the magnificent success that we have already scored in this field will be followed by no less striking victories on land and sea.

The next question regarding which we made inquiries was the probable effect of the moratorium upon the course of business. And this is bound up with a question of perhaps still greater importance—the circulation of money. Obviously, if a large purchaser delays payment for goods supplied, the manufacturer's working capital is reduced to that extent; the latter cannot order raw material or pay wages with freedom, lest he should run short of capital, and he is unable to accept contracts which would keep his men employed even when they are offered. The purchasing power of the workmen is thus curtailed, and the inevitable tendency is towards the cessation of trade and industry, the starvation of the poorer classes and national bankruptcy, involving the ruin of the selfish purchaser himself. It is of the very utmost importance, therefore, that goods shall be paid for promptly at the accustomed dates, and that the relief permitted by the moratorium shall be availed of only when absolutely necessary. In this connection, we venture to appeal to all muni-

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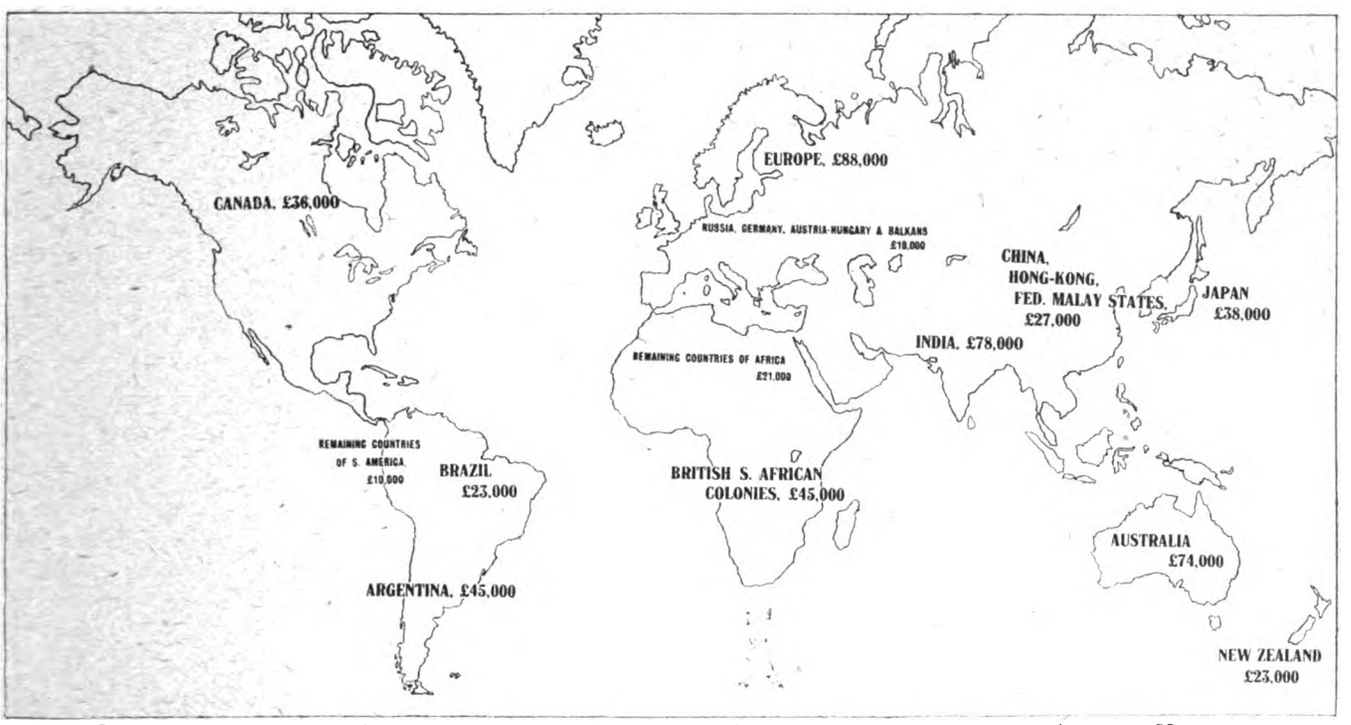
cipalities and other great purchasing corporations scrupulously to avoid delay in payment for work done, and even to anticipate the usual date when possible, in order to assist in the free and unfettered circulation of money and the maintenance of full employment throughout our industries. By so doing they will be performing a patriotic service of the greatest value to the State, and, incidentally, will be serving their own interests to the best advantage, for it is infinitely better to keep men employed on useful and productive occupations than to feed them when they have been thrown out of employment for want of work. The importance of this question is so great that we may even regard it as the key to our position, which, if adequately safeguarded, will render our defences impregnable, our credit unassailable, and our prosperity now and after the war a certainty.

Our attention has been pointedly drawn to this matter by the fact that a few firms—hardly any electrical firms—in headlong haste, have issued circulars broadcast to their clients, stating that in future they must have "cash with order." We cannot refrain from characterising this as an unpatriotic action deserving of the strongest condemnation, and calculated, if widely imitated, to bring about that very disaster which we all desire, and are determined, to avoid. We are glad to say that we know of very few instances in which this course was followed, and we trust that the firms in question, on reflection, will perceive the dangers with which it is associated, and will lose no time in cancelling the circulars, which, we may add, were addressed indiscriminately to firms of the highest standing, as well as to those which may not be so substantial as to justify extended credit under the existing conditions.

It will be agreed that it is highly desirable that no departure shall be made from the usual practice with regard to credit accounts, unless circumstances arise which render it absolutely unavoidable. And there is no evidence at present that such circumstances will arise. They can only arise through the locking-up of funds to which we have referred, and, if money is kept in circulation, this will be avoided.

We are pleased to be able to record the fact that on Friday last the Council of the British Electrical and Allied Manufacturers' Association communicated with its members pointing out that prices should not be unduly inflated, and that care should be taken to avoid creating alarm; on the contrary, the Council expressed the earnest hope that the members would refrain from any changes in prices or business terms which might give rise to uneasiness. These views we cordially endorse, and we may add that, without a single exception, the replies that we have received from electrical manufacturing firms in London and the provinces indicate that no changes are contemplated. The payment of dividends at the customary dates is another matter to which attention may be directed. In a few cases industrial companies have refrained from distributing their profits, a measure of precaution which may prove disastrous to some of their shareholders.

Next let us refer to the important question of transportation facilities by land and sea. The railways of the United Kingdom are now amalgamated into one great national system under the control of the Government, and the rolling stock of the railway companies has been used in accordance with the requirements of the moment for the purposes of mobilisation, without regard to ownership, so that no doubt it has become considerably mixed. This, however, is of small consequence; the trucks at any rate are still within our borders, and though some delays may occur during the next few weeks, the railway companies, whose organisation is intact and highly efficient, can be trusted to restore normal conditions at the earliest possible moment after the completion of the mobilisation. As regards transport by sea, there is no doubt some temporary uncertainty, and this will obtain until the British Admiralty is in a position to declare all seas safe for our ships. Already, however, the rates for war insurance are at a more moderate figure, and apart from the North Sea traffic, which is at present restricted, there is little to fear on this score. In passing, we may remark that war insurance on sea-borne goods is somewhat peculiar, in that it is properly chargeable to the purchaser, even when goods are shipped c.i.f. It is the purchaser's business, therefore, to attend to this matter under the existing conditions. The risk, presumably, is measured by the rate of premium charged, which indicates that for the present it is advisable to avoid shipping large and valuable consignments abroad; but we confidently anticipate relief from this restriction within the next few weeks. The question of the importation of raw material is, perhaps, at the moment of greater significance than that of exportation of manufactured goods, for there are certain materials such as copper, lead, rubber, &c., of which an adequate supply cannot be obtained from our internal resources. Without raw materials it is obviously impossible to produce the goods, and for this reason the restoration of normal shipping conditions will be anxiously awaited. We are glad to be able to state, however, that some, at any rate, of our manufacturers have laid in large stocks which will enable them to continue in full swing for many months. One of the unexpected disclosures effected by the outbreak of war is the extent to which reliance has been placed by British manufacturers upon supplies of raw material from Germany, as evidenced by the number who have had to close their works for want of it. We trust



PRINCIPAL FOREIGN AND COLONIAL ELECTRICAL MARKETS OF GREAT BRITAIN, SHOWING THE AVERAGE MONTHLY VALUES OF ELECTRICAL EXPORTS. (Referred to on p. 237.)

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that the outcome will be the transference of the bulk of this trade to British producers of "raw material" such as iron and steel, &c.

With the exception of the firms last mentioned, which will doubtless take steps to supply their needs from home sources, the intention is invariably expressed of carrying on the works at full swing, and keeping in employment as many men as possible. Should it become inevitable that output must be reduced, the unanimous resolve is to work short time rather than to dismiss a single workman—a patriotic policy which cannot be too heartily approved. The proportion of Reservists and Territorials called up to the colours ranges from 5 to 10 per cent. of the employés, so that there should be no difficulty in producing the usual output, with a small amount of overtime if necessary. Vacancies in the staff will not be filled; the duties of those who are away on service will be discharged by their colleagues, and the families of the former will receive generous treatment, being paid in some cases the full salaries. Workmen called up will similarly be paid, at rates varying from 10s. a week to half their usual wages, and if their places are filled by others, they will be reinstated on their return. Further, many firms express the intention of "looking after" the families of the absent men, not merely paying them. We are happy and proud to be able to make these statements, and to express our admiration of the patriotism which we meet with on all hands.

With regard to the disposal of the output of the works, the intention of all whose products are suitable for Government use is to place them unreservedly at the disposal of the military and naval authorities, and to exert every effort to cope with the demand for such supplies. Immediately after the outbreak of hostilities, the Council of the B.E.A.M.A., on behalf of the members, wrote to the Admiralty and War Office offering to use every endeavour towards expediting Government contracts. The Council had no doubt that their action would meet with the hearty support and approval of every member of the Association. We could say more upon this subject, but it is not advisable, in the national interests, to particularise at this stage. After the needs of the Government have been satisfied, old customers will be given the preference over new ones. There is in this connection evidence of the existence of a grievance, not a bitter feeling but a very real one, against British manufacturers and contractors who in the past have gone abroad for goods and material which they could have obtained at home. It is said that there is no sentiment in business; sometimes there is not, but as a general statement the saying is not true.

Solicitude is everywhere expressed for the position of small firms, which may not be possessed of adequate means for prompt settlement of their accounts, especially those which deal with the general public and may sometimes be obliged to give long credit. The large manufacturing firms are prepared to treat them with the greatest consideration, and to avoid applying pressure to them, even where in normal times this would be regarded as justified.

It is gratifying to record that it is reported in many quarters that orders and payments are coming in just as usual, with the exception, of course, of those that are interfered with by the abnormal conditions affecting transport by sea. Some of our informants have expressed a wish to remain anonymous, evidently having no desire to advertise their patriotism, or to make capital out of the war, and we have thought it well, therefore, throughout this article to refrain from mentioning any firm by name; but we may quote from a few of the letters that we have received as samples of the whole:—

With reference to your letter of the 7th inst., we are carrying on our business just as usual, and shall continue to do so to the best of our ability. We have the assurance of our suppliers that unless conditions alter for the worse very materially, they will be able to keep us going. The chief fear we have is that purchasers of our manufactured articles may refuse to take delivery, thus causing great inconvenience and congestion in the works. So far as the men are concerned, we are keeping everybody's place open, and making provision for the dependants of those who are called up or volunteer. We would prefer that our name does not appear.

One result of the war strikes us very forcibly. We have this week been inundated with orders for small meters and also for large meters from entirely new customers, and we can make out quite an elaborate list of patriotic electrical engineers who support home industries. It has also opened our eyes to the number of manufacturers from whom we are obtaining our raw material who, owing to communications with the Continent having been broken off, cannot now supply material. If the man in the street only had all this information we feel sure that he would support tariff reform in some form or other.

We beg to acknowledge receipt of yours of the 7th inst. with regard to the conditions now obtaining in the electrical trades. We quite agree that it is important to limit the disturbance as much as possible, and we shall do all we can to keep our workpeople employed. Up to the present we have not felt any very special dislocation, and we believe that if the trade generally continue to carry out their business as nearly as possible under normal conditions, things will not be quite as bad as they appeared likely to be. We anticipate accepting orders as usual, and on the usual terms of payment.

In reply to your inquiry as to the probable effect of the war on our trade, we beg to say that we are continuing business as usual—accepting orders at our usual prices and at usual terms of payment—and that it is our intention to do so until circumstances arise that may oblige us to make any change. The volume of orders on hand is normal and the works are running full time. There has been no reduction in the customary flow of orders or inquiries. We do not depend upon the Continent for the supply of any of the material or parts of our manufactures (alternating current motors and accessories), and are not, therefore, we believe, likely to be held up for want of material. We anticipate that though in some trades slackness is bound to ensue, there will be unusual activity in others to supply the requirements of the Army and Navy; and foreign imports being restricted we consider it probable that our works will be kept fully employed. Should it, however, become necessary, we should work short time rather than dismiss workmen. With regard to Reservists in our employ, the dependants of those who are called up will be looked after—as they have been in the past—and the Reservists themselves will be taken on again on their return.

As for the future, we deal with this in our leading columns; but we may here express the view that, taking it for granted that the war will result in the overthrow of the German naval and military power, as we all hope and believe, the cut-throat competition from which our manufacturers have suffered in the past will be removed, the exploitation of the British Dominions and Colonies (of which the Rand is so conspicuous an example) will cease, and a large volume of foreign trade will be diverted from the Continent to our workshops. Thanks to the mad policy which has been followed by the German Government, the sympathy of the whole world has been alienated, and Germany stands almost without a friend but Austria. As we urged in our leader last week, the prime essential at the moment is to obey the call of duty, which comes to every one of us; then we need not fear the result. Our manufacturers have patriotically obeyed the call, and, as one correspondent says, "business will go on as usual." That is, in a nutshell, the watchword of victory.

WIRELESS TELEPHONY IN RAILWAY OPERATION.

By H. A. TINSON.

Severe snow and wind storms prevailed in the eastern portion of the United States during February last. The telegraph and telephone systems of all the railroads running to New York were practically demoralized. This state of affairs lasted in some sections of the country for more than a week, and it was on that occasion that the officials of the Delaware, Lackawanna and Western Railroad had the opportunity of demonstrating the practical utility of the Marconi system of wireless telegraphy in the operation of their trains. The installation was described in our issue of March 20th, 1914.

Since that time Mr. L. B. Foley, Superintendent of Telegraphs for the Delaware, Lackawanna and Western Railroad, has been investigating the further possibilities of utilizing wireless telegraphy and telephony for keeping in communication with moving trains.

Recent investigations in this field have resulted in a successful demonstration of wireless telephony between the Company's station at Scranton, Pa., and moving trains. With Marconi telegraph transmitters, communication has been maintained from a passenger train up to a distance of 60 miles, and up to 207 miles from a track side station to a train.

The system now being investigated and tried out

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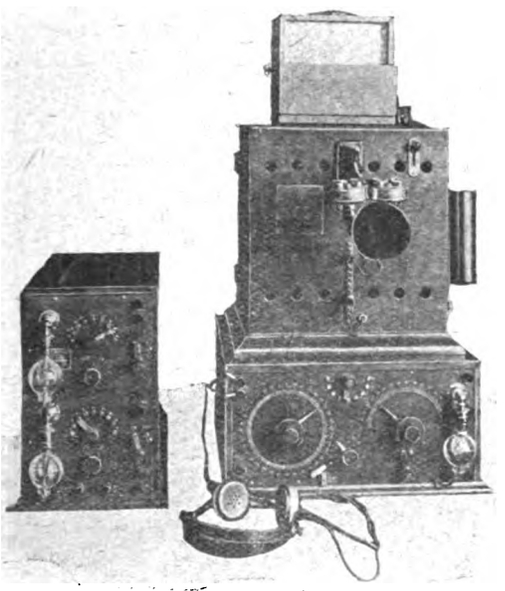
by the Lackawanna Railroad is that devised by Dr. Lee de Forest. The installation at Scranton was put in by the Radio Telephone and Telegraph Company of New York, and it has been possible to maintain clear voice transmission with a fast-moving train at any point between Stroudsburg, Pa., and Binghamton, N.Y., a distance of 120 miles.

The installation at Scranton consists of a generating set of about 1 KW. capacity, the frequency being approximately 3,000 cycles per second. The antenna is 300 feet in length, and at an elevation of 150 feet above the ground. A quenched spark is used with the transmitter.

Dr. Lee de Forest first used an oscillator with two metal electrodes having a water jet playing between them. He obtained a quenched spark effect which proved very efficient as a generator of high-frequency current. The negative electrode of this form



DE FOREST RAILWAY WIRELESS TELEPHONE OUTFIT.

of oscillator consists of a small copper disc about six inches in diameter, which is made to rotate. The positive electrode is made up of a copper tube or quill rotating about an axis placed at right angles to the axis of the negative electrode disc. The arc length is about .02 inch, the water jet playing directly upon the parts of contact.

In shunt around the electrodes is connected an oscillating circuit, including a condenser and inductance. The inductance is loosely coupled to the inductance of the antenna and the oscillator is used with or without a magnetic field. The de Forest transmitter, it is said, requires no adjustments when once tuned and set for a definite wave length. No attention is required on the part of the user, other than throwing a switch from transmitting to receiving, or *vice versa*.

The antennae on the trains extend over four cars. The generator on the train is directly connected to a small steam turbine in the baggage car, supplied from the steam heating pipes beneath the car.

A detector styled the "audion" is used with this system. Train noises render it imperative to use an amplifier and a detector on the train. A two-step amplifier, giving from 50 to 60 amplifications, is used.

The officials of the D.L. and W.R.R. system, it is understood, intend to make wireless telephone installations a part of their permanent equipment on the two trains used for their "Lackawanna Limited" service.

Messages will be handled at a fixed rate, the same as with the telegraph, but they will be telephoned by a regular member of the train crew.

Apart from the experiments described above, the Radio Telephone Company states that it is now telephoning from Scranton to Binghamton over the D.L. and W.R.R. using about ¼ KW. from a 3,000-cycle alternating generator, with special quenched spark. This transmitter is found much more efficient and effective than any arc system, and requires no attention on the part of the speaker except to throw the switch from transmitting to listening. The company expects to have the system installed on certain trains of the D.L. and W.R.R. very soon, and hopes with apparatus of 5 KW. to telephone 500 miles over land under favourable conditions, with the audion at the receiving end, but without amplification.

THE RUNNING AND MAINTENANCE COSTS OF ELECTRICAL MOTOR FIRE ENGINES.

SOME interesting details of the motor equipment of the Berlin Fire Brigade, and its running and maintenance costs, are given in the report recently issued by the Chief of the Brigade for the year ending March 31st last. The equipment at present consists of twelve sets or "trains" of electric machines, each set comprising a chemical fire engine, an electrically-propelled steam or petrol-operated motor pumping engine, a stores wagon, and an escape ladder, plus one vehicle used for practice purposes, there being, thus, altogether forty-nine electric machines. The number of petrol vehicles owned by the Brigade is twenty-five, these comprising eighteen cars for the Chief and principal officers, three pumping engines, one stores wagon, and three miscellaneous machines. Berlin has, thus, a total of seventy-four motor vehicles in its Fire Brigade, but requires another

THE BERLIN FIRE BRIGADE.

Record of the Running and Maintenance Costs of Eight Electrical Trains (each Train comprising a Chemical Fire Engine, a Pumping Engine, a Stores Wagon, and an Escape Ladder) from the date of being put in service to March 31st, 1914.

Train No.	In operation for	Cost of maintenance.				Running costs.			Total costs for period stated in second column.	Average annual cost.		Aver'ge time in hrs. per vehicle per year undergoing repairs, and consequently not available for service.	Miles covered since put in service.
		Chassis.	Body work.	Tires.	Non-skid bands.	Current.	Batteries.	Lubricants.		Per train.	Per vehicle.		
	Yrs. Mths.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.		
20	5 6	71 3	54 13*	122 13	263 10	337 19	662 18	3 14	1,516 10	275 14	68 18	16	12,730
15	4 5	92 4	12 19	78 13	232 18	308 18	520 5	2 13	1,248 10	282 13	70 13	14	11,317
19	4 2	64 8	14 4	96 5	266 10	315 12	499 10	2 11	1,259 0	302 3	75 0	16	12,347
23	3 10	117 1†	20 14	144 17	238 12	363 3‡	461 11	2 8	1,348 6	351 14	87 18	8	10,453
7	2 5	16 11	12 10	21 10	82 0	135 14	259 18	1 9	529 12	219 3	54 15	2	5,752
21	1 11	17 15	10 16	37 3	77 10	129 10	259 5	1 9	533 8	278 5	69 11	6	5,985
8	1 2	2 10	—	12 19	10 10	49 16	143 15	0 15	220 5	188 15	47 3	—	1,916
11	1 3	13 3	8 1	—	1 10	33 8	139 3	0 13	195 18	156 14	39 3	10	1,620
Total for 8 trains (32 vehicles).	24 8	394 15	133 17	514 0	1,173 0	1,674 0	2,946 5	15 12	6,851 9	277 15	69 8	15	62,120

* Includes repainting. † Due to faulty delivery. ‡ Extra cost of current due to transforming.

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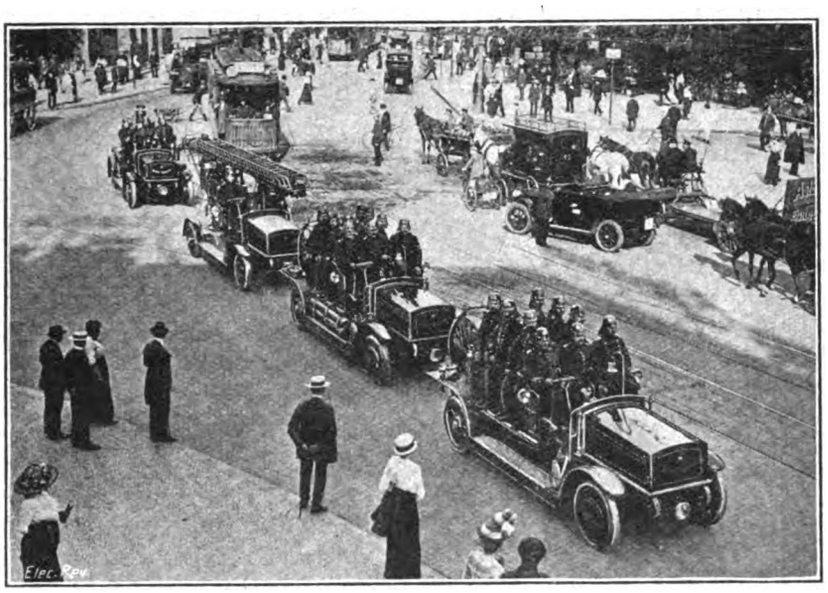
seventy-one to completely "motorise" its equipment.

It was as a result of exhaustive trials carried out in 1907, and in the early part of 1908, that the Berlin authorities decided to adopt electrically-propelled machines for city fires, and petrol vehicles for the transport officers, for suburban fires, and the transport of stores, and the report states that the decision then arrived at has proved itself to have been a wise one, owing to the rapidity with which the electrical vehicles can respond to a fire call. All the electric machines in service—the first one of which dates from September, 1908—were built by the Daimler Motoren Gesellschaft, of Marienfelde, Berlin, and are of what are known in this country as the Cedes type, the electric motors being enclosed in the hubs of the front or rear road wheels, which are thus driven direct without the intervention of any gearing. The motors—two per vehicle—are rated at 7½ h.p. each, and are able to propel the machines at a maximum speed of 22½ miles per hour. The necessary current is supplied by a battery of 84 accumulators of the capacity of 146 ampere-hours at a 5-hour discharge rate; one charge of the battery is capable of propelling the machine a distance of about 31 miles at a speed of 18¾ m.p.h.

In place of the electrically-propelled steam-operated pumping engine units of the trains that have until recently been employed, similar machines, but with pumps worked by petrol engines, are now being introduced into the service. The principal advantage of the new type of machine is a considerable reduction in the total weight to be transported, which has resulted not only in an extension of the radius capacity of the battery charge of this particular unit but also of the complete train.



BERLIN FIRE BRIGADE ELECTRIC VEHICLE TRAIN.

As regards the running and maintenance costs of the vehicles, a careful record has been kept, and the Chief has prepared a table—reproduced herewith—of the figures relating to eight of the "trains"—each comprising, as already mentioned, four vehicles which have been in service for not less than a year, the average length of service being 3 1-12 years.

Fire Brigade work is, of course, entirely of a special character, and the figures of costs shown, it will be readily understood, cannot be taken as the basis of any comparison or criterion of those of electrically-propelled vehicles for delivery purposes, where the quantity of goods to be dealt with, and the approximate daily mileage to be covered are known. The exact number of calls that the electric fire trains may be called upon to respond to in any one year is, of course, unascertainable, and only the average over a number of years can be taken as a guide. Last year, for example, the Berlin Brigade had to deal with a total of 14,854 fires, but whether the number be 14,854 or only 1,485, the vehicles have constantly to be in such a condition, both electrically and mechanically, that they are ready to answer a call at a few seconds notice. Hence, while the cost of maintenance of the electric fire trains may, in themselves, appear high, it can only be compared with that of the system it has displaced, and from the accompanying table it will be seen that the total annual costs work out at £277 15s. per train, or, approximately, £69 8s. per vehicle, these figures comparing with £1,095 13s. per train, and £273 18s. per vehicle, per year, in the case of horse-drawn machines. This means that four electric "trains" can be run at the same cost as a single horse-drawn train. Furthermore, it is expected that the cost of maintenance of the electrical vehicles will in future be lower, as arrangements have been completed whereby all repairs will be carried out in the workshops attached to the headquarters of the Fire Brigade, where, also, all spare parts will be made. It is, furthermore, hoped to effect an economy in the tire bill. It will be noticed that, so far, one of the most costly items has been that of non-skid bands. As a result of the experience that has been gained, it has, however, been discovered that better results, as regards freedom from skidding, are obtained with only two of the tires fitted with such bands—one at the front and one at the rear, arranged diagonally—than where three or four non-skids are used. A number of vehicles have also been provided with twin tires at the rear, and, in conjunction with these, one non-skid—on the front—has been found sufficient.

The cost of current is also considered high, and efforts are being made to secure a reduction in the rate charged, which, at present, is 1.8d. per kilowatt-hour. As for the batteries, it may be stated that these are maintained under contract at an annual charge of £23 15s. per battery, and that one spare set of accumulators is kept on hand for each train of four vehicles. As no signs of sulphating have occurred, and experiment is to be made in the way of entirely discharging and recharging the cells only once every two months instead of once a month as at present. An interesting feature of the table is the column which shows that the average time per vehicle per year devoted to repairs, or, in other words, the time that the vehicles were not available for response to a fire call, was 15 hours.

As regards the petrol vehicles belonging to the Berlin Brigade, the Chief reports that these have not been sufficiently long in service to give comparative figures. He remarks, however, that the cost of repairs has so far proved somewhat high, and that, correspondingly, the time the vehicles are not available for service is also high. Careful records are being kept of the petrol vehicles, and these will be published in due course.

In an early issue we hope to give some particulars of the electrically-propelled vehicles employed by the London Fire Brigade, and also some figures as to their running and maintenance costs, which will form an interesting complement to those given above for the Berlin Brigade.

German Wireless Station Destroyed.—A British cruiser has destroyed the German wireless station at Dar-es-Salam, in German East Africa.

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THE EDISON & SWAN CO.'S NEW CITY SHOWROOM.

The accompanying view shows the interior of the Edison and Swan United Electric Light Co.'s new showroom in Queen Victoria Street. As mentioned in our note on page 185, the new premises extend through into Upper Thames Street, where the trade entrance is situated, and include stores, offices, and every facility for carrying on the firm's extensive business in electrical apparatus of all kinds. The new premises are centrally situated; the showroom, which measures some 83 ft. × 53 ft. by about 30 ft. in height, is on an imposing scale; side galleries give additional space, while the alcoves underneath them provide facilities for the display for smaller wall fittings, &c.

The arrangement of ceiling battens and supports allows of some hundreds of pendant fittings being on view, and a special feature is the provision for showing every fitting alight.

The decorations are in excellent taste, and the Ediswan emporium—it contains examples of practically everything turned out by the firm, which is saying a good deal—will be welcomed as a fitting addition to London's electrical rendezvous.

Readers should note that the new Victoria Street premises are now the firm's City headquarters, and that the well-known Queen Street and College Hill premises have been closed.

Showroom at the Edison & Swan Co.'s New City Depôt.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Electrical Trades Benevolent Institution.

At the present moment there must be a considerable number of firms whose staffs have been somewhat depleted by the calls on the Territorials and also the departu e of foreigners to their countries.

As this Institution is now assisting four or five gentlemen who would be capable of occupying such positions for the time being, I shall be glad if, through your columns, you can induce firms requiring any of these to communicate with me.

This will have a double advantage: first, providing work for persons who are wanting it, and, secondly, enabling this Institution to husband its resources, a step which is more necessary than ever at the present time.

I may add that I regret to hear from one of those we have assisted in the shape of helping the man and his wife to set up lodgings, that owing to the war a German lodger who was sent to them by an electrical firm has had to go, and they are thus again placed in pecuniary difficulties. Their house is close to one of the South London tube stations.

F. B. O. Hawes,
Secretary.

18, Park Mansions, Vauxhall Park,
London, S.W., *August 6th*, 1914.

Engaging a Foreman.

Referring to your report in the issue of July 31st last of a case by our client, Mr. A. E. Short, against Messrs. Watson Marsh & Co., Ltd., of Brondesbury, we should like to point out that Mr. Marsh admitted in the witness-box he was so satisfied with our client's testimonials that he did not want to lose his services, and Mr. Marsh agreed to engage him with the prospect of an advance of salary in the following September.

The letter written by our client to the defendants only stated that nothing definite as to the increase of salary had been settled, and did not refer to the actual engagement at £2 10s. per week.

We trust that you will insert this letter in order that our client may make his position clear to your readers.

We might add that although the Judge decided against our client, he refused to give any costs to the defendants.

Armitage & Co.

London, N., *August 7th*, 1914.

Electrical Engineers and the War.

The suggestions made for the enrolment or registration of electrical engineers who are not members of any existing force are such as, no doubt, all will be in sympathy with, but I venture to suggest that it would be a mistake to multiply

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such bodies, and that—at all events in the London district—a reserve to the Electrical Engineers Territorial force, under the control of that organisation, would be more useful. Further, the majority of those who would enrol themselves would, no doubt, be anxious not to be committed to be members of a body which would have no active duties, but would only be waiting to be called on, while their undertaking would prevent them from doing other work.

For example, those who, like the writer, own and drive cars, would probably be of service in that way, though, as electrical engineers, they would be more useful in electrical work if they could get anything to do. We all want to do something, however unimportant the work may be, but special knowledge should obviously be made use of if possible.

M.I.E.E.

Referring to my letter under the above heading which you kindly inserted in last week's issue, I should like to thank those gentlemen who have promptly offered their services, many of whom promise to assist in their respective districts, replies having reached me from all parts of the country.

All grades of electrical engineers are coming forward anxious to serve their country in the hour of need, and I hope others will follow, as it is numbers that tell, and skilled men in our profession play an important part in wartime. As soon as a sufficient number of signatures are forthcoming a Committee will be formed and prompt action taken.

In conclusion, I would state that it appears to me to be outside the scope of our Institution to take action, as the membership is very cosmopolitan.

W. Ellerd-Styles.

Leytonstone, N.E., *August 9th*, 1914.

[The Institution has already taken steps in the matter. Particulars will be found in our "Notes" columns.—Eds. Elec. Rev.]

End of the London Wiremen's Strike.

I have pleasure in notifying you that the strike of electrical wiremen in London, initiated by the Electrical Trades Union on April 1st, is now at an end, the members of the Union having been instructed to return to work.

The working rules issued by the London Electrical Masters' Association in March, 1914, have been adopted for a further six months, and a Joint Committee of masters and men will be appointed to adjudicate on any questions of hardship that may be brought forward.

I may add that these proposals were put forward by the masters in the early part of April, but were then refused by the Union.

Leonard G. Tate, *Hon. Secretary,*
London Electrical Masters' Association.

London, E.C., *August 10th*, 1914.

Mysterious Behaviour of a Generating Set.

I am employed at a fairly large colliery in South Yorkshire. We have a turbo-alternator, Willans turbo and Siemens generator (mixed pressure), running at 3,000 R.P.M., three-phase, 650 volts, 880 K.V.A., 750 KW. One day last week, when everything was running well, with about ¾-load on, it lost its excitation. (The exciter is direct-coupled, shunt-wound with interpoles, giving 110 volts, 105 amperes.) We stopped the turbo, examined round and could find nothing, so started up again, leaving everything as before, and she built up straight away with a reversed polarity, no connection being changed in any way. This week-end, however, we have tried changing the exciter connections. First of all we just changed the shunt, with no results. We put it back, and then changed the main brush connection, with the following results:—The exciter ammeter and A.C. voltmeter oscillated from half exciting current and half voltage back to zero; when the ammeter was going up the voltmeter would be going down. We then changed back again as before, and just changed the ammeter connections on the shunt. The ammeter then read in the right direction, but with a reading of maximum excitation current with no load.

J. Wood.

Darfield, *August 10th*, 1914.

The Protection of Engineering Works.

I shall be greatly obliged if you will make it known through the medium of your valuable journal that members of the Volunteer Civil Force are prepared to offer their services in any part of the country for the protection of engineering works and electrical power stations, &c. In view of certain possibilities, some satisfactory means of protection of private property should be found at once, and this we are prepared to do by sending trained men who have had experience in a similar direction.

Full particulars will be forwarded on application to Ruskin House, Rochester Row, Westminster, S.W.

W. R. Eustace.

London, S.W., *August 11th*, 1914.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Seachlights.

The London Electric Firm, of George Street, Croydon, have made a number of wheel-house type searchlights for a large Scotch shipbuilder, for use on passenger steamers, as shown in fig. 1. They are constructed of brass throughout, and are consequently very handsome machines. The size is 20 in., and they are fitted with high-grade silvered parabolic mirrors and diverging lenses, the voltage being 100. They have also introduced an entirely new type of searchlight for the use of fire brigades in

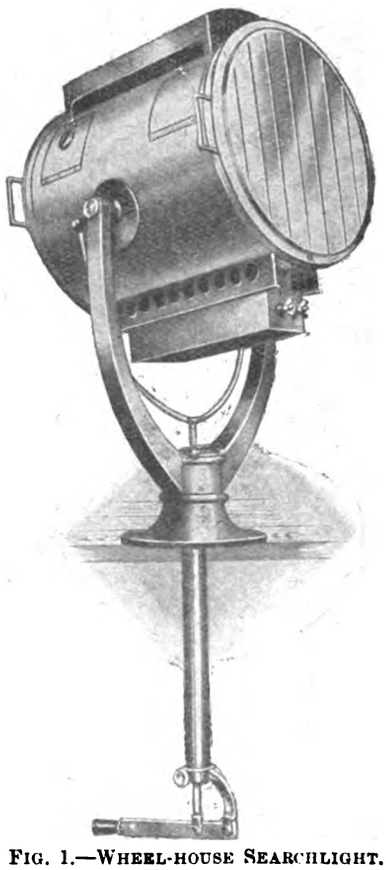

Fig. 1.—Wheel-house Searchlight.

illuminating shadow-cast exteriors and dark interiors of buildings. These are made extremely light, to enable them to be carried about easily, and very strong to stand the rough work inevitable with such service. The tripod collapses by means of sliding members, and also folds up, thus giving the maximum of advantage for transport purposes.

The machine gives a very widely-dispersed beam of light in all directions, and is also on the swivelling and tilting plan, giving a wide range of action. The candle-power is 3,000 at 100 volts, and current is supplied from a dynamo carried on the fire tender.

A "Witton" Traction Switchboard.

During the recent Convention of the I.M.E.A. in Birmingham, a visit was paid to the Witton Works of the General Electric Co., Ltd., where a large continuous-current switchboard which had just been constructed for the Cardiff Corporation was on view. This board consists of 25 panels and is over 45 ft. in length; it has been designed for controlling a supply for both lighting and

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traction purposes. The panels themselves are constructed of fine white marble, and as will be seen from fig. 2, the board presents a very attractive appearance. An innovation for heavy-current switchboards has been embodied in the arrangements for the back

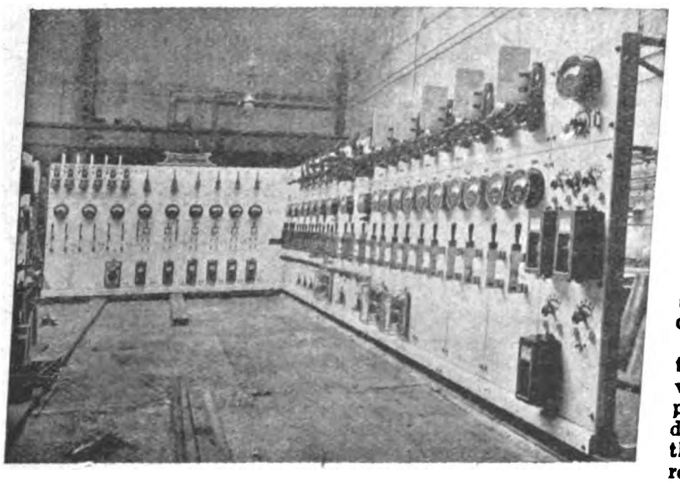

Fig. 2.—"Witton" Lighting and Traction Switchboard for Cardiff Corporation.

of the board. Instead of being carried from the usual brackets, the bus-bars are supported by the stems from the switches. These stems, therefore, serve both for a mechanical support and for the current carrying connection.

LEGAL.

Action Against the Tyneside Tramways Co.

At the North Shields County Court on the 6th inst., before Judge Greenwell, Eleanor Appleby, of Wallsend-on-Tyne, sued the Tyneside Tramways and Tramroads Co., to recover damages for personal injuries.

The allegation was that a car re-started while the plaintiff was dismounting from the car on February 2nd, and the plaintiff was thrown on to the curb, being rendered unconscious, and, as a result, was 14 weeks off work, and had not yet recovered.

Dr. Wilson, describing plaintiff's injuries, said it must have been a pretty hard blow that caused them.

The defence was that the plaintiff attempted to leave the car before it had stopped, and so received the injuries.

Judge Greenwell gave judgment for the Tramways Co.

A Compensation Case.

In a case heard at the Nottingham County Court the British L. M. Ericsson Co., Ltd., of Beeston, asked for the suspension of all compensation payable to Catherine Booth, tester of electrical apparatus, until the respondent had submitted to a simple operation to the middle finger of the right hand.

Judge Allen decided that compensation should cease until the operation was undergone, but the company then offered £75, without costs, in settlement of all liability, and the offer was accepted.

PHYSICAL SOCIETY OF LONDON.

At the meeting held on June 20th, at the Cavendish Laboratory, Cambridge, a paper entitled "Production of Very Soft Röntgen Radiation by the Impact of Positive and Slow Cathode Rays," was read by the President, Sir J. J. Thomson, O.M., F.R.S.

Röntgen and his pupils had always held that light waves were identical in nature with electrical waves produced by mechanical means, but there was a gap, on which very little work had been done, between the longest infra-red radiation and the shortest electrical wave that could be mechanically produced. He believed the investigation of this gap to be essential to the proper study of the constitution of the atom. The work already done on X-rays had demonstrated the existence of two separate rings of electrons in the atom, one within the other. These rings were responsible for the K and L types of radiation respectively. The L radiation was so much softer than the K that if a third ring of electrons existed, the radiation from which was proportionately softer than that of the L type, this radiation would fall well within the gap already mentioned.

In the first experiment described a special form of discharge tube was employed. The positive rays passed through a tubular perforation in the cathode and impinged obliquely on a metal target. A photographic plate of the Schumann type was situated at the further end of a branch tube in such a position that no solid obstacle interposed between the target and the plate. When the discharge passed between the electrodes, the photographic plate was affected. The application of an intense transverse electrostatic field between two metal plates situated between the cathode and the target completely stopped the effect, showing that this was not due to stray radiation reflected from the target, since, while charged particles would be swept to one side, radiation would not be affected by the field. Hence the passage of positive particles from the cathode to the target was essential. On the other hand, a strong transverse electrostatic field in the branch tube had no effect, showing that a radiation was passing betweeen the target and the plate, which was not, therefore, merely affected by positive particles rebounding down the side tube after impact on the target.

The properties of this radiation were intermediate between ordinary X-rays and Schumann waves. They were susceptible to reflection by metal surfaces, and their penetrating power was very small. They were completely stopped by the finest collodion film obtainable.

It was shown that the quality of the radiation did not depend on the energy of the moving particles which gave rise to it, but on the velocity. Hence equally soft rays should be produced by cathode particles if these were travelling as slowly as the positive rays. A discharge tube was constructed in which the cathode rays, leaving the cathode with the ordinary velocity, could be subjected to a retarding electrostatic field of variable strength before impinging on the target. In this way the velocity of impact could be varied over a large range, and radiations were obtained varying in quality from ordinary hard X-rays to the so-called Schumann waves. It was hoped by the study of these radiations to be able to determine not only the number of rings of electrons within the atom, but the number of electrons in each ring.

Sir Oliver Lodge expressed the opinion that the work just described was of far-reaching importance, and he felt confident that the results warranted the anticipation that further work would confirm the explanation foreshadowed by the President.

At the meeting held on June 26th, 1914, at the Imperial College of Science, a paper entitled "On Atmospheric Refraction and its Bearing on the Transmission of Electromagnetic Waves round the Earth's Surface," was read by Prof. J. A. Fleming.

In this paper the author considers the conditions under which true atmospheric refraction would be sufficient to carry a ray of light or electromagnetic radiation sent out horizontally from any point on the earth's surface round the earth parallel to its surface. It is now generally agreed that pure diffraction is insufficient to account for all the phenomena of long-distance wireless telegraphy, but that we have to postulate some action of the atmosphere which tends to curve the radiation round the earth. The theory of ionic refraction has been put forward, which is based on the theoretical conclusion that in ionised air the velocity of long electric waves is increased. We know as a matter of fact that the atmosphere decreases in density as we rise upwards, and this alone produces a decrease of refractive index and an increase in velocity.

The first part of the paper is concerned with the deduction of formulæ expressing this variation of density with height, taking into account as far as possible the known temperature variation with increase of height. It is shown that at a height of 100 km. the terrestrial atmosphere must consist substantially of hydrogen and helium. An expression is then obtained for the radius of curvature at any point of a ray of light sent out horizontally from the earth's surface, and it is shown that if the terrestrial atmosphere consisted wholly of krypton a ray sent out horizontally would be refracted round the earth, and in such an atmosphere wireless telegraphy to the Antipodes would be possible.

The question of atmospheric composition is then considered in the light of what is known about the auroral spectrum. The suggestion is made that perhaps the non-valent gases neon and krypton are manufactured at great atmospheric heights by electric discharges occurring in the rarified hydrogen atmosphere; also that by their ease of ionisation they contribute to produce the ionised layer demanded by the theories of Heaviside and Eccles to account for the actual achievements of long-distance wireless telegraphy.

Finally, it is suggested that our earth is perhaps unique in being the only planet on which such long-distance radiotelegraphy is possible.

Mr. Duddell considered it was very difficult to follow what was going on in long-distance transmission. One difficulty was that it seemed probable that the heavier gases were absent from the upper atmosphere, yet we had to assume their presence either to get the refraction effect or the Eccles effect.

Dr. C. Chree said that a fundamental point was whether the auroral spectrum did or did not connote a gas different from all hitherto isolated at the earth's surface. Wegener thought it did, and believed the unknown gas thus indicated to be a very light one, which at great heights was even more important than hydrogen. The fact that Prof. Störmer's recent photographic determination of auroral heights had in some cases supplied heights well over 300 km. was evidence that an atmosphere of some kind extended to a very great height. The fact emphasised by Dr. Fleming that wireless results by day and night differed markedly certainly seemed to support strongly his contention that the upper atmosphere played a most important part in the phenomenon. A similar conclusion had been drawn in the case of the ordinary diurnal variation of the elements of terrestrial magnetism, where normally changes were much larger by day than by night, and much larger in summer than winter.

Prof. G. W. O. Howe pointed out that although the upper

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atmosphere undoubtedly had a profound effect on the transmission of electromagnetic waves over long distances, they were still uncertain to what extent long-distance radiotelegraphy would be possible without any assistance from the upper atmosphere. As successive mathematicians attacked the problem, errors were discovered in the previous work, and up to the present the effect of the correction seemed to have been in every case to increase the amount of energy diffracted around the globe.

Prof. Marchant mentioned that recently it was shown that the difference between the carrying power of signals by night and by day was very much greater in summer than in winter.

A paper on "Atmospheric Electricity Observations made at Kew Observatory," by Mr. Gordon Dobson, was read, and a paper on "Thermal and Electrical Conductivities of some of the Rarer Metals and Alloys," was read by Mr. T. Barratt.

A paper entitled "Some Investigations on the Arc as a Generator of High-Frequency Oscillations," by Mr. F. Mercer, was read. This paper contains the results of a series of experiments on the copper-carbon arc when used as a generator of high-frequency oscillations.

ELECTRIC COOKING IN MARINE SERVICE.

The recent trial trip of the U.S.S. *Texas* is of special interest because for the first time a large number of men (715) at sea were entirely dependent upon electric cooking for their daily meals. The results of the trial test on the cooking apparatus were discussed by Mr. J. Mauger, at a meeting of the American Institute of Electrical Engineers.

Data secured during the trial trip demonstrated that the ship's equipment of fifteen ranges and two bake ovens was more than sufficient to care for a crew of 970 men, including seventy officers. The success of the trial is more apparent in view of the fact that none of the cooks had had any previous experience in using electrical apparatus and that they became acquainted so readily with its operation and had no difficulty in performing their prescribed duties.

Of the five ranges installed in the officers' galley four were in use daily. Six to eight of the ten ranges in the crew's galley as well as the two bake ovens were employed simultaneously. Food for 162 men was prepared in the officers' galley and that for 553 men in the crew's galley. The bake

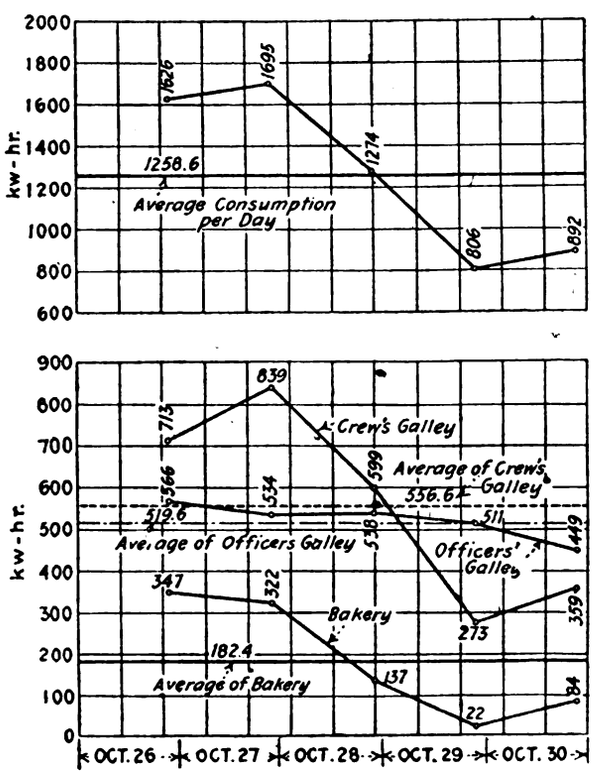

Fig. 1.—Total energy consumption of electric ranges and bake ovens on U.S.S. "Texas."

ovens proved to be sufficient to supply a crew twice as large as that aboard the ship during the trial trip. The officers' galley was in use from 6 a.m. to 9.30 p.m. except for one hour and a half from 2.30 p.m. to 4 p.m. A few hot-plates were kept in service at all times for heating coffee. The crew's galley was in use from 4.30 a.m. to 8.30 a.m., 10 a.m. to 1.30 p.m. and 4 p.m. to 8.30 p.m., depending somewhat on the daily menu.

Two of the accompanying diagrams indicate the average total daily energy consumption and the consumption over a period of four days subdivided under officers' and crew's galleys and bakery. Other curves are shown indicating the variation in load during the preparation of a typical day's meals.

The total daily energy consumption averaged 1,258.6 kw.-hr.; the highest demand was 1,695 kw.-hr. and the lowest 806 kw.-hr. The downward slope of the curve shows a radical increase in economy occasioned by the cooks becoming accustomed to the use of the electric ranges. It is probable that more extended experience would still further increase this economy. The energy consumed per person per day averaged 1.7 kw.-hr. The average total consumption in the crew's galley (556 kw.-hr.) was only slightly more than that in the officers' galley (519 kw.-hr.). The average consumption per man per day in the crew's galley was 1 kw.-hr., as compared with 3.2 kw.-hr. in the officers'. The average daily consumption in the bakery was 182 kw.-hr., or 0.25 kw.-hr. per man.

In accounting for the difference of the energy consumption per man per day in the two galleys, it may be said that about 25 per cent. to 30 per cent. of the cooking in the crew's galley was performed in steam-heated cauldrons, while electricity was used exclusively in the other galley. Another advantage obtaining in the crew's galley was that the ranges could be operated at a better load factor because more food had to be prepared.

Analysis of one of the daily energy-consumption curves in the officers' galley shows that the average demand was 27.4 kw., while the maximum occurring during the preparation of dinner reached 54 kw. Four ranges were in actual use during

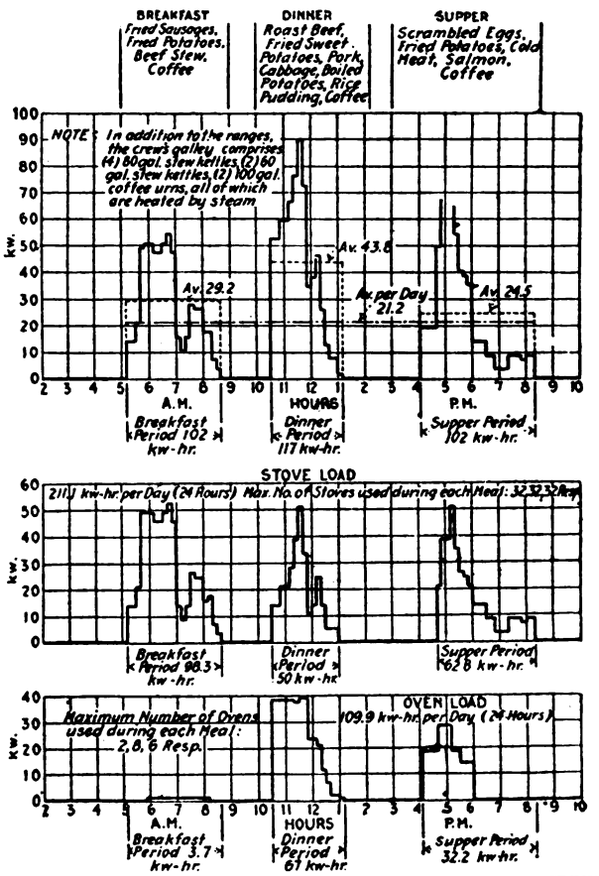

Fig. 2.—Power consumption of electric ranges in crew's galley.

the preparation of the particular meal referred to. The ratio of the maximum demand to the connected load was therefore about 54 to 120, and the load-factor about 50 per cent.

During the preparation of a typical day's meals in the crew's galley the average demand was 21.2 kw. and the maximum 90 kw., making the load-factor about 24 per cent. Eight of the ten ranges were used, so the ratio of the connected load to the maximum load was 90 to 240. By properly concentrating the cooking in fewer ranges a ratio of 90 to 120 could have been obtained.

The kilowatt-hour curves were taken from wattmeter readings, and the other curves were plotted from ten-minute readings taken throughout the operating periods.

The ranges have a hot-plate area of 888 sq. in.; the broilers measure 18 in. by 24 in. and the ovens 18 in. by 28 in. by 16 in. Each hot-plate requires 1,750 watts maximum, each broiler 4,000 watts and each oven 4,800 watts maximum, making the total connected load in each range 31.6 kw. One range will roast 75 lb. of meat at one time.

The bake ovens require 16 kw. maximum and are capable of preparing 100 loaves of bread. The loaves do not have to be shifted in an electric oven to procure good results as has to be done in the coal-fired type, therefore the heat is not dissipated and wasted through open doors.

The ranges are capable of cooking larger quantities of food than the coal-fired type of the same size, as the compartments usually devoted to fire and ash boxes are utilized as a roasting oven in the electric type.

Another advantage of the electric range is that it is equipped with a broiler, which the coal range lacks. The broilers can be used for toasting, warming dishes and browning the products from the oven.—*Electrical World*.

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INDIVIDUAL DRIVING OF SMALL AND MEDIUM SIZE MACHINE TOOLS.

By ADOLF R. STELLING, Dipl.Ing., A.M.I.E.E.

No question is ever raised nowadays as to the commercial value of the electric drive for large or heavy machine tools, but the driving of smaller tools requiring less than 5 H.P. per unit, such as centre lathes and semi-automatic lathes up to 8 in. swing, milling machines up to No. 2 American size, light radial drills, shapers, &c., by means of individual motors, is still regarded askance by machine tool users. Machine tool makers and electrical engineers have combined during the past two years to put forward improved drives, but there is still much room for improvement.

Consider the fundamental differences in the working of heavy and light tools. On heavy tools the period of setting up may take from two to six hours; no one would consider letting the motor run idle during this period. When cutting commences, the tool and its driving motor are usually working at from 75 per cent. to 100 per cent. full rated load for long periods. The electric motor is, therefore, being used very economically, and is a commercial and technical success.

With the small machine tool the conditions are altered. The setting-up time on shapers, millers and centre lathes is long when compared with the actual cutting time. Both being actually short, it becomes inadvisable to stop the motor every time a change is made, especially if direct-current motors are used. Moreover, in the majority of shops the medium size tool is seldom working at its maximum metal-removing capacity. In the case of semi-automatic machines, probably only one of six or eight operations taxes the metal removing capacity of the tool to its rated maximum. With radial drills the discrepancy between the periods of maximum metal removing and light load is still greater. The driving of such tools may therefore be regarded as a constant low load with overload periods of short duration.

Machine tool makers in selling this class of tool make a special feature of the high metal removing capacity and specify motors with a continuous output based upon this capacity. Electrical engineers are almost as much to blame for complying with this specification and thereby increasing the cost of "individual drive."

Practical experience goes to prove that motors of smaller rated outputs but high overload capacities are more suitable from all points of view. The efficiency at light loads (running back, finishing cuts, &c.) is much improved by using a motor of lower nominal rating; the motor, being smaller, can more easily be accommodated on the machine tool, and, above all, the first cost is reduced. With the application of induction motors, the question of the power factor is another argument in support of this contention.

The "all gear" drive of medium size tools is making headway in no uncertain fashion, with the result that constant speed and therefore cheap motors can be used. This, together with the increased distribution of three-phase current, opens a favourable field for the cheap constant speed squirrel-cage type of induction motor, but the problem must be carefully handled on the lines indicated above. One great advantage of the small induction motor is that with such machines as are enumerated above, the clutch can be interlocked with the triple-pole switch, so that current is only used when cutting.

In conclusion, this article puts forward a plea for further investigation and for co-operation between manufacturers of machine tools and electrical machinery. With the advent of cheaper power, a simple, cheap and effective electrical individual drive should prove a commercial success, and manufacturers have every encouragement to strive towards improvements.

A Colliery Installation.—We regret that in our note last week on the installation at the Warwickshire Coal Co.'s Coventry Colliery, the fact that Messrs. Willans & Robinson, Ltd., were the principal contractors for the plant—*i.e.*, the turbo-generators and condensers—was not stated.

BUSINESS NOTES.

Trade Announcements.—Messrs. Gillespie and Beales, of Amberley House, Norfolk Street, Strand, have recently been appointed sole selling agents to the Corporations of Great Britain by Messrs. Charles Mackintosh & Co., of Manchester, for their solid motor traction tires.

Premises situated at the junction of Charles Street and Swain Street, Bradford, will shortly be opened by the Albion Electric Stores, wholesale factors of electrical accessories, who have an establishment at 9, New Station Street, Leeds.

Mr. C. W. Webster, of Whiteley Street, Bingley, sole sale concessionaire for the flame carbons of the Compania Fabril de Carbones Electricos of Barcelona, Spain, announces that despite the demands on his English stock of flame carbons, he is able to execute all orders, as his main supply from the Barcelona works is still kept open.

The British Telephone Supply Co. (late of 17, Bloomsbury Street, Birmingham) announce that their new address (since July 25th) is 4, Slaney Street, Birmingham; telephone number, Central 6392.

Messrs. J. Hopkinson & Co., Ltd., of Huddersfield, announce that they have removed their London office from Queen Victoria Street to more central premises at Imperial House, Kingsway.

The Jandus Arc Lamp and Electric Co., Ltd., of Hartham Road, Holloway, N., inform us that they are prepared to deliver to their customers, for use in Jandus lamps only, sufficient arc lamp carbons for six months' use. The company manufacture the special carbons for their regenerative lamps, and hold a very large stock of raw materials which they anticipate will supply all requirements.

Catalogues and Lists.—The Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, S.W.—Leaflet No. H 16, illustrating and giving particulars, dimensions, prices, &c., of the firm's standard direct-current motor starters. New features incorporated are renewable contacts on smaller sizes, and glass inspection windows for completely enclosed types; various extras are also listed, prices are revised, and the firm inform us that, due to their stocks and use of English materials, they are but little affected by the war. Also E.A.C. Notes No. 10, dealing with meters, starters, controllers, &c.

Messrs. Mavor & Coulson, Ltd., 47, King Street, Glasgow.—Monthly "Pick-Quick" coal-cutter card, containing August calendar and data regarding the working of a small D.C. electric coal-cutter.

Messrs. Ralph H. Haylock & Son, 63, Queen Victoria Street, E.C.—Leaflet describing, with illustrations and prices, "Hotpoint" heating and cooking apparatus, viz., the El Glo Stove, the El Grillo, the Hotpoint iron, and the El Boilo (an immersion heater).

British Thomson-Houston Co., Ltd., Mazda House, Upper Thames Street, E.C.—July-August issue of the "Mazda House News," containing much interesting information on the subject of illumination, Mazda lamp developments, &c.

Messrs. Doulton & Co., Ltd., Lambeth, S.E.—New insulator catalogue, No. 93, 1914, 20 pages, illustrating and describing a large selection of standard stoneware and cream glazed vitreous porcelain cable insulators made at Lambeth. New types are included and prices are given. The firm point out that they are fully prepared to supply the increased demand anticipated from the absence of foreign supplies.

Private Arrangements.—Accumulator Industries, Ltd, Oriental Institute, Woking.—A meeting of the creditors of the above was held on Friday last at Winchester House, Old Broad Street, E.C. The chair was occupied by Mr. W. McLaren, the chairman of the company, who was also the largest creditor. An approximate statement of affairs was presented, which had been prepared by Mr. A. W. Sully, of 19-21, Queen Victoria Street, E.C., who had been appointed to act as the liquidator of the company. The statement disclosed ranking liabilities of £46,229, of which £38,883 was due to Mr. McLaren for cash advanced at various dates. The London and South-Western Bank was scheduled for £945, while the amount due to trade creditors was £6,401. At book values the assets were set down at £8,592, but at a realisation they were expected to produce £3,627. From the latter figure had to be deducted £187 for preferential claims, leaving net assets £3,440, or a deficiency as regarded the creditors of £42,789. The assets were as follows:—Buildings, additions and lease £1,400, estimated to realise £400; machinery, plant and tools, including Dowson plant £4,513, expected to produce £1,600; stock-in-trade, £2,214 9s. 4d., valued at £1,500; sundry debtors, £341, estimated to realise £75, and furniture £50, and calls in arrears £22, expected to produce £2. Mr. Sully said it had been difficult to prepare the statement of affairs owing to the close connection between the company and the Leitner Electrical Co. In taking the stock it had been necessary to differentiate between the raw material and the finished goods. Raw material had been supplied by the Leitner Electrical Co., and work done upon it. An offer had been received from the Rotax Co. to purchase the assets for £1,000, and to take over the stock of pig iron and red lead at market prices. That offer was made conditional on war not breaking out, and, therefore, under the circumstances, the liquidator thought it might be assumed that the offer did not now hold good. It was further stated that the company was formed about 12 years ago, with a nominal capital of £40,000. The issued

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capital was £37,318, but the whole of that amount was not subscribed for in cash. Up till 1911 the principal business of the company was putting on the market a system for lighting automobiles. The company worked under a licence granted by Mr H. Leitner, under which they had the right to manufacture according to that gentleman's patents. Mr. Leitner was now a creditor, and a good deal of his claim was in respect of unpaid royalties. In 1911 the company was in financial difficulties, and Mr. Leitner cancelled the licence he had given. Shortly afterwards Mr. Leitner formed the Leitner Electrical Co., and an agreement was entered into between that concern and the Accumulator Industries, by which the latter, under reasonable conditions, was relieved of its liabilities. The company manufactured goods for the Leitner Electrical Co. Last September the Leitner Electrical Co. entered into an agreement with one of the largest firms in the trade. Under the agreement the Leitner Electrical Co. and the Accumulator Industries were to be taken over by the large concern. If the agreement had gone through, all the creditors would have been paid in full. The matter, however, had not gone through, and as the Leitner Electrical Co. was without funds, the present position had arisen. In answer to questions, the liquidator stated that the deficiency shown in the statement of affairs was caused by losses which had occurred over a number of years. A special manager of the Leitner Electrical Co. had been appointed, pending the hearing of a petition which had been presented against that concern. It might be true that some orders on behalf of the company were given by the Leitner Electrical Co., against whom there might be some claim. The Leitner Electrical Co. had been the selling agents for the Accumulator Industries. A resolution was passed by the creditors agreeing to an application being made to the Court for the appointment of Mr. G. E. Corfield, of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C., as joint liquidator with Mr. Sully. A committee of the principal creditors was also elected.

Robert Crust, electrical engineer, Brook Street, Bradford.—The creditors interested herein were called together recently at the offices of Messrs. Heap & Heap, solicitors, of Market Street Chambers, Bradford. The statement of affairs presented showed ranking liabilities of £429, of which £399 was due to unsecured creditors and £30 to cash creditors. There were also preferential claims of £15. The assets consisted of cash at bank £16; book debts £187 estimated to realise £150; and stock-in-trade expected to produce £75. It was reported that the debtor started trading about six years ago with a capital of £100. The turnover of the business had averaged from £800 to £900 per annum. The deficiency was attributed to bad debts, and a loss of £70 on a contract. After discussing the position it was decided that provided the debtor was able to obtain financial assistance from friends the business should be continued with a view to the payment of the debts in full. A committee of the representatives of the three principal creditors was also elected.

Annual Outing.—The Willesden works of the B.T.H. Co. held their first annual outing at Windsor, on Saturday, July 25th. Private omnibuses were hired for the occasion, and the journey was very much enjoyed. On arrival at Windsor the whole party were photographed; subsequently sports were held and prizes awarded to the successful competitors. Boating on the river, inspection of the castle, &c., were followed by a tea served in a large marquee, close to the river, and later, by a concert in which the following contributed to the programme: Misses D. Thomas D. Riley and I. Jones; Messrs. A. de Curtis, B. Townsend, W., Pepper, H. Cameron and F. Bennett.

Liquidations and Dissolutions. — Consolidated Diesel Engine Manufacturers, Ltd.—A compulsory winding-up order was made on July 7th, and Mr. W. B. Peat was appointed special manager to act for the Official Receiver.

The Demon Vacuum Cleaner Co., Ltd.—This company is winding up voluntarily with Mr. A. H. Evans as liquidator.

The British Economical Lamp Co., Ltd.—This company is winding up voluntarily for the purpose of reconstruction with Mr. H. E. Leigh, of Windsor House, Kingsway, W.C., as liquidator.

Book Notices.—*Proceedings* of the Incorporated Municipal Electrical Association, 1914." London: Wyman & Sons, Ltd. Price 5s.

"*Prospectus* of University Courses in the Municipal School of Technology, Manchester, Session 1914-15." Manchester: The School of Technology.

LIGHTING and POWER NOTES.

Aldershot.—New Plant.—The U.D.C. has decided to provide a cooling tower at the electricity works, at a cost of about £400, to be met from the reserve fund.

Bacup.—Mill Driving and Lighting.—The Electricity and Tramways Committee has decided to supply electricity for lighting and power to India Mill, providing that the proprietors, Messrs. Hoyle & Sons, Ltd., contribute towards the cost of the service, and is considering an application from Messrs. Hoyle Bros., Ltd., for a supply of energy for lighting at Olive Mill. The mains are to be extended in Siding Street and the Lee Mill district.

Barrow.—New Mains, &c.—The T.C. has authorised the electrical engineer to obtain new mains and switchgear, estimated to cost £1,400, in order to give a temporary supply of electricity to Messrs. Vickers' works.

Blackburn.—New Generating Station.—The T.C. has authorised a Special Committee to deal with the question of purchasing land at Whitebirk, for the purpose of erecting a new electricity station thereon.

Canada.—According to the *Journal of Electricity*, Messrs. Sanderson & Porter, of New York, have submitted a proposal to the city of Edmonton, Alberta, to furnish power from a plant to be erected at Moose River, B.C., in the Yellowhead Pass of the Rocky Mountains, 250 miles west, at prices ranging from one cent per KW.-hour for the first 50,000,000, to a half-cent per KW.-hour when 120,000,000 is reached. The plant, to be installed on a branch of the Fraser River, will cost $3,500,000. Its minimum capacity is placed at 300,000,000 KW.-hours. The present cost of producing electric power in Edmonton in 1¾ cents per KW.-hour, which is to be reduced to 1½ cents.

Cheshunt. — Proposed E.L. — The Gas Co. has informed the U.D.C. that it has decided not to apply for powers for E.L. in the district, owing to the N. Metropolitan E.P.S. Co. having decided to exercise its power of supplying current. The latter company has given the Council particulars of the scheme, and the question of public lighting is to be considered at an early meeting of the Council.

Chobham.—Proposed E.L. — The Woking Electric Supply Co. has intimated to the P.C. that it is applying to the L.G.B. for powers to supply Chobham with electricity, and the Ascot District Gas and Electricity Co. has written stating that it intends to supply the village with electricity in accordance with powers it already holds. The Council welcomed the advent of electricity from any source, and decided to support the Woking Co.'s application should the Ascot Co. not exercise its powers in a reasonable time.

Continental Notes.—France.—The *Revue Industrielle* gives some interesting details of the growth of electrical enterprise in France. Seven years ago, it says, the number of communes served by electrical distribution networks was under 3,000; this has more than doubled since then, reaching, as it now does, a total of 7,000. In the northern half of France the steam stations have extended their networks and increased their generating stations so that their total capacity now exceeds 500,000 H.P. The hydroelectric works in the Alps, Pyrenees and the Central plateau cover with their networks the southern half of France, and place at the disposition of the industries and population they serve more than 700,000 H.P. The capacity of the generating stations thus exceeds at the present time 1,000,000 H.P. The installations in course of execution or projected stand for another million. The capital invested in power houses and networks reaches at the moment the figure of 1½ milliards, without reckoning the hundreds of millions invested in manufacturing concerns which supply the machinery and material for electrical undertakings.

Dover.—Proposed Loan and Bulk Supply.—The T.C. has decided to apply to the L.G.B. for an additional loan of £500 for E.L. services.

The following terms for the supply of electricity to the S.E. & C.R. Co.'s marine station have been agreed to:—Lighting, from 30,000 to 50,000 units per annum, 3½d. per unit; from 50,000 to 100,000, 2½d.; from 100,000 to 150,000, 1¾d.; beyond, 1d. Power, up to 20,000 units per annum, 2½d. per unit; beyond, 2d. This is subject to an agreement for at least five years.

Eastbourne.—Proposed New Plant.—The E.L. Committee has recommended the T.C. to obtain a new 500-KW. turbo-alternator, at a cost of £4,000.

Charging Battery Vehicles.—The Committee also recommended that an existing dynamo be converted into a charging set for the purpose of re-charging electric battery vehicles, at a rate of 1½d. per unit. The engineer reported that 54 municipalities and three company-owned electricity works are now supplying electric vehicles for charging purposes, at 1d. per unit, or less.

Flaxton.—Overhead Wires.—The R.D.C. has consented to the York T.C. transmitting electricity through the rural district.

Glasgow.—Annual Accounts.—The accounts of the Corporation electricity department for the past year show that the revenue amounted to £378,315, an increase of £32,565 on the previous year, and the expenditure to £200,847, an increase of £30,000, of which £19,000 is accounted for by the increased cost of coal. After allocating £65,040 to interest, £59,388 to the sinking fund and £52,171 to depreciation, there was a surplus of £819. The average price received per unit sold was 1·157d., a decrease of ·131. Owing to the state of the coal market, the Electricity Committee recommends that the rates, which are as low, if not the lowest, of any in the kingdom, be not reduced.

Great Harwood.—Proposed E.L.—The Accrington T.C. has appointed a sub-committee to consider an inquiry from the Great Harwood U.D.C. for the T.C.'s terms for supplying electricity to the town.

Great Ouseburn.—Overhead Wires.—The R.D.C. has given the York T.C. permission to erect overhead wires in parts of its district for the supply of electricity.

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Halifax.—The T.C. has agreed to a proposal of the Tramways and Electricity Committee to supply electricity to Messrs. S. Thornton & Co., of Arden Works, at ½d. per unit, providing the consumption is not less than 750 units per H.P. demanded per quarter, and the annual revenue is not less than £330

Haslingden.—Bulk Supply Conference.—There has been a joint interview between representatives of Haslingden and Accrington T.C.'s with regard to the supply of electricity by the latter authority. The discussion mainly related to items for debit and credit in the cost of production at the electricity works, and eventually the question was deferred. The Haslingden Council asked for a reduction in the price of current in order to permit it to quote special terms for large consumers in the district, but the Accrington Council decided that it could not accede to the request.

Hastings.—Mains Extensions.—The T.C. has decided to lay electricity mains to the Brisco Estate, at an estimated cost of £1,185; 11 public lamps on the route are to be converted from gas to electric lighting, and it is estimated that the annual saving will amount to £16. The Council has also sanctioned the extension of the mains in the west of the town, at a cost of £804, and 19 public gas lamps are to be converted to E.L., at an annual saving of £28.

Holmfirth.—Prov. Order.—The B. of T. has extended the period for carrying out the E L. order of 1912 by the U.D.C. until August 7th, 1915.

India.—The present electrical plant which supplies power to Darjeeling being taxed to its full capacity, a new scheme has been formed for the supply of current to the two cantonments at Jalapahar and Lebong, as well as the outskirts of the town. The plant, which is estimated to cost Rs. 1,76,000, is to be erected at Phulbazaar, and work will begin on the return of the permanent engineer to the Municipality, Mr. G. P. Robertson, next month.—*Indian and Eastern Engineer.*

Kingston-on-Thames.—Annual Report.—The report of Mr. J. E. Edgcome, borough electrical engineer, on the past year's working of the Corporation electricity department, shows that the total receipts were £15,416, against £14,645 in the previous year, and the working expenses were £8,785, against £8,572. After paying interest, £3,058, and capital repayments, £4,295, there was a deficit of £721, against £833 last year. The total output was 1,242,042 units, against 1,151,988. From April 1st to September 5th, 1913, the works were run entirely by steam, and from then to the end of the financial year (March 31st, 1914), the Diesel engine plant was mainly used, the steam plant being used as a stand-by and on peak loads. The respective fuel costs per unit, including cartage, were: Coal, 1·355d., and oil, 0·450d. The engineer states that it is evident from these figures that, in order to obtain the full benefit of the oil fuel plant, it is necessary to shut down the whole of the steam plant, and tenders for the extension of the oil fuel plant are being obtained. The total cost per unit sold was 1·697d., against 1·867d., and, including capital charges, 3·118d., against 3·306d., while the total revenue per unit was 2·978d., against 3·045d.

Portrush.—E.L. Scheme.—At the last meeting of the U.D.C. a report by Messrs. John Woodside & Co., of Belfast, on the proposed electricity works for Portrush, was presented. The expenditure is placed at £6,488, and the annual revenue at £1,129. Putting the capital charges on a loan of £6,500 at 8 per cent., the net profit would be £109 per annum. The matter was deferred.

Rhyl.—E.L. Inaugurated.—On Friday last week, Mr. T. D. Jones, chairman of the Electricity Committee, started the new electric lighting plant, which has been installed at a cost of nearly £4,000. The new plant is run by a Diesel oil engine, and is in substitution of the old steam sets.

Rotherham.—Loan Sanction.—The T.C. has received sanction to borrow £8,446 for electricity generating plant and circulating water-pipes, £7,768 for mains, and £3,218 for a converting plant and crane.

Salford.—Street Lighting, &c.—The Electricity Committee proposes to replace the existing Brockie-Pell arc lamps in Chapel Street, the Crescent and Broad Street by modern type lamps with lowering gear. The Committee is to arrange with Messrs. C. S. Allott & Son, of Manchester, to advise on the foundations required for the new 5,000-KW. turbo-alternator at the Frederick Road generating station.

Selby.—Proposed E.L.—Negotiations are in progress between the Selby U.D C. and the Yorkshire Electric Power Co. with reference to the supply of electricity in Selby. The company is applying for a prov. order, and the Council is to consider the matter later.

Southport.—Proposed Destructor.—The Electricity Committee has approved a scheme for the installation of a second refuse destructor at Crowlands, at an estimated cost of £6,000. It is proposed to generate electricity for supply to the electricity undertaking.

Shoreham (Sussex).—Street Lighting.—The U.D.C. has appointed a committee to consider the present system of public lighting in the district.

Stockport.—Market Lighting and Bulk Supply.—The provision of electric lighting for stalls outside the market is to be dealt with by the borough electrical engineer.

The Electricity Committee has instructed the engineer to prepare a report as to the terms upon which a bulk supply of electricity could be given to the Cheadle and Gatley U.D.C., and, as an alternative, as to the price the Committee would charge for supplying electricity direct to consumers in the area mentioned.

Sudbury (Suffolk).—Workhouse Lighting.—The B. of G. is proceeding with a scheme for the lighting of the workhouse by electricity; it is considered that this would save £59 a year.

Tavistock.—Public Lighting.—The U.D.C. has accepted the tender of the E.L. Co. for the installation of public electric lighting to the extent of 20,800 C.P. at £461 per annum. The offer of the gas company was for 17,000 C.P. at £450 per annum.

York.—Overhead Wires.—The T.C. has applied to the B. of T. for permission to use overhead wires for the transmission of electricity at Middlethorpe, at 3,000 volts.

Wotton Without.—The Gloucester R.D.C. has given the Gloucester T.C. consent to supply electricity in this part of the district.

TRAMWAY and RAILWAY NOTES.

Argentina.—The concession granted in 1907 to Messrs. Francke & Co. for the construction of an electric railway between La Plata and Avellaneda has been annulled, and the guarantee deposit of $50,000 has been forfeited.—*Review of the River Plate.*

Belfast.—Proposed Loan.—The T.C. has decided to apply to the B. of T. for sanction to a loan of £2,600 in connection with the doubling of the tramway track at Glengormley.

Continental Notes.—Italy.—The Provincial Council of Genoa has favourably entertained the application for a concession for an electric tramway from Genoa to Casalino, with branches to Scrisia and Voghera. A feature of the undertaking is that it will involve the construction of two tunnels under the Delle Grazie and Creto Hills respectively.

A line is contemplated from Padua to Vicenza, making junction with the Montagnana and Vicenza tramway network, and opening up the chief centres of the provinces of Padua and Vicenza.

Doncaster.—New Tramcars.—The tramways manager has been instructed to obtain estimates for tramcars for the Brodsworth and Warmsworth route.

Free Rides.—In Manchester, Salford, Liverpool, Belfast, London and other centres, military men in uniform have been given the free use of tramways and 'buses. In many cases Reservists and others are to be reinstated on the tramways after the war, and their wives and families are receiving monetary allowances during their absence with the army.

Glasgow.—A special Sub-Committee of the T.C.'s Committee on Tramways has been appointed to consider and report on the desirability and practicability of the tramways department providing cottage dwellings to be rented by workmen in the service of the department.

The traffic and permanent way staffs of the T.C. department have been depleted by about 800 men through members having been called up for service with the Reserves and Territorials, but no reduction has so far been made in the number of cars on the routes.

Rotherham.—The T.C. has been recommended to construct a tramway from Westgate to Effingham Square. The borough engineer is to arrange for the carrying out of the work, to cover the cost of which it is proposed to borrow £3,760. The Tramways Committee has asked permission to instruct the tramways manager to prepare a report on the estimated cost of running motor-'buses in certain districts.

United States.—Railway Electrification.—The contract for the electrical equipment of the Brigham City—Preston extension of the Ogden Rapid Transit Co.'s interurban system has been awarded to the American Westinghouse Co. This extension is 96 miles long, and connects with the Bamberger electric line, which also connects with the Orem line. The Orem line, 50 miles long, is now being electrified, and a 20-mile extension is to be commenced next year. When this is completed, the State of Utah will be traversed from north to south by 200 miles of electric railways.—*Journal of Electricity.*

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TELEGRAPH and TELEPHONE NOTES.

Germany.—The latest statistics regarding the development of wireless telegraphy in the German Empire are up to the beginning of 1913. At the beginning of that year there were 23 coast stations and 376 ship stations. Of the coast stations, 12 were open to general traffic, 10 with limitations, and 1 for official use. Of the ship stations, 237 were for public, 134 for official, and 5 for private traffic. The number of wireless telegrams sent from the shore to the ships in 1912 was only 5,312; in the contrary direction, 14,893. Between ships 7,242 telegrams were exchanged. This makes a total traffic in telegrams of 27,447. Receipts for the year totalled 250,000 marks. In these figures the German Protectorates are included.

Solar Eclipse Observations.—The British Association Committee for Radio-telegraphic Investigation states that, owing to the outbreak of war, and the dismantling of private wireless telegraph installations, it will be impossible to carry out the programme of observations during the eclipse on August 21st.

Telephone Censorship.—It is reported that a modified form of censorship has been established over the telephone system of Great Britain. No one is allowed to speak except in English, and those attempting to use any other language are at once cut off.

The Telegraph Service.—The telegraph authorities notify that the deferred rate and week-end letter services to all countries *viâ* France, Teneriffe, Noronha and the Western cables, are suspended.

It is reported that German telegrams to New York are being transmitted *viâ* Copenhagen.

No telegrams of any kind are accepted for places in Germany and Austria-Hungary. Ordinary telegrams for other places abroad, and radio-telegrams, however addressed, can only be accepted at senders' risk and if written in plain English or French. In the case of telegrams for Switzerland and Turkey, French only is allowed. All telegrams are subject to censorship, and must bear the sender's name at the end as part of the paid text, otherwise they are liable to be stopped until the name is notified by paid telegram. Registered abbreviated addresses will not be accepted either as the addresses of telegrams or as names of senders. Ordinary telegrams in code and cipher or without text are prohibited. In order to facilitate the sorting and despatch of mails for places abroad to which dispatches are not made daily, the public are requested to post one or two days before the normal day of dispatch.

United States.—The German-owned wireless plant at Tuckerton has been offered to Mr. Bryan for the transmission to Germany of messages to the American Ambassador in Berlin.

Wireless Station Captured.—By our capture of Togoland, one of the largest wireless telegraph stations in the world has been acquired. The Telefunken Co. established communications between Berlin and Togoland, a distance of over 3,000 miles, mostly overland.

Wireless Stations.—The Bureau International de l'Union Télégraphique has sent a portion of the proofs of the fourth edition of the nomenclature of wireless stations to the printers, and the publication, it is expected, will be ready by the end of the year.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—August 31st. Sydney Harbour Trust. Four electrically-operated semi-portable travelling cranes. Forms of tender from Mr. H. F. Norrie, Secretary to the Trust, Sydney.

September 14th. Municipal Council. 22,500 yd. of 33,000-volt, three-core, paper-insulated, lead-covered cable. Deposit £200. Specification, 10s. 6d., from the City Electrical Engineer; a copy may be seen at the B. of T. Commercial Intelligence Dept., London.

Brisbane.—September 2nd. Measuring instruments, protectors and parts, telephone and telegraph instruments, for the Postmaster-General. See "Official Notices" July 31st.

Adelaide.—Sept. 9th and 23rd. Telephone material, microphones, protectors, &c., switchboards, bells and cells, for the Postmaster-General. See "Official Notices" July 31st and August 7th.

Adelaide Tramways Trust.—September 1st. One booster set, with cables and spares.—*Australian Mining Standard.*

Melbourne.—August 18th. Electricity recording meters and carbon brushes, for the Melbourne City Council. See "Official Notices" July 31st.

August 26th. Insulated copper wire, for the Melbourne City Council. See "Official Notices" to-day.

September 23rd. 102 electric motors, starters, switchboards and wiring for installing electrical drive at Messrs. Sands & McDougall, printers. Mr. M. C. Coates, consulting engineer.—*Tenders.*

Victorian Railways Department.—October 7th. Motors and switchgear, and motor-driven air compressors for the Ballarat and Bendigo workshops.

Perth.—September 9th. Coin attachments for Postmaster-General. See "Official Notices" to-day.

Belfast.—August 24th. Corporation. One electric motor tower-wagon. See "Official Notices" July 31st.

Coxhoe and Kelloe.—August 17th. Parish Council. Poles, lamps, cables, &c., for electrical installation. Specifications from Mr. J. W. Anderson, Engineer, East Hetton Colliery, Coxhoe.

Earsdon (Northumberland).—August 15th. U.D.C. For the supply of poles, cables, lamps, &c., in connection with the extension of public lighting. Particulars from Mr. J. R. MacMillen, Surveyor, Council Offices, Shiremoor.

Eastbourne.—August 18th. Corporation. Main machine and feeder switchboard for the electricity works See "Official Notices" July 24th.

Edinburgh.—August 17th. Corporation. Extensions to the electric lighting installation at the City Museum. Specification from the Engineer's office, Dewar Place.

August 17th. Corporation. Electric light installation at the public wash-house, Greenside. Specifications from Mr. F. A. Newington, Engineer, Dewar Place.

August 17th. Guardians. Electric light installation at the laundry, Craiglockhart Poorhouse. Specification from Mr. R. M. Cameron, 53, Great King Street, Edinburgh.

Kingston-upon-Hull.—August 22nd. Corporation. Electrical fittings for the Guildhall Council Chamber, &c. See "Official Notices" July 24th.

At a meeting of the T.C. on August 6th, the Property Committee, reporting on the invitation for tenders for the supply of electrical fittings for the Guildhall, stated that the architect had submitted a condition that the whole of the work must be carried out on the premises of the contracting firm, and be available for inspection and supervision of the architect or his representative at any time during progress, and that it must be clearly understood that the successful firm would not be allowed to sublet any portion of the work. The Committee recommended the acceptance of these stipulations. Col. Easton took strong objection, and moved reference back to the Committee. Mr. Larard, supporting, said that in his opinion the London architect engaged on the work at the Guildhall was endeavouring to bind them down too much. The Chairman of the Committee (Ald. Hall) said that so far as he was concerned he had never found a more harmonious man to work with than the architect, and he had never seen any indication that he wanted to be master. The reference back was agreed to.

Lisnakea.—August 15th. Wiring the workhouse and auxiliary buildings with necessary fittings, &c., for the B. of G. Specifications from Mr. J. O'R. Hoey, Clerk.

London.—L.C.C.—September 8th. Cables, H.T. and L.T., and laying stoneware ducts (tramways). See "Official Notices" August 7th.

September 8th. Reconstruction of motor-generators in the tramway southern sub-stations. See "Official Notices" to-day.

Manchester.—August 25th. Tramways Committee. Tenders for cast-iron pipes for heating purposes. Particulars from Mr. J. M. McElroy, General Manager, 55, Piccadilly.

Middlesbrough.—September 12th. Corporation. Three electric motor-driven sewage pumps, priming pumps, metering arrangement, pipework, overhead travelling crane. See "Official Notices" to-day.

Newport (Mon.).—August 17th. Corporation. Converting plant, &c. See "Official Notices" July 31st.

New Zealand.—New Plymouth.—August 28th. 6,600-volt sub-station switchboard, contract No. 10: additions to 2,300-volt sub-station switchboard, contract No. 11, for the New Plymouth B.C. Specifications from the Board of Trade Offices, London.—*New Zealand Shipping and Commerce.*

Oldham.—August 16th. Corporation. D.C. motor-generator and extension to E.H.T. switchboard. See "Official Notices" July 24th.

August 24th. Corporation. Three economisers and three induced-draught fans and motors. See "Official Notices" July 31st.

August 24th. Corporation. Storage battery, reversible booster and switchgear. See "Official Notices" August 7th.

Paris.—August 21st. Tenders are invited for the supply of a 20-metre sliding platform for the Vangirard depôt. Particulars from the Bureaux du Service Electrique (1e division), 43, Rue de Rome, Paris.

Rathmines (Co. Dublin).—August 17th. U.D.C. 400 tons of steam coal, for the electricity works. Particulars from the electricity works.

Spain.—The municipal authorities of Villanueva del Rey (Province of Cordova) are inviting tenders until the 27th inst. for the concession for the electric lighting of the town during a period of 10 years.

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South Africa.—August 31st. 22 electric motors for the Salt River workshops, for the administration of the South African Railway. Copies of specification from the Secretary to the Tender Board, S.A.R., Headquarters Office, Johannesburg.

EAST LONDON, C.P.—Tenders will shortly be invited by the Municipality for material for duplicating the existing tramway track at East London, C.P. and rearranging the overhead equipment, &c. Estimated cost, £7,814. Particulars from the Town Clerk, Municipal Buildings, East London, C.P.

GERMISTON, TRANSVAAL.—Material and equipment for a two-mile extension of the tramway system. Particulars from the Town Clerk, Germiston.—*Brit. and S.A. Export Gazette.*

Sunderland.—August 18th. Corporation. Two 1,500-KW. motor-generators or rotaries. See "Official Notices" July 31st.

Swinton and Pendlebury.—August 19th. U.D.C. Cables, fittings, &c. See "Official Notices" July 31st.

Walthamstow.—August 19th. U.D.C. Supply and delivery of tramway rails, castings, fishplates, &c. Forms of tender from Mr. E. Morley, Surveyor to the Council.

West Hartlepool.—August 17th. Corporation. Machine tools for tramways depôt workshops. See "Official Notices" July 31st.

Woodford Green.—August 18th. U.D.C. Installation and maintenance of the Knight system of fire-alarms. Particulars from Mr. W. Farrington, Surveyor, Council offices.

CLOSED.

Bridlington.—The T.C. has accepted the tender of Mr. W. B. Wilson for 2,000 tons of Bullcroft Main washed small coal, for the electricity works, at 13*s.* per ton. Sixty-six tenders were received.

Crewe.—The Health Committee has accepted the tender of Messrs. Carrington & Button for six magneto instruments and switchboard at the hospital, for £26.

Faversham.—The T.C. has accepted the tender of Messrs. Honeyball & Son for coke for the electricity works, at 17*s.* 6d. per ton.

Glasgow.—The Tramways Works and Stores Committee has accepted the following tenders for special work:—The Lorain Steel Co. and Hadfield's Steel Foundry Co.

The Watching and Lighting Committee has accepted the offer of Messrs. Watson & Whyte for 1,000 electric hand-lamps for the police force, at 13*s.* 9d. each.

Grimsby.—The Public Lighting Committee has accepted the following tenders:—

Tudor Accumulator Co., Ltd., £3,116 for a Tudor battery, a Phœnix booster and Bertram-Thomas switchgear; Swaby & Walsham, £1,538 for building battery room, &c., at the electricity works.

London.—ST. PANCRAS.—The British Niclausse Boiler Co., Ltd, has been awarded the contract for four boilers, complete with Niclausse stokers, superheaters, and economisers, fitted with forced and induced draught, chimneys, and other accessories. Each unit is to be capable of evaporating 40,000 lb. of steam per hour at 120° F. at a steam pressure of 220 lb. per sq. in., superheated 250° F.

Manchester.—The Electricity Committee has accepted the following tenders for the supply of stores for 12 months:—

Asbestos goods.—Witty & Wyatt, Ltd.
Brass and copper work.—Till & Whitehead.
Canvas and Hessian.—L. Andrew & Co.
Lead-covered cables.—Union Cable Co., Ltd.
Service cables.—W. T. Glover & Co., Ltd.
Cement.—Ship Canal Cement Mfg. Co., Ltd.
Cotton waste and rags.—W. C. Jones, Ltd.
Dynamo brushes.—R. Johnson, Clapham & Morris.
Earthenware bridges, pipes, bends, insulator blocks.—Doulton & Co., Ltd.
" stretchers, pipes, bends, siphons and grids.—Isherwood Bros.
Electrical accessories.—Falk, Stadelmann & Co., Ltd., B.T.H. Co., Ltd., and G.E. Co., Ltd.
Fire-bricks and fire-clay.—Glenboig Union Fire Clay Co., Ltd.
India-rubber goods.—L. Andrew & Co., G. MacLellan & Co.
Insulators.—Bullers, Ltd., Doulton & Co., Ltd., Sloan Electrical Co., Ltd.
Iron castings.—Hendsford Foundry Co, Ltd., J. & S. Eyres, Ltd., J. Stubbs, Ltd., Holwell Iron Co., Ltd., J. Turton.
Iron pipes (cast).—Stanton Ironworks Co., Ltd.
Iron and steel.—Hall & Pickles, Ltd.
Leather belting.—P. Haworth & Co., Ltd.
Balata belting.—C. Mackintosh & Co., Ltd.
Manhole flaps.—Crosfield & Seddon.
Paints.—J. E. Williams & Co.
Rubber tape.—L. Andrew & Co., W. T. Glover & Co., I.-R., G.-P., and Telegraph Works Co., Ltd., W. T. Henley's Telegraph Works Co., Ltd.
Steam and gas fittings.—John Russell & Co., Ltd., Jas. Russell & Co., Ltd.
Insulating cloth.—Meirowsky & Co.
Wood cable-troughing.—A. Bruce & Co.
Cast-iron cable-troughing.—Coalbrookdale Co., Ltd.
Diatomite asbestos non-conducting composition.—Diatomite Co., Ltd.
Crucibles.—Morgan Crucible Co., Ltd.
Blackley tape.—Connolly Bros., Ltd.
Alkali.—Brunner, Mond & Co., Ltd.
Creosote and common tar.—Hardman & Holden, Ltd.
Anti-sulphuric enamels.—Griffiths Bros. & Co.
Everlite jointing.—R. L. Ross & Co., Ltd.
Soldering paste.—W. T. Burnley & Co.
Tubing and fittings.—Brotherton Tubes and Conduits, Ltd., Simplex Conduits, Ltd.
Tubing.—Eureka Conduits and Fittings Co.
Dry cells.—A. H. Hunt.
D.C. wire, silk-covered, and Eureka wires.—London Electric Wire Co. and Smiths, Ltd.
Enamelled wire.—Connolly Bros., Ltd.
Nickel chrome wire and strip.—H. Wiggin & Co., Ltd.
Tinned steel and armature wires.—W. N. Brunton & Son.
Recorder paper.—Elcho Recording Press.
Varnish.—Pinchin, Johnson & Co.
Commercial hydro and sulphuric acids.—H. M. Morris & Co.
Boiler tubes (land type).—Babcock & Wilcox, Ltd.
" (marine type).—British Mannesmann Tube Co., Ltd.
Box composition and bittite tape.—Callender's Cable and Construction Co., Ltd.
Gauge glasses.—S. & C. Bishop & Co.
Metal polish.—Matchless Metal Polish Co., Ltd.
Engine paste.—G. McLaren & Son.

The Committee has also accepted the tenders of Messrs. A. Bruce and Co. and the Coalbrookdale Co., Ltd., for wooden troughing and iron troughing respectively up to June 30th, 1916; and also the tenders of the B.I. & Helsby Cables, Ltd., and the Electrical Engineering and Equipment Co., Ltd., for supplies of cables.

The Tramways Committee has accepted the tender of Messrs. C. H. Normanton & Son, Ltd., for the erection of offices in Barlow Moor Road, and that of Messrs. Heaton & Son, for two steel boilers for heating purposes at the Hyde Road car works.

The Education Committee has accepted the tender of Messrs. W. P. Theerman & Co., for electrical installation at the Mill Street School.

The tender of the Keighley Electrical Engineering Co., Ltd., for wiring at Abergele Sanatorium, has been accepted by the Sanitary Committee.

Middleton.—The Electricity Committee has accepted the tender of Messrs. E. Green & Son, for economisers.

New Zealand.—Post and Telegraph stores:

Richardson, McCabe & Co., 7,000 dry cells, £246; Phillips & Pike, 500 Gordon cells, £347; B. L. Donne, 3,000 wall telephones, £7,527; A. and T. Burs, Ltd., 100,000 insulator cups, £1,527, 100,000 insulator bolts, £1,173; ditto, swan-neck bolts, £255; Lawrence & Hanson, 80,000 yards jumper wire, £96; Richardson, McCabe & Co., 3 tons annealed copper wire, £342.—*New Zealand Shipping and Commerce.*

Salford.—The Town Hall Committee has accepted the quotation of Messrs. Halliwell & Co., Manchester, to provide an electrical installation at the Town Hall, and also wiring for two hoist motors, for £29.

Sheffield.—The Corporation Tramways Committee has accepted the following tenders for coal to June 30th, 1915:—Mr. G. Turner, 11*s.* 6d per ton; Messrs. Rose & Co., 11*s.* 8d. per ton; Messrs. J. Ward, Ltd., 11*s.* 9d. per ton; and Messrs. M. C. Barnby & Sons, 11*s.* 11½d. per ton.

Torquay.—The T.C. has accepted the tender of Messrs. Matthews & Yates, Ltd., for an induced draught fan, &c., for the electricity extension works, at £252, and that of Messrs. Poulton, Timmis & Co., for boiler setting, at £220.

Whitefield.—The U.D.C. has accepted the tender of the Lancashire Electric Power Co. for the electric lighting of the offices and Council chamber, for the sum of £31.

Wolverhampton.—The Corporation Electricity Committee has accepted the tender of Messrs. G. Robson & Co., for four sets of coal-measuring apparatus for the new boiler plant, at £190.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, August 22nd. Visit Chronicle Printing Works, Withy Grove, Manchester.

Association of Mining Electrical Engineers.—Saturday, August 22nd. Visit Wallsend and Hebburn Coal Co.'s Pit.

NOTES.

National Service for Electrical Engineers.—The Council of the Institution of Electrical Engineers has issued a circular to the members pointing out that there are two important directions in which they may be of great service to the nation at the present time:—

First: To place their services as electrical engineers at the disposal of the War Office and the Admiralty.

Secondly: To be in readiness to fill vacancies in public services, electric power stations, tramways, railways, &c., caused by the calling up of the Reserves and Territorial Forces.

With the view of being ready to assist the authorities and the public services, the Council has decided to prepare classified lists of suitable men, and for this purpose has asked members who are in a position to assist in any of the directions indicated, to fill in and return a form giving full particulars of the occupations for which they are fitted. It is assumed that the rates of pay would be the current rates for the services rendered.

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The Council desires not only to receive offers of services from members of the Institution, but also that all members should assist it to obtain the names of as many qualified men as possible (whether or not members of the Institution) willing to offer their services in the directions indicated. For this purpose additional sets of papers are enclosed with the circulars. Full information can be obtained from the Secretary, Mr. P. F. Rowell, at the Institution, Victoria Embankment, W.C. We refer to the matter in our leading columns.

The Council has offered to place at the disposal of the War Office, for immediate occupation and free of charge, the available portions of the Institution building, of a total area of 10,000 sq. ft.

Educational Notes. — Northampton Polytechnic Institute.—The next session opens September 28th. Particulars of the courses in engineering and technical optics appear in our advertisement pages to-day.

University of Edinburgh (Engineering Department).—The next session begins on October 13th. Particulars appear in our advertisement pages to-day.

University College: Faculty of Engineering.—We have received the handbook of the Faculty for the forthcoming session, which gives particulars of the arrangements and courses of instruction, as well as of the scholarships, &c., that are available at the College. Prof. J. A. Fleming is the Dean, and Prof. E. G. Coker, Vice-Dean, of the Faculty of Engineering.

Volunteer Force to Protect Electrical Apparatus.—A correspondent writes as follows:—"There is without doubt at the present time an urgent call for men who have a practical experience of electricity, and I suggest you should form a corps of volunteers who are prepared to devote their whole or spare time to providing a practical electrical contingent willing to accept service for the defence of all and every electrical apparatus. The force to be used for protection work in the home counties only.

"It would of course be advisable to arrange that such a corps had the recognition of the Government. May I express the hope that this suggestion will meet with approval, and I shall have the pleasure of being one of the first members. It would, of course, be necessary to have an understanding that all members required officially in other directions would be released immediately."

The importance of protecting electricity works, sub-stations, &c., from malicious interference is obvious. It seems to us, however, that the multiplication of organisations should be avoided, and we suggest that the proposal be considered either by the I.E.E. in conjunction with the scheme which is published above, or by the Volunteer Civil Force of which particulars are also given to-day.

Flying Corps Appeal for Men.—The Royal Flying Corps, Military Wing, urgently calls for the special enlistment of tradesmen for one year, or for the duration of the war. Men of the following trades are urgently required:—Blacksmiths, cable-joiners, carpenters and joiners, clerks, coppersmiths, draughtsmen (mechanical), drillers, dynamo attendants, electric-bell fitters, electricians, engine-testers, fitters, instrument repairers, joiners, metal joiners, motor fitters, painters, pattern-makers, photographers, plumbers, riggers, sail makers, switchboard attendants, tinsmiths, tool grinders, turners, wheelwrights, whitesmiths, wireless operators, wiremen, wood-turners. Men who have served as apprentices or improvers in a general mechanical engineering workshop, and in addition have served at full rate in a petrol motor engineering works, including experience in the engine-test shop, or have served as aeroplane mechanics. They should have a good knowledge of general motor engineering, and a thorough knowledge of the principles of magneto and coil ignition, and be able to make intelligible sketches of machinery details and rough calculations connected therewith. Pay varies according to trade, from 4s. to 7s. 6d. per day, all found. Applicants for enlistment should apply in person to the Craig's Court entrance of the Central London Recruiting Depôt, or to the officer commanding the Military Wing, Royal Flying Corps, Farnborough, Hants., and must be prepared to furnish certificates of character, of previous trade experience and of present trade qualifications.

Electrical Companies and the War.—From all sides we have received information to the effect that electrical companies are resolved on keeping their men fully employed during the war, and that the normal conditions of business will be preserved as far as possible. Large numbers of their employés have been called out, as Reservists or Territorials, and with one accord the employers declare their intention to provide for the families of the married men and the dependants of the unmarried on a generous scale. Many firms have requested us not to refer to them by name in this connection, and in justice to them we feel that it would be invidious to name others; but if the restriction is removed, we shall be pleased to publish particulars of the arrangements that have been made, which in every case do honour to the sentiments by which the employers are actuated. In some instances they have gone so far as to pay full wages to the married men on active service, in addition, of course, to the pay that they receive from the Government; more usually half wages are paid, and in no case has the rate been less than 10s. a week. Moreover, in every instance that has come to our knowledge, the men who are called out on naval or military service will be reinstated on the termination of their active service. The manner in which our electrical firms have dealt with the situation reflects the greatest credit upon the industry.

Cable Transport Vehicles.—Messrs. Adolph Saurer, of Arbon, Switzerland, have recently supplied to the postal authorities in Munich a 3-ton petrol motor lorry with two special trailers for transporting large cable drums, as well as telegraph poles or piping, without difficulty. The two trailers can be coupled together, thus forming a self-contained unit, which can be drawn by horses when the cable drum is empty or when the motor vehicle is employed elsewhere. The chassis of the latter is driven by a 36-H.P. motor, and is also provided with an electric motor for driving a cable winch to assist in loading operations. Above the rear axle is mounted a swivelling attachment for the three-wheeled cable drum trailer, or a swivelling bolster to carry telegraph poles, &c., when the two-wheeled pole trailer is in use. In the former case, half of the platform is available for carrying tools or other articles. The cable drum trailer runs on two main wheels, and has a small front wheel mounted on a screwed vertical spindle, which arrangement allows the trailer to be easily attached to or detached from the tractor vehicle; when coupled to the latter the trailer only travels on its two rear wheels. The trailer is provided with a simple worm-operated lifting gear, which enables the drum to be placed in position without the aid of a crane or other lifting appliance. It is also fitted with a brake which can be applied by a hand lever from the driver's seat. Cable drums varying in diameter between 3¼ and 8¼ ft., up to a width of 4 ft., and of a maximum weight of 5 tons, can be carried. The pole of the two-wheeled trailer is coupled to the rear end of the tractor vehicle frame in the usual manner, and its bolster is also provided with a special coupling for attaching the cable drum trailer.

Sea Transport.—On Monday night the Admiralty stated that permission to ship coal from this country to Norway and Italy could be obtained on application to the Customs officer of the port of shipment. This announcement indicated, said the *Times*, that no undue risk was likely to attach to British ships crossing to Norway, or making the passage to the Mediterranean. The removal of two German warships in the Mediterranean from active service clears the route to the East, and the German cruisers in the Atlantic are being hunted down by British warships.

German Patents.—In reply to a question in the House of Commons, Mr. Runciman stated that the Board of Trade had taken power to deal with cases in which the manufacture of materials required by British industries was covered by German patents; the Board could make rules to meet such cases, and the matter was under consideration.

An Electrical Farm.—Our special correspondent in Norway writes that in the agricultural department of the Exhibition at Christiania there is, among other exhibits, an entire farm with buildings, in which electricity seems to have taken the place of servants altogether, and made them almost superfluous.

The energy for this model farm is supposed to come from a small waterfall in the neighbourhood that has been harnessed. The visitor is first of all struck by the splendid appearance of the fields, which turns out to be due to the employment of artificial manure electrically manufactured. In the evening the house, the yard, stables and outhouses are radiant with electric light. In the kitchen there is an electrical oven, with four hot plates, a roasting oven, and a baking oven. When the food is cooked, it is placed in an electrical heating apparatus. There are also electrical apparatus for cooking eggs and heating water. In the pantry there is a small motor of ¼ H.P., to which can be coupled nine different machines, such as a sausage mill, coffee mill, knife polisher, machine for cutting bread, ice machine, and a press to obtain juice from berries. The whole house is heated by means of electricity. In his bedroom the farmer has an electrical apparatus for heating water for a shave, and the housewife a neat electrical hair-curling apparatus.

In the wash-house is installed a 3-H.P. motor, driving a washing machine and an electrical centrifugal drier as well as an electrical mangle and an electrical iron. The workshop is equipped with an electrically-driven lathe, saw, grind-stone, glue heater and soldering iron. In the stables for cows and horses there is a motor of ½ H.P., to which apparatus for rubbing-down horses and shearing sheep can be coupled. There is also a milking apparatus, the "Omega," which is driven by a 1-H.P. motor. In the same building is a portable 10-H.P. motor, which supplies power for working the threshing machine and other agricultural machines.

An electrical incubator is shown in another part of the Exhibition. The whole exhibit shows excellently how the conditions of a farmer's life can be improved and how pleasantly and easily nearly all the work can now be carried out electrically.

Institution Notes.—North-East Coast Institution of Engineers and Shipbuilders.—The North-East Coast Institution of Engineers and Shipbuilders (Incorporated) was registered on August 7th as a company limited by guarantee, with an unlimited number of members, each liable for £1 in the event of winding up. It will take over the assets and liabilities and continue the work of the unincorporated institution established in 1884 and known as the North-East Coast Institution of Engineers and Shipbuilders.

American Association for the Advancement of Science.—The Association will hold its next Convocation-week meeting in Philadelphia, Pa., from December 28th, 1914, to January 2nd, 1915. The annual meetings are usually attended by 2,000 or more of scientific men and women, and it is expected that the coming meeting will surpass previous meetings in the importance of its scientific programme. Particulars can be obtained from Mr. L. O. Howard, Smithsonian Institution, Washington, D.C., U.S.A.

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Appointments Vacant.—Cable jointer, for Dundalk U.D.C. electricity department (9½d.); shift engineer (£2), for Stretford U.D.C.; switchboard attendant (30s.), for Newcastle and District Electric Light Co.; instructor in electric wiremen's work (12s. 6d. per evening), for East Ham Technical College Evening Classes. Particulars are given in our advertisement pages.

British Association's Australian Tour.—Information has been received in London from the officers of the British Association in Australia to the effect that the oversea party has arrived there safely, and that the meeting is proceeding in accordance with the original programme.—*The Times.*

The Course of Trade.—In connection with the questions discussed elsewhere in this issue regarding the diversion of trade from the Continent to this country, the following remarks by Mr. Bonar Law, reported in the *Times* of August 7th, are interesting:—"If we keep the command of the sea, what is going to happen? Five-sixths of our production is employed in the home trade. What goes abroad is very important, and, of course, if the population which supplies this one-sixth were thrown out of work, that would react on the whole. But, after all, the total amount of our exports to all the European countries which are now at war is only a small part of our total exports. There is here no question of fiscal policy. We are far beyond that. It is a question of fact. Our total exports to all the countries which are now at war do not, in my belief—I have not looked into the figures—exceed our exports to India and Australia, taken alone. Now, consider this: we shall have freedom of trade, if the command of the sea is maintained, with the Colonies and with the whole of the American Continent, while, unfortunately for them, both our allies and our enemies will not be competing with us in these markets. Look at it as a problem. I think we have a right to believe, not that trade will be good, but that it will be much more nearly normal than is generally supposed."

Fatality.—Carnarvon.—A verdict of "Death as a result of shock" was returned at an inquest held by Mr. P. Williams, at Carnarvon, on Stella Jones (17), whose family resides at and has charge of the telephone exchange. During the thunderstorm one night last May Miss Jones went to answer what she supposed was a telephone call, when she received an electric shock which numbed her right side. A fortnight ago she was removed to the cottage hospital, and she died there last Saturday. The medical certificate was to the effect that the primary cause of death was shock which latterly developed into cardiac dilatation. Inspector Ellison, who gave evidence on behalf of the Post Office, said that under the circumstances prevailing at the exchange where they had special floors and where the wires were protected, it was impossible for an operator to receive a shock.

Parliamentary.—Third Reading.—In the House of Commons, on August 5th, the Glasgow Corporation (Tramways, &c.) Bill was read a third time.

National Relief Fund.—We have been invited by Mr. C. Arthur Pearson to draw attention to the Prince of Wales's National Relief Fund; we feel sure that many of our readers, who are unable to render service in other ways, will be glad to assist in mitigating the sufferings of those to whom the war will bring only grief and distress. Contributions should be addressed to H.R.H. the Prince of Wales, Buckingham Palace, London, with a statement of the amount, and the name and address of the sender. The envelope need not be stamped.

Electric Light Switching Examination.—The following is a complete list of successful overseas competitors in the last examination in electric light switching conducted by Messrs. A. P. Lundberg & Sons, of Liverpool Road, N.:—

Advanced Grade.—A. W. Honychurch, Christchurch, Barbadoes, West Indies.
H. S. Tiley, Potchefstroom, South Africa.
Intermediate Grade.—H. R. Constantine, M.Sc. Tech., Student I.E.E., Zug, Switzerland.
R. Drilhon, Pau, France.
Preliminary Grade.—H. Cristall, London, Ontario, Canada.
A. K. Dass, Delhi, India.

The next examination will be held in November, and particulars may be had on application to Messrs. Lundberg.

The Supply of Ignition Magnetos.—A meeting of British motor manufacturers was held in Coventry on Wednesday last for the purpose of making arrangements for the supply of magnetos for motor-cars and motor-cycles. As is well known, large numbers of these have been purchased in the past from Germany, but, of course, this channel of supply is now stopped. A representative committee was appointed to communicate with English electrical firms with the view of obtaining supplies of magnetos in the future, and all firms desirous of entering into these important branches of the motor trade are requested to apply to the convener of this meeting, Mr. Harry Smith, The Rover Co., Ltd., Coventry. Some important British firms have already expressed their intention of going into this trade.

Wreck.—From the *Shipping World* we note that the steamship *Buccaneer*, belonging to the India-Rubber, Gutta-Percha, and Telegraph Works Co., Ltd., was wrecked near Tamatave on August 4th. We are glad to add that on inquiry, we learn that the staff and crew were rescued.

"Wireless" Men for the Navy.—Wireless telegraph operators who wish to enrol in the Royal Naval Reserve for service in the Fleet should apply immediately direct to the Commodores at the Royal Naval Barracks at Chatham, Portsmouth or Devonport, who will furnish particulars of the conditions of service.

Training for National Service.—The Empire League of Freedom, at its North London Rifle Club, 211, High Street, Camden Town, gives instruction to men over enlisting age and for women:—

1. In aid to civil authority.
2. Shooting and drill to qualify as second reserve for defence, armed patrols, &c.
3. First aid and ambulance work.

The instruction is free, the only charge being 3d. per 10 shots for cartridges and target, but all who can afford are asked to join the club, 6s. per annum, or larger subscriptions by those who can afford them. Most of the trained men of enlisting age have volunteered for active service. The League is conducted entirely by unpaid organisers, and Mr. G. W. de Tunzelmann (chairman), Mr. H. F. Wyatt (Joint Founder of the Imperial Maritime League), and Lieut.-Col. J. C. B. Craster (Hon. Secretary), appeal for support for this work.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. Ogden and Mr. Chamberlain have been appointed as joint electrical engineers for the borough of Oldham, in place of the late Mr. Newington. Mr. Ogden is to take charge of the inside work, and Mr. Chamberlain of the outside work, but in the absence of either the other will have entire control.

The Sheffield T.C. proposes to appoint Mr. Charles W. Erskine as sub-station assistant at a salary of £117 per annum. The Establishment Committee proposes that the salary of Mr. A. S. Frost, assistant station superintendent in the electric supply department, be increased from £200 to £225 per annum as from January 1st, 1915, with further annual increments of £25 to £300 per annum.

The Worksop U.D.C. on Monday appointed Mr. T. Allsop as meter inspector and repairer; and Mr. E. Linay as switchboard attendant at the electricity works.

The Newcastle-under-Lyme Corporation has increased the salary of the borough electrical engineer, Mr. A. J. C. De Renzi, by £25 per annum, the question of a further increase to be deferred until the end of the present financial year.

The Wolverhampton T.C. has been recommended to grant the following increases of salary:—Mr. G. Stubbs, chief engineer, from £200 to £225; Mr. T. Smith, distribution engineer, £245 to £270; Mr. E. Forder, engine room superintendent, £150 to £165; Mr. C. Billhouse, boiler house superintendent, £150 to £165.

General.—The marriage took place at Crossstone Church, Todmorden, on July 25th, of Mr. Wm. Duckworth, A.M.I.E.E., of Cork, and Miss Elsie Redman, of Todmorden.

On the occasion of his marriage at Westcliff, Southend-on-Sea, on August 5th, Mr. Stanley J. H. Paxman was presented by the staff of the Eastern Telegraph Co. with a case of silver and cutlery.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Egyptian Delta Light Railways, Ltd.—Particulars of £645,380 debentures to bearer created by resolutions dated from March 25th, 1897, to July 10th, 1914, and secured by trust deeds of various dates, filed pursuant to Sec. 98 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £34,000. Property charged: The company's undertaking and property, present and future, including all shares, debentures, securities and railways, subject as to property purchased from La Compagnie des Chemins de fer Economiques de l'Est, Egyptian, to a prior charge securing £233,300 3½ per cent. debentures. Trustees: M. Sharp, L. J. Lumley, Earl of Ronaldshay, M.P., and the Hon. Vicary Gibbs.

Collingwood & Co., Ltd.—Debenture dated July 27th, 1914, to secure £150, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. O. Collingwood, 58, Vine Street, E.C.

Tucuman Tramways, Light and Power Co., Ltd.—Trust deed dated July 8th (supplemental to trust deed dated May 20th, 1914, securing £400,000 debenture stock). Trustees: City Safe Deposit and Agency Co., Ltd., 13, Throgmorton Avenue, E.C., and M. W. Mattinson, K.C., 1, Garden Court, Temple, E.C. No property is actually charged by this deed, but the deed contained a covenant by the company to do and execute at the request of the trustees all such acts, deeds and things necessary to institute any assets in the Argentine Republic which may be acquired with the proceeds of the debenture stock secured by original deed a valid floating security according to the laws of the Argentine Republic.

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Aron Electricity Meter, Ltd. (58,650).—Capital, £350,000 in £1 shares (225,000 ordinary and 125,000 preference). Return dated July 14th, 1914. 125,000 ordinary and 124,896 preference shares taken up, £1 per share called up on the preference, £124,948 10s. paid, including £52 10s. on 104 preference shares forfeited. £125,000 considered as paid on the ordinary. Mortgages and charges: £96,600.

Penarth Electric Supply Co., Ltd. (52,912).—Capital, £50,000 in £10 shares (2,500 pref. and 2,500 ord.). Return dated May 11th, 1914; 2,500 ord. shares taken up; £10 per share called up; £25,000 paid. Mortgages and charges: £15,937.

Peterborough Electric Traction Co., Ltd. (74,563).—Capital, £60,000 in 6,000 pref. and 6,000 ord. shares of £5 each. Return dated May 6th, 1914; 4,400 pref. and 4,000 ord. shares taken up; £5 per share called up; £42,000 paid. Mortgages and charges: £21,000.

CITY NOTES.

Tyneside Tramways and Tramroads Co.

The directors' report for the half-year ending June 30th, 1914, shows a surplus of receipts over expenses of £5,824, which, with the balance brought forward from last half-year of £388, makes a total to the credit of profit and loss account of £6,212, and after deducting interest on debentures, loans, &c., amounting to £1,011, there remains an available balance of £5,200.

The directors propose to pay dividends on the preference shares at the rate of 5 per cent. per annum (less income-tax), £601; on the ordinary shares at the rate of 3 per cent. per annum (less income-tax), £2,008; to place to reserve for renewals, depreciation, and other contingencies, £1,200, increasing the fund to £17,525. £330 is set aside for the reduction of registration and formation expenses, &c., and £1,060 carried forward to next half-year.

The traffic receipts show an increase of £986, as compared with the corresponding period of last year.

Stock Exchange Notices.—Applications to the Committee for official quotations in the following securities have been made:—

Auckland (City of).—£234,500 4½ per cent. electric power additional loan bonds of £100, Nos. 1 to 2,345, in lieu of scrip.

Christchurch (City of).—£100,000 4½ per cent. electricity distribution loan bonds of £100, Nos. 201 to 1,200, in lieu of scrip.

The South American Cable Co. is re-organising under the title "Compagnie des Cables Sud-Americains," and will have its head office in Paris at 25, Rue de Clichy.

Brompton and Kensington Electricity Supply Co., Ltd.—The directors announce an interim dividend for the half-year to June 30th on the ordinary shares at the rate of 9 per cent. per annum (free of income-tax).

Lanarkshire Tramways Co., Ltd.—The twenty-sixth ordinary general meeting was held on Friday last at 83, Cannon Street, E.C., Mr. A R. Monks presiding. The chairman formally proposed the adoption of the report (Electrical Review, page 188), which was seconded by Mr. H. C. Levis, and agreed to.

Hydro-Electric Power and Metallurgical Co., Ltd.—A meeting of the holders of the first mortgage debentures is to be held at Winchester House, Old Broad Street, E.C., on August 19th to consider a resolution by which the debenture-holders agree to accept in discharge of their claims against the company in respect of principal moneys and of all interest from March 31st, 1914, Tasmanian Government 4½ per cent. bonds or stock at the rate of £95 for every £100 of debentures held. The balance of the moneys now in the hands of the trustees remaining after payment of expenses is to be applied towards payment of the interest due on April 1st, such payment to be made so soon as the trust has been finally wound up. The time for payment by the company of any balance of the interest due on April 1st is to be extended until three calendar months after the trust has been finally wound up.

France.—The report of the Compagnie Continentale Edison, of Paris, for last year shows a net profit of £184,096, as compared with only £146,348 in 1912. Of this sum £9,046 is being placed to reserve, £21,600 accorded to the directors, £96,000 distributed to the shareholders, and £50,400 to the holders of the founders' shares, leaving £7,050 to be carried forward.

Marconi's Wireless Telegraph Co., Ltd.—An extraordinary general meeting was held on Wednesday, at Marconi House, Strand, Commendatore G. Marconi in the chair, when a resolution relating to pension funds, &c., which was passed at the extraordinary general meeting held on July 21st, was confirmed as a special resolution.

Waste Heat and Gas Electrical Generating Stations, Ltd.—The directors have declared an interim dividend of 2½ per cent., less income-tax, on the issued share capital in respect of the half-year ending July 31st, 1914, payable on August 31st.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange remains closed. Throughout the world, bourses and stock exchanges are shut, with the exception of the Paris official bourse, where transactions are being carried on in a few securities. Business in London and throughout the provinces has come to what is for all practical purposes a full stop. Whatever may happen, it is obvious that, when the Stock Exchange re-opens, business will be so materially reduced from that prevailing in the pre-war days as to necessitate continuance of living for a time on capital. A few bargains have been done this week in Consols, and the Government has been a buyer in the neighbourhood of 70. Outside these transactions, there have been a few scattered bargains, possibly not more than a score in all; and the newspaper statements of the amount of business which has been negotiated by telephone can be disregarded. So far as electric lighting issues are concerned, it may be stated that one of the principal firms in this department has not booked a bargain since the Stock Exchange closed on July 31st—which date, incidentally, seems to be very much more than a fortnight ago.

In the circumstances, it is mere waste of space to reproduce our ordinary lists of stocks and shares, with their prices. There are, of course, no reliable quotations available; and although it may be claimed that this or that paper offers facilities for public dealing, there is no market in the Stock Exchange sense of the word, which is a place where purchaser and seller can both be sure of meeting with men who will sell or buy at slightly different prices.

Anxious attention is bent upon the possibility of the Stock Exchange re-opening at an early date. All kinds of suggestions are being put forward, with a view to facilitating this consummation so desirable in the interests of many thousands of others besides those directly connected with the House itself. The broker sitting in his office day after day, contemplating outgoings what time he is not making a penny piece against them, knows well enough that his enforced inaction reacts upon the legal profession and a surprisingly large number of industries. At the same time, the remedy would be worse than the disease if premature opening of markets were to lead to the precipitation of financial panic on a scale commensurate with that of the present war; and the Committee of the House have every reason to walk most warily during the present crisis, in the interests of the community—in fact, of everybody throughout the world who is affected by the prices of securities.

As to these last, painstaking search shows that there are not many open sellers about. For the Debenture stocks of the electric lighting companies, for example, there are ready buyers in most cases. Either jobbers are short of stock, or they have brokers who have already professed their willingness to buy at reasonable quotations, and this means that dealings can be arranged on the basis of the prices published here last week. The buyer naturally would expect to get some advantage, and should be able to count upon obtaining stock a point or two below the nominal quotations. But up to the present, at any rate, there has been no forcing of a stock; while, on the other hand, desire is general to maintain levels, so far as may be, on the same plane as existed before the Stock Exchange closed.

In the case of shares, to take City of London Ordinary as an example, the last price was 16 middle. We would venture to guess that if anybody wanted to buy Cities just now, he would probably be able to get them in the neighbourhood of 15½ for cash; and, were he to come across a harassed holder, he might possibly get them cheaper. The same thing applies to the other markets, although in such speculative shares as Marconis, for instance, conditions, it seems hardly necessary to say, are different.

Everything is being done in order to facilitate the clearing up of whatever Stock Exchange bargains are open. Buyers and sellers alike are recognising that they can ease the whole situation by speeding their transactions, and the former, by Royal Proclamation, have to pay interest at the rate of 6 per cent. per annum if they elect to postpone payment, for purchases, until the expiry of the moratorium.

Considerable discussion is taking place quietly in various boardrooms as to whether directors shall pay or withhold dividends. Certain of the big railway companies set what seems to us an undesirable example in refusing to distribute the dividends which have been earned, and which, in the ordinary way, would have fallen due this month. Directors of such undertakings as have declared their half-yearly distributions have no difficulty in finding sound reasons for retaining the money, and so strengthening the financial position of their companies. On the other side of the shield, however, it is logical to urge that, where profits have been made, and are standing to the credit of a company in the bank's books, the money should be released, in order to alleviate the financial position as far as possible. It is not necessary to labour the fact that thousands of proprietors depend for a substantial part of their income on these dividends; and at a time when everybody is being exhorted to do what he can for the common good, we submit that undue hardship is inflicted by the withholding of such division of profits.

The manufacturing, lighting and other companies are bearing their burden with the rest in the matter of the war. All have lost a certain number of men, and as regards the electric supply undertakers, some have had machinery commandeered for the service of various Government departments. There is high authority for stating, however, that the metropolitan lighting companies can carry out all their operations in a normal manner, and that no fears are entertained for the regular supply of current to consumers—assurances that will be of comfort to shareholders and customers alike.

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REVIEWS.

A Text-book of Physics: Electricity and Magnetism. Parts I and II. Static Electricity and Magnetism. By Prof. J. H. Poynting and Sir J. J. Thomson. London: Charles Griffin & Co., Ltd. Price 10/6 net.

This is a book suitable for fairly advanced students of physics—at any rate for those who have clearly passed their novitiate. The subject is developed along mathematical and research lines, theories being substantiated by facts, although neither the theories nor the facts have been carried to excessive limits. The authors had originally decided to treat of Magnetism and Electricity in a volume by itself, but it was found necessary to divide it into two. The present volume contains an account of the chief phenomena of electric and magnetic systems when they are respectively charged and magnetised. The effects of changes in the systems are only considered statically after the changes are effected, and the systems have become steady again. The phenomena accompanying the progress of change are treated in another volume now in the press.

Faraday's conception—developed mathematically by Maxwell—that there is an alteration in the material medium between electrified bodies is just as correct now as in the days when it was formulated. The authors very sensibly call this alteration "electric strain," and use it in preference to "electric displacement" or "electric polarisation." It is extraordinary what difficulty practical men find in thoroughly comprehending the terms "stress" and "strain." The definitions are quite simple and straightforward, and apply equally well to the mechanical and electrical branches of engineering. "Stress" is load or force of whatever kind it may be—tensile, compressive, shear, electric, magnetic, etc., per unit area over which the force acts; "strain" is the consequence of stress and is the dimensional alteration produced divided by the original dimension.

Part I of the book deals with static electricity. After an account of the common phenomena there is a chapter on the Inverse Square Law, and the student would do well to study it diligently, for this method of calculation also holds for magnetic and gravitative systems. Gauss's theorem, by which the intensities at a point in an electric field can in certain cases be obtained very simply, and which also shows that lines and tubes of force indicate the magnitude as well as the direction of the intensity at every point in their length, is clearly and easily proved. Then in the light of this theorem such propositions as a spherical shell uniformly charged, intensity at any point in the axis of a uniformly charged disc, intensity due to a very long uniformly charged cylinder near the middle, and so on, are gone into and solved. Other chapters deal with the electric field considered with regard to the induction or electric strain produced in it; the force on a small charged body in the field, and the pull outwards per unit area on a charged conducting surface; electrical level or potential; the energy in electrified systems; potential and capacity in certain systems and some methods of measuring them; the dielectric, specific inductive capacity and residual effects; relation of specific inductive capacity to refractive index; alterations observed in the dielectric when electrically strained; pyroelectricity and piezoelectricity.

Some of the line diagrams are a little rough. For instance, the curves on page 57 look as though they had been drawn with a very shaky pen. Again, the arrows, which are used to indicate directions, might be made to look more like real arrows. In all cases the barbs open out in a way that would make an engineering draughtsman ill. Small points, perhaps, when compared with the valuable text, but nevertheless worth putting right.

Part II—on Magnetism—first gives a general account of magnetic actions, and then considers the molecular hypothesis of the constitution of magnets, the latter being pretty exhaustively treated, and illustrated with many diagrams. It is pointed out that the molecular hypothesis only carries down the magnetisation from the visible mass of the bar as a whole to its molecular constituents and does not account for *their* magnetisation. Attempts to explain this last were in the early days made by Ampère with his circulatory electric theory, and later by Langevin and others with the "electron" hypothesis; but the matter is not yet satisfactorily cleared up. Then come Paramagnetics and Diamagnetics, magnetic fields, induced magnetism, stresses in the medium, and the measurement of permeability. The last chapter—on Magnetism and Light—is one of the most important in the book. It summarises what has been discovered about the interaction of the two from the time when Faraday first detected the rotation of a ray of plane-polarised light in the magnetic field.

The book contains 340 pages, and is beautifully printed and bound in the well-known manner of all Messrs. Griffin's publications.

W. J. C.

The Mechanical Engineer's Pocket Book, 1914. By D. Kinnear Clark and H. H. P. Powles. London: Crosby Lockwood & Son. Price 4/6 net.

In this, the eighth edition of our proven friend of the drawing office, a few necessary corrections and additions have been made, some tables have been extended, and new tables have been added to the appendix for convenience in converting atmospheres to lb. per sq. in., and *vice versa*, also 1or converting kg. per cu. m. to lb. per cu. ft. The table of equivalent Centigrade and Fahrenheit temperatures has been extended and Dr. Max Jakob's valuable curves relating to the average specific heat of superheated steam (for pressures from 2 to 20 atmospheres and temperatures up to 550° C.) are reproduced. The notes on Diesel engines and steam turbines remain as in the 1913 edition, and though not complete seem to present as much information as the mechanical engineer is likely to require. The general arrangement of the book remains as before; the short list of errata immediately following the preface should be noted. The mathematical and general tables and the mechanical engineering sections are above criticism. Not so, however, the fifty pages devoted to Electrical Engineering, which appear to have survived unchanged since the days when Nernst lamps were in their infancy and before arc and metal-filament lamps (even of the 1½-w. p.c. variety) were available to light the path of darkness. In its primary function as a pocket book for mechanical engineers, this work can be recommended confidently, but even the needs of mechanical engineers demand that the electrical pages of the book be brought up to date. Personally we believe that, apart from the question of obsolescence, a selection of electrical information much more useful to the mechanical engineer might be included in future editions.

Library Lighting.—The annual report of the Manchester Public Libraries Committee states that during the year electric light has been installed at Moston Library, and alterations have been made in the electric lighting at Longsight and Newton Heath. The last two are part of the rearrangement of the electric lighting which, together with the adoption of efficient lamps, since it was begun a few years ago, has reduced the cost of electrical energy by 50 per cent., a saving to the Committee of about £1,000 per annum.

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THE PRESENT CONDITION OF AMERICAN ELECTRICAL INDUSTRY.

[BY A NEW YORK CORRESPONDENT.]

Some time ago an enterprising firm of New York utility operators, anxious to prove the stability of the light and power business, even through times of business depression, prepared and published a set of charts making a graphical comparison of the market position of various classes of securities—railroad bonds, public utility issues, and industrials. The facts which were therein developed brought out in a very striking way the extreme desirability of investment in the better grade of utility issues, and showed that, not only was there much less fluctuation with this class of security, but the risk of receivership was almost absent. Since that time these figures have been very widely quoted, and very effective use has been made of the conclusions which were indubitably to be drawn from the curves. Since that time, also, the investment market has witnessed a strong advance on the part of electric utility securities, until to-day such issues hold almost the foremost place among the lists of high-grade and really desirable investments.

The general industrial situation during the last twelve months has been such as to put to a searching test the claims of the operating firm in question and of all those who have been singing the praises of light and power securities as a stable investment; and it can be quite truthfully stated that the operating companies in the field, and the securities behind them on Wall Street, have more than justified the assertions which had been made. No one who has studied the figures of the earnings and output of the operating companies during recent months will assert that they are quite up to the high rate of increase which was found to obtain in some of the record-breaking years of the last decade; but at least the utilities have been showing large increases over last year, dividend rates have been maintained, and the market prices of the securities at the back of the properties have held up to previous figures in a very remarkable manner. Students of market prices and dividend rates have lately come to regard as commonplace the announcement in the financial Press that another railroad has been compelled to pass or reduce its dividend, and the situation in the field of industrials has not been a great deal better. Comparisons of the average price this year of twenty or thirty typical railroad bonds with the corresponding price of last year has invariably shown a woeful falling-off in realizable value, and if we were to judge the business condition of the country by the present condition of the finances of the main steam roads (as indeed it might be perfectly correct to do, although that is neither here nor there) we should certainly be led to the conclusion that the country was going through the worst period of stagnation which it had experienced for years. And yet when we turn to a study of operating statistics of the light and power utilities we find the indications of an entirely different state of affairs, and might indeed be excused for imagining that the land was enjoying a real boom.

The writer has had access to the monthly figures of earnings and output of the operating companies which are now being collected by the *Electrical World;* and, carrying the calculation right down to the most recent months, it has been shown that in 1914 the American light and power utilities are increasing their gross over last year at a rate which is better than ten per cent. A mean for the whole country might be eleven or twelve per cent.; while It would seem that the energy output of the central stations was some twelve to fifteen per cent. higher this year than last. In drawing conclusions from any of these figures the English reader should remember that there are in America greater possibilities for electrical expansion than any to be found in England, and also that these rates of increase, gratifying as they are, are perceptibly less than those established as normal by the 1907-1912 Government census. In the period 1902-1912 the light and power utilities in this country increased their gross earnings at an average annual rate of over twenty per cent., while even during the latter half of the ten-year period the rate was something over fourteen per cent. Nevertheless, this demonstrated expansion for the present year is very wonderful when we take into consideration the fact that the gross of the railroads is not only showing no increases, but in a very large number of cases is actually falling off.

It is therefore safe to draw the conclusion that, so far as the demand upon the electricity supply companies is concerned, the present year is seeing a healthy increase over 1913; but it must be pointed out that this is rather an index to the purchasing power of the communities than to the general health of the electrical industry. The supply companies are registering gains in earnings and income, but they are placing no heavy orders for equipment. The large increase in demand which is being placed upon the stations is being met by last year's apparatus and the previous year's apparatus. Whereas during the good times of a year or two years ago the plant factor (or the ratio of connected load to generating capacity) was fairly low for most sections of the country, the present year sees it rising and next year will see it still higher. At the present time (speaking broadly) the properties in the field are in excellent shape physically for meeting substantial increases in connected load and energy demand for some time to come; but the policy of the operating end of the industry has always been in the past to make ample provision for the future, and to see to it that the stations always have a good deal in hand in catering for the local demands. It can easily be seen that just now the manufacturers are by no means having a boom time, and they are eagerly and somewhat anxiously looking forward to the general uplift of the clouds of depression. The political situation this summer is not encouraging for the operating companies, and the good intentions of the Administration have not yet been so patently evidenced that any of the operators who can help it feel like making any heavy outlay for new plant. Most of them have sufficient physical equipment in hand to carry them safely along for a considerable time; and until things have taken a decided turn for the better the electric utilities will probably not be disposed to enter the market to any noticeable extent. The manufacturers meanwhile are working considerably below capacity, and the general condition of the electrical factories to-day is not such as to invite the Englishman to come over and try his luck. Workmen are, in many localities, serving on reduced time or being laid off altogether; while in some centres the office force, including commercial men, designers and draughtsmen, is being reduced. This condition is bound to continue for some months (at least) to come, although it may be confidently predicted that, when general business picks up and the supply companies feel that they can safely go ahead with all the financing that their properties require, the allied electrical industries will show the booming results to as marked an extent as any other set of interests in the whole country, and probably to a greater degree than most.

Of the various rates of growth which are this year being recorded in the different sections of the United States, the most considerable are coming from those along the south Atlantic seaboard, and indeed the demonstrated figures for the increase in energy output of the central stations there are such as actually to disprove any contention that the country is suffering from panic or anything resembling panic. After every allowance has been made for the most aggressive new-business campaigns, no one can

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argue that the people of the southern states have been impoverished or are hoarding their money when it can be shown that the light and power companies are increasing their gross earnings at the rate of fifteen or sixteen per cent. as compared with last year, or that the industries of the south are dwindling and stagnating when it can be proved that the energy demand upon the stations is still growing at a rate of over twenty per cent. per annum. It was in the south that the most spectacular records were set up in the ten-year period 1902-1912, and all the indications at present are that the southern states are still to enjoy a period of industrial, and therefore electrical, health and prosperity. On the Pacific coast conditions are not so good, and all the available returns from that section of the country indicate that the coast states are still in the thrall of the depression from which they have been suffering for a long time. Some of the companies are returning rates of increase as high as ten per cent., but five and six are nearer the average, and that rate is not so high as it used to be and as it ought to be. The most satisfactory thing about the condition of the industry on the coast, however, is that the present is the worst time that can possibly be experienced, and that the early future is bound to see a great improvement. The last two years have been an anxious time for the directors of several large Western companies, and more than once they have come to the verge of embarrassment in carrying through their construction programme. The financing has now been successfully and skilfully carried out, and the properties are in magnificent shape for meeting vast increases in energy demand. The next few years will be comparatively plain sailing. The grilling work has been done, and provision has been made for the future commensurate with the infinite possibilities for expansion which reside in the Pacific states. As more and more of these possibilities are realized (and some of them cannot be long deferred) the supply companies will face the pleasant situation of having to assimilate heavy increases in gross without having to lavish big money on physical equipment. One would imagine that in California to-day there is sufficient installed generating capacity to take ample care of all the increase of population and industry in the next ten years.

ALL-STEEL DYNAMOS AND MOTORS.

It is a curious fact that although European manufacturers employed steel to a considerable extent in place of cast iron, in the construction of direct-current electrical machinery, for some years before steel was used in the States, it has been left to American manufacturers to carry this tendency to its logical limit and build what may be called—except as regards their insulated copper windings—"all-steel" dynamos and motors. In Europe cast steel was adopted in D.C. machines because it was magnetically a better material than cast iron but in America it has been recognised that steel is the better material magnetically and mechanically for every part of D.C. and A.C. machines in which cast iron has hitherto been employed. Where wages are high and large numbers of standard machines are to be produced, the advantages of steel are particularly great.

The following figures (extracted from curves presented by G. Pontecorvo in *Elek. Zeitschrift*) compare the magnetic properties of cast iron, cast and rolled steel, and show the advantages of the latter materials in this respect:—

Amp. turns per Cm.	Flux per Sq. Cm. Cast-iron.	Cast-steel.	Rolled steel.
5	2,500	9,000	12,000
10	3,600	12,000	14,000
20	5,500	13,800	15,800
30	6,400	14,600	16,500
50	8,000	15,800	17,400
100	10,000	17,000	18,500
150	12,000	17,800	19,400

The saturation curve for rolled steel is practically coincident with that of forged steel and is considerably better than that of cast steel. Further, the rolled metal is free from blow-holes and stronger than cast steel (see subjoined data); hence, on both grounds, its section can be considerably reduced as compared with cast steel or iron:—

	Max. Tensile Strength. lb. per Sq. In.
Cast-iron	15,000
Parts of cast-iron	10,000
Cast-steel and parts thereof	56,500
Rolled steel	60,000

Despite the reduced mechanical and magnetic factor of safety permissible where rolled steel is employed, the loss by breakage is lessened and the time required to dress castings is completely eliminated.

It must be clearly understood, however, that rolled steel can be used economically only by a firm turning out such large numbers of standard machines that it can afford to install costly special tools (punches and presses, etc.). To make the yoke or frame of a dynamo or motor, a rolled steel plate (of thickness determined by the flux subsequently to be carried in D.C. machines and by purely mechanical considerations in A.C. machines) is cut into strips. After punching ventilating holes the plates are made red-hot, bent to form a closed ring, and welded electrically in the case of D.C. machines. It is not necessary to weld the joint in A.C. machines. Yoke pedestals and bearing brackets are built of punched and pressed steel, as also are slide rails and bed-plates. The hydraulic press used to bend the foot and bearing bracket punchings exerts a maximum force of 1,000 tons, and can make 150 strokes per minute; it bends a foot bracket from $6\frac{1}{4} \times 48 \times \frac{1}{2}$ inch plate in a single stroke. Such a machine costs £4,000. It is preferable to a hammer in that the latter acts chiefly on the surface of the work. By suitably designing the press tools it is possible to give thin steel parts the appearance of being as massive as the cast-iron parts to which they are mechanically and electrically equivalent. A few rivets, suitably located and closed by machine, unite quickly and permanently those parts needing to be so joined. Narrow A.C. machines have no ring shell but simply a pressed steel ring at each end, holding the laminations and serving for attachment of the bearing brackets.

The wholesale production, necessary to make economical the above method of manufacture, requires elaborate arrangements for handling, storing and testing parts and finished machines. Several hundred motors ranging from 0.37 to 185 KW. were tested in various works for many months before commercial manufacture was commenced. The strength of the riveted foot joints was proved by gear- and crank-driving a shaft carrying a heavy eccentric load. Dropping a complete motor from a considerable height did no more damage than to bend one foot.

Other innovations in the new method of construction include the use of pressed brush-holders, steel slip rings (in A.C. machines) and steel tube journals slotted for oil rings and run in with white metal. About 80 per cent. of the total number of induction motors in America have squirrel cage rotors and, to be uniform with the all-steel frame and housing construction, a rotor construction has been evolved in which the bars are mounted in an insulating and heat-hardening cement and connected circumferen-

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tially by a cast-on ring. Such rotors are practically indestructible, and all-steel motors of every type should prove very useful wherever strength and lightness are of special importance.

NEW ELECTRO-MAGNETIC HAMMER.

In contrast with the rapid progress made in electric driving of other machine tools, no thoroughly satisfactory means have hitherto been evolved for electric operation of percussion tools. Chipping and riveting hammers are indispensable in structural work of any kind, and it is not unusual to find air compressors installed to supply them where electricity is used for lighting and all other power applications. A satisfactory electromagnetic hammer would save the capital cost of such a special air equipment and eliminate the losses due to inefficient tools, poor load factor and leakage, etc. The direct application of electromagnetic attraction to a core acting as a hammer is not feasible since breaking the field circuit after each blow involves very slow working or violent sparking, which quickly destroys the contacts. Depocle produced an oscillating field in a solenoid by combining direct and low-frequency alternating current fields, but the hammer and special dynamo required were complicated and slow working. Many crank-driven hammers have been produced, and in most of these a spring is used to store energy till it is required for the hammer below. The spring is not durable and the equipment is heavy, a 120-watt crank-driven hammer to deliver 1,500 blows per minute weighing 30-33 lb., as compared with 11 lb., the weight of an equivalent air hammer. The use of a flexible shaft saves weight on the tool itself but introduces inefficiency, and leaves the operator to resist the torque transmitted.

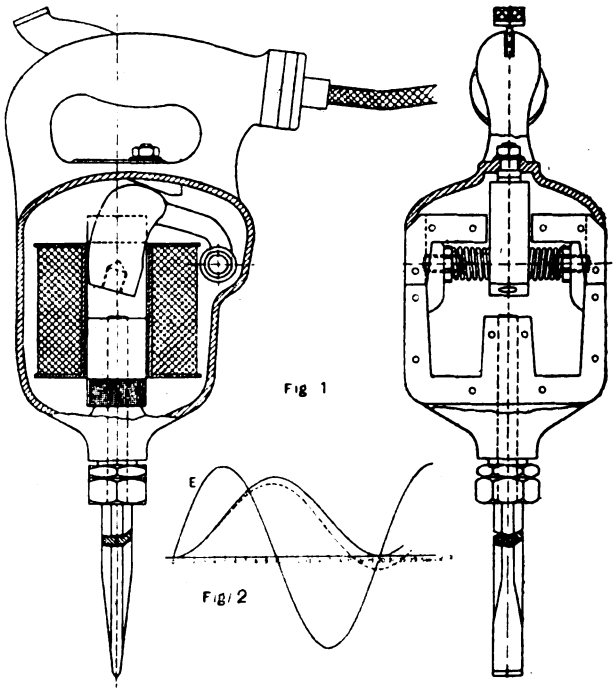
A hammer recently placed on the American market uses a crank driven electromagnet, the armature of which constitutes the hammer; the magnetic field is used to store energy supplied by the motor. Obviously, for the sake of simplicity, cheapness and light weight the magnet should serve at once as source of energy and energy reservoir. Attempts to prevent sparking at the contacts of a simple "on" and "off" solenoid, by the use of condensers, resistances and magnetic blow-outs have been unsuccessful. The back e.m.f. of the magnet winding acts in series with the line pressure at the moment of breaking circuit and, in the case of a 120-watt hammer delivering 17 blows per second and storing, say, 20 per cent. of the useful energy in its magnetic field, 1.4 watt-secs. has to be dissipated during say 0.008 sec., *i.e.*, the breaking spark represents 180 watts and is repeated 27 times per second. Actually it is hardly possible to break contact quickly enough to work at this frequency.

Instead of attempting to dissipate (without damage) the energy stored in the field by opening the field circuit, L. Schuler seeks a solution analogous to the use of the interpole, instead of resistance commutation, in dynamos and motors. This solution requires the use of alternating current. In 1889 Marvin devised a simple hammer oscillating between two coils alternately excited by alternating current. It was possible, but difficult, to interchange the field connections at the moment of zero current. A special 20-cycle alternator was required, and the return of the hammer being as rapid as its outward motion, equal energy was consumed on working and return strokes.

The Schuler hammer* (Fig. 1) employs alternating current and a synchronous contact maker which opens and closes the field circuit, in synchronism with the current used, once per period and always at the moment of zero pressure. In a purely inductive permanently closed circuit the alternating current E would produce a pulsating but unidirectional current i. Actually the theoretical current curve i (Fig. 2) is distorted to the form of i' by presence of resistance and gradually comes into quadrature with E. The first current wave has, however, almost double amplitude and double period, and therefore quadruple working power. Probably for the first time that switching-in phenomenon, which gives so much trouble in transformer and induction motor practice, now finds useful application.

By suitable design the current and field i in the neighbourhood of point 20 (Fig. 2) can be made so small that no appreciable sparking occurs. The current curve cutting the axis at small slope and while the pressure is low, very accurate setting of the contact breaker is unnecessary. The small negative current is actually advantageous in destroying remanant magnetism and preventing sticking of the magnet. Energy stored in the field iron is recovered before the circuit is broken. By extending the return of the armature over two periods, the energy required (which varies with $1/\sqrt{\text{time}}$) is made so small that it can be supplied by a spring. The latter reduces the useful blow by only a few per cent. On 50-cycle supply the hammer strikes 50 blows in three seconds, and by using a 3-way synchronous distributing switch, three hammers can be made between them to utilise each and every cycle of the supply current. Unless the generator has six, or a multiple of six poles, or unless a synchronous distributor is used, the contact maker must be suitably geared to the generator shaft.

The form of core illustrated in Fig. 1 reduces the air path practically to the main gap, energy in which can alone be utilised efficiently. Wattless current and the corresponding copper loss are a minimum, and the position of the main gap between the field coils makes the leakage field as small as possible. Actually it is at least 60 per cent. of the effective field, and must be allowed for in design; the reduced leakage as the armature descends increases the pull on the latter though the total flux is already decreasing. The pivoted striker



—armature is carried between steel points which offer little bearing friction and permit accurate adjustment og the armature. The elevation of the tool bar above the central stationary limb of the yoke need be very small, hence little energy is incapable of utilisation in the "clearance" depth of the gap. A detailed example of the electromagnetic design of a hammer of this type is to be found "E.T.Z.," pp. 589-593, 1914. In order that weight and heating may not be excessive, it is necessary to build electric tools of high efficiency even where the cost of energy is of quite secondary importance. The efficiency of an electric hammer delivering 17 blows per second (mean force during 0.4-inch hammer stroke = 104 lb.) is about 60 per cent, whereas that of an equivalent air hammer, including compressor and pipe losses, does not exceed 10 per cent. The total weight of the electric hammer is 13¼ lb. (4 lb. active iron, 4¼ lb. copper) and that of the air hammer about 11 lb.

*Described in the *Elek. Zeitschrift.*

AUTO-REGULATOR SYSTEM FOR DIRECT CURRENT TRACTION.

The Metropolitan Railway Co., of Paris, has successively used various multiple unit control systems on its trains, and has recently tested an auto-regulator system which eliminates loss in starting resistances and which provides for regenerative braking. The new system is derived from the well-known Ward Leonard system which, as applied to electric traction, places in series with the train motors a reversible booster capable of adding to or subtracting from the line voltage. In the present case, the regulator set comprises a constant-current machine and a small exciter both driven by one constant-speed compound motor. The regulator machine has two field windings excited respectively in shunt across its own terminals and by a constant current from the supply network. Starting is effected by increasing gradually the pressure applied to the main motors; during running, the current through the latter is held practically constant by the regulator machine; and during retardation, the regulator secures return to the network of a considerable part of the kinetic energy of the train.

Regulator Characteristics.—**In fig. 1, potential difference at the regulator brushes is represented by ordinates Y Y' and ampere-turns excitation is represented by abscissæ X X'. The characteristic due to the shunt-winding on the regulator is represented by a line O E, and by varying the resistance of the shunt field circuits the slope of this line can be made to coincide with that of the open circuit characteristic O R, which is practically a**

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straight line while the magnetic circuit is unsaturated. The shunt field winding is so connected as to produce in the regulator armature an E.M.F. equal and opposite to the P.D. applied to the brushes. Whatever the latter, so long as the limit of saturation is not reached, the machine neither receives nor discharges current (in respect of the shunt field and the applied P.D.). The separately excited field coil produces an effect depending on the direction of current flow through it; if its ampere-turns aid those of the shunt winding, the armature delivers current to the supply network. If V represents the regulator terminal P.D.; E_1, H_1, the E.M.F.'s generated by the shunt and independent field windings respectively; I, the current and R, the armature resistance, then— $E_1 - V + H_1 - I, R = 0$, but since E_1 always $= V$, this equation reduces to $H_1 = I, R$. In fig. 1, A B represents the E.M.F. (equal and opposite to V) due to the shunt ampere-turns O A; the

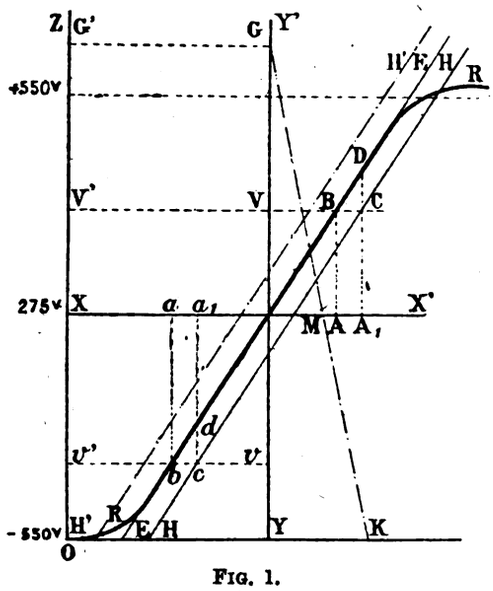

Fig. 1.

ampere-turns A A′ of the independent field winding aid those of the shunt winding, the total armature E.M.F. is represented by A_1 D, and the increase C D due to the independent field winding $= H_1$ and is constant. In other words, the point C, as V varies, lies on a straight line H H, parallel to O E; since H_1 ($=$ C D $=$ I. R, the line H H represents the variations in current delivered. If the independent winding opposes the shunt winding, the machine operates as a motor, the locus of the points C being again parallel to O E, but situated above the latter (as H H′ fig. 1). Within the limits indicated the regulator operates automatically as a constant current generator or motor, according to the magnitude and direction of the independent excitation, and irrespective of the P.D. applied to its brushes. The machine to which the regulator is coupled operates as a dynamo or motor, according as the regulator motors or generates.

Action During Starting.—In the simplified diagram of connections fig. 2, referring to a motor-car with two motors, X represents the supply line, G the earth, M_1 M_2 the traction motor armatures, m_1 m_2 the series fields of the latter, F_1 F_2 the regulator and machine direct coupled to the latter, E H the shunt and independent field

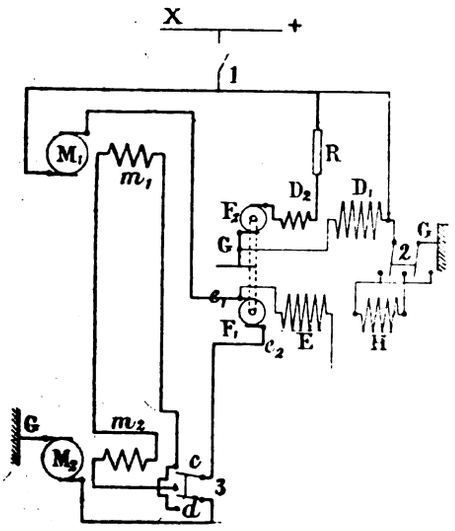

Fig. 2.

winding of F_1, and D_1 D_2 the shunt and series field windings of F_2. The regulator armature is connected between and in series with the traction motors.

On starting, the switch 1 is closed after placing the change-over switch, 2 so that H opposes E and causes F_1 to run as a motor. The group F_1 F_2 is then started by aid of the variable resistance R. Current now flows through E in series with M_1 M_2, but the reversing switch 3, connecting the field coils m_1 m_2 is not closed till F_1 F_2 has attained full speed and the regulator E.M.F. is practically equal, and opposite to the line voltage, so that no heavy current rush occurs at the moment of completing the main motor circuit. The actual value of the current flowing through the regulator, and, therefore, through the traction motor, is determined by the excitation of H. During this period, the machine F_2 runs as a generator and returns to the line a current slightly less than that absorbed by F_1 (owing to losses in F_1 F_2). As the motors M_1 M_2 speed up, the P.D. between e_1 d is reduced, but since the E.M.F. produced by E decreases simultaneously, automatically and by the same amount, the current flowing through M_1 F_1 M_2 remains constant. At a certain moment during acceleration, the applied P.D. between e_1 and d is zero; at this moment, the motors M_1 M_2 are essentially in simple series between X and G, and it would be possible to place F_1 F_2 out of circuit without affecting the main motors. If F_1 F_2 be left in service, the main motors continue to accelerate, and there is established a P.D. between e_1 d in the opposite direction. The current in E is then reversed, F_1 operates as a generator and F_2 as a motor. The winding E continues to balance the E.M.F. applied to e_1 d, and the winding H maintains constant current flow in the circuit M_1 F_1 M_2. Ultimately E adds to the supply pressure an E.M.F. equal to the latter; the motors M_1 M_2 are each subjected to the full line voltage, and could be connected in simple parallel between X D, the set F_1 F_2 being shut down. On the Metropolitan Railway, since the stations are close together, the regulator is permanently connected to the network, and during coasting and stops the switch 3 is opened.

Regeneration.—By reversing the switch 2 in the independent field circuit of the regulator machine, the regulator E.M.F. due to H is opposed to the line pressure. The switch 3 being set so that M_1 M_2 operate as dynamos, the resultant E.M.F. in the circuit M_1 F_1 M_2 exceeds and opposes the supply pressure, hence the train is retarded by the conversion of its kinetic energy into electrical energy which is delivered to the supply network.

Two distinct periods are to be recognised during regeneration, viz., a short period during which regeneration is established, the speed of the traction motor being practically constant; and the remaining period of regeneration, during which the current has its normal value. At the moment when regeneration is established by closing the switch 3, the P.D. applied to the regulator brushes varies almost instantaneously over a wide range; even during the subsequent period of regeneration the rise in E.M.F. of the series generators following any accidental increase in current, leads to further current increase, and hence to unstable operation, unless special provision be made to prevent it. The trouble being due to the low self-induction of the motors, the simplest remedy is to provide suitable damping in the traction motor field circuit. This is done by shunting the latter with the armature of an auxiliary exciter machine direct coupled to the group F_1 F_2, and hence running at constant speed. One field winding on the exciter is connected across the supply mains and produces constant E.M.F.; the other field winding is connected across the regulator terminals, and, therefore, produces E.M.F., varying in direction and magnitude with the P.D. applied to the regulator, *i.e.*, with the main motor speed. This arrangement does not disturb the series characteristics of the traction motors, the torque of which increases as the speed decreases, and, being a maximum at standstill, produces smooth and complete braking. Different rates of retardation are obtainable by varying the independent excitation of the regulator machine. At high speeds the regulator runs as a motor, but at low speeds, it operates as a generator; the current returned to the mains decreases progressively as braking proceeds.

The three auxiliary machines required by the auto-regulator system weigh about 4,070 lb.; contactor switchgear is, of course, employed, but eight fewer contactors are required than in the Sprague-Thomson multiple-unit system, and the usual heavy starting resistances are completely eliminated, so that the net increase in weight is only about 3,080 lb. in the new system. This represents only 3 per cent. increase in the total weight of a 150-ton (3 motors + 2 trailers) train.

It is claimed that the auto-regulator system effects about 30 per cent. saving in energy in tube service, and it is estimated that its adoption on all the Metropolitan (Paris) trains would reduce the annual energy consumption by about 20 million KW.-hours. The present expenditure of this energy represents loss of money and useless heating of the tunnels. At present there accumulates in the latter about 500 tons per annum of metallic dust—chiefly the products of abrasion during braking. This dust adheres to the oily substances and surfaces of the rails, ballast and insulators, and is difficult to remove. Regenerative braking would obviate the nuisance by eliminating its cause.

The Electric Vehicle in France.—Following the example set by this country, a movement has been commenced with the view of bringing about a revival of interest in electric motor vehicles in France. M. Dubournais, of the Société Gastambide, suggests that the French Automobile Club should take the matter up, and endeavour to induce central station authorities to make provision for the charging of automobile batteries, not only promptly but also at a reasonable charge.

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NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electric Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

17,684. "Terminal or attachment fittings of electric conductors." H. Edmonds (trading as G. Edmonds). July 27th.

17,686. "Compound for making water-tight the joints of covers of boxes for underground electric mains and distributors and similar joints of boxes fixed in exposed positions." W. H. Walker. July 27th.

17,705. "Sparking plugs." R. Colin. July 27th.

17,707. "Magnetic blow-out device for safety fuses." A. Mond. (Maschinenfabrik Oerlikon, Switzerland.) July 27th. (Complete.)

17,732. "Electric thermostatic fire-alarm contacts." H. Dixon. July 27th. (Complete.)

17,733. "Electric metallic incandescent lamp." K. Kende. July 27th. (Complete.)

17,745. "Process of rolling metal." S. O. Cowper-Coles. July 27th.

17,746. "Process for the electro-deposition of lead." S. O. Cowper-Coles. July 27th.

17,747. "Process for coating or plating metal sheets with other metals by electro-deposition." S. O. Cowper-Coles. July 27th.

17,755. "Writing or copying telegraphy." Telepantograph G.m.b.H. July 27th. (Convention date July 28th, 1913, Germany.) (Complete.)

17,761. "Air conditioning apparatus." A. F. Berry. July 27th.

17,762. "Electrical heating apparatus suitable for cooking, water heating and like purposes." A. F. Berry. July 27th.

17,763. "Electrolytic production of alkali metals." J. Y. Johnson (Badische Anilin & Soda Fabrik, Germany). July 27th.

17,768. "Measuring of continuous electric current." E. Besag. July 27th. (Convention date, August 20th, 1913, Germany.) (Complete.)

17,797. "Socket terminals for electric conductors." W. A. Hill. (Apparate Bauanstalt Fischer G.m.b.H., Germany.) July 28th.

17,811. "System for the generation of electric currents." C. F. Benitez. July 28th. (Complete.)

17,836. "Means for detecting or recording electric currents. T. Illingworth and W. C. Mann. July 28th.

17,850. "Means for electrically determining transmitted power." W. E. McCoy and S. D. Sprong. July 28th. (Complete.)

17,851. "Transformer motors." D. Suchostawer. July 28th.

17,863. "Contact apparatus particularly for telephone systems." F. Brinkmann. July 28th. (Convention date, August 9th, 1913, Germany.) (Complete.)

17,872. "Construction of high-frequency alternators." Soc. Marius Latour et Cie. July 28th. (Divided application on 26,934/13.) Convention date, November 27th, 1913, Belgium.) (Complete.)

17,894. "Electric motor control." British Thomson Houston Co., Ltd., and H. C. Hastings. July 28th.

17,909. "Electric furnaces." J. L. Dixon. July 29th.

17,920. "Telegraph circuits." A. Orling and Orling's Telegraph Instruments Syndicate, Ltd. July 29th.

17,924. "Insulated lamp-holder for electric lamps." L. S. Hearlin. July 29th.

17,945. "Electric heaters." R. Weaving, F. Smith, and Ferranti, Ltd. July 29th. (Complete.)

17,949. "Starting switches or controllers for dynamo-electric machinery." Siemens Schuckertwerke G.m.b.H. July 29th. (Convention date, July 29th, 1913, Germany.) (Complete.)

17,986. "Electric time switches." J. E. H. Beraud. July 29th. (Addition to 945/14.) (Complete.)

17,988. "Multiple-contact electric switches." H. J. Norballe and J. L. Lawson. (July 29th.) (Divided application on 23,127/13. October 13th.)

18,009. "Sender for Hertzian waves with polyphase generators." V. Bouchardon. July 30th. (Convention date, August 1st, 1913, Germany.) (Complete.)

18,011. "Electrical equipment of motor cars." H. Garner and W. J. Parker. July 30th.

18,023. "Process for enriching or activating liquids or gases with radium emanation." E. Schwarz. July 30th. (Convention date, July 30th, 1913, Austria.) (Complete.)

18,033. "Telephone systems." J. G. Blessing. July 30th. (Convention date, July 31st, 1913, United States.) (Complete.)

18,042. "Electrically-driven machine tools having several tools." H. Kienzle. July 30th. (Convention date, August 1st, 1913, Germany.) (Complete.)

18,043. "X-ray apparatus." H. W. Cox & Co., Ltd., and H. E. Donnithorne. July 30th.

18,060. "Closing devices for conduits." Soc. dite M. Goudard et Mennesson July 30th. (Convention date, November 21st, 1913, Belgium.) (Complete.)

18,064. "Telephone and like apparatus." F. W. Lanchester. July 30th.

18,076. "Selecting devices for automatic or semi-automatic telephone systems." G. A. Betulander. July 30th. (Convention date, August 1st, 1913, Sweden.) (Complete.)

18,092. "Electric accumulators or secondary batteries." F. A. Coles. July 31st.

18,106. "Electric current graduating devices or resistances." W. Sumner. July 31st. (Complete.)

18,123. "Signalling arrangements for use with projectors or searchlights." Siemens Schuckertwerke G.m.b.H. July 31st. (Convention date, July 31st, 1913, Germany.) (Complete.)

18,143. "Electrical conduit systems." M. J. Railing and T. Taylor. July 31st.

18,154. "Selecting-devices for automatic or semi-automatic telephone systems." Gotthilf Ansgarius Betulander. July 31st. (Addition to 18,076/14.) (Complete.)

18,155. "Mattresses for insulating purposes." J. A. Dick. July 31st.

18,184. "Switch-gear for controlling the motor which operates the feed-screw of electrically-operated reciprocating tools." Lancashire Dynamo & Motor Co., Ltd., and W. Hargreaves. August 1st.

18,202. "Step-by-step mechanism suitable for starting electric motors." Sir W. G. Armstrong Whitworth & Co., Ltd., and W. H. Waddingham. August 1st.

18,203. "Wireless telegraph direction-finders." Marconi's Wireless Telegraph Co., Ltd., and E. Ichino. August 1st.

18,238. "Manufacture of fittings and accessories for electric and other lamps and illuminating devices." W. J. Owen. August 1st.

18,239. "Telephone installations." Siemens & Halske Akt. Ges. August 1st. (Convention date, August 4th, 1913, Germany.) (Complete.)

18,242. "Transmission of electrical impulse circuits of high electrostatic capacity." G. Musso. August 1st. (Addition to 17,246/14.) (Complete.)

18,243. "Apparatus for transmission of electric impulses." G. Musso. August 1st. (Addition to 17,245/13.) (Complete.)

18,244. "Storage battery plates." M. Krokavetz. August 1st.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

13,890. Electrical Connection Devices for Railway and like Vehicles. L. Boirault. June 14th. (July 29th, 1913.)

15,875. Arrangement for Starting Groups of Electrical Machines, consisting of a Synchronous Machine and an Asynchronous Machine connected in cascade with it. (March 21st, 1913.) July 9th. Ateliers de Constructions Electriques de Charleroi, Soc. Anon.

15,928. Synchronisation of Clocks. I. H. Parsons and A. E. J. Ball. July 10th.

16,187. Arrangements for Controlling the Quantity of Heat supplied to Heating Radiators. M. Arndt. July 14th. (July 15th, 1913.)

16,198. Electrically-operated Rotary Constant-speed Device. R. P. Howgrave-Graham. July 14th.

16,257. Electric Miners' Lamp with Fire-lamp Indicator. J. C. Rigaux. July 15th.

16,298. Receivers for Submarine Sound-signals. Signal Ges. July 15th. (July 29th, 1913.)

16,380. Adjusting and Supporting Means for the Stretched Threads of Electric Measuring and Indicating Apparatus. C. Lorenz Akt. Ges. July 16th. (June 20th, 1913.)

16,392. Electric Dinner or Service Lifts. F. Hodgson. July 16th.

16,538. Automatic and Semi-automatic Telephone Systems. Siemens & Halske Akt. Ges. July 18th. (September 10th, 1912.)

16,549. Devices for Recording Sounds. E. Costantini. July 18th, (December 18th, 1912.)

17,453. Electric Cooking and Heating Apparatus. C. Clarke. July 30th.

17,589. Control of Alternating Current Motors. Siemens Schuckertwerke Ges. July 31st. (August 2nd, 1912.)

18,673. Arrangements for Exciting Rontgen-ray Tubes. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.) August 16th.

22,222. Manufacture of Electrodes for Electric Arc Lamps. F. Lewis. October 2nd. (July 2nd, 1913.)

23,277. Magnetic Motor. E. W. Fuller. October 15th.

23,698. Dynamo-electric Machines for use on Motor Vehicles. H. K. Kouyoumjian. October 20th. (July 19th, 1913.)

23,867, Rocker Arms and Brush Holders for use on Electrical Motors and Generators. J. Leech. October 21st.

24,899. Construction of Electric Snap-action Switch. E. M. Wildey. November 1st. (Divided application on 1,471/13. July 18th.)

25,668. Apparatus for the Preparation of Electric Baths. J. Dulven November 10th. (November 13th, 1912.)

25,774. Method and Apparatus for Electric Code Impulse Signalling Systems. Western Electric Co. (Woodward, acting for Western Electric Co.) November 11th.

27,354. Regulation of Dynamo-electric Generators. F. L. Hollister. November 27th. (Divided application on 28,748/12. December 13th.)

27,365. Manufacture of Anodes of Massive Manganese Peroxide. Siemens & Halske Akt. Ges. and Huth. November 27th. (Addition to 605/09.)

27,679. Telephonic Instruments. E. A. Graham. December 1st.

28,051. Apparatus for Exhibiting Symbols, Pictures and the like. F. Moreno. December 5th.

28,126. Means for Indicating Change of Temperature. I. Hall. December 6th

28,950. Magnetic Balances. R. W. Paul. December 16th.

1914.

373. Electric Apparatus for Heating Liquids. J. Von Hentzel. January 6th.

1,641. Automatic Switches for use in Telephone Exchange Systems. Western Electric Co. (Woodward, acting for Western Electric Co.).

2,023. Transportable Military Telephone. E. Schuler & G. Schuler. January 26th.

2,075. Common Battery Telephone Systems. Western Electric Co. (Woodward, acting for Western Electric Co.). January 26th.

2,693. Automatic Switches for Telephone Systems. Western Electric Co. (Woodward, acting for Western Electric Co.). February 2nd.

3,232. Frequency Transformers. W. P. Thompson (Goldschmidt). February 7th.

3,649. Electric Switches. Igranic Electric Co. (Cutler Hammer Mfg. Co.). February 12th.

5,096. Number Plates and Rear Lights for Motor Vehicles. W. H. Bishop. December 27th.

5,281. Wireless Oscillator. H. P. Dwyer. March 2nd.

6,079. Devices for Recording Sounds. E. Constantini. July 18th. (December 18th, 1912. Divided application on 16,549/13. July 18th.)

6,418. Electric Condensers. Allgemeine Elektricitats Ges. March 13th. (March 14th, 1913.)

8,975. Electric Signalling Devices for use with Winding Engines of Collieries. J. A. Adlington. April 9th.

9,232. Electrolytic Apparatus. W. Thum. April 14th.

9,492. Electric Switches. W. M. Rolph. April 16th.

Foreign Trade in July.—The following are the electrical and machinery figures given in the official returns for July trade:—

	Month of July	*Inc. or dec.*	*Seven months, 1914.*	*Inc. or dec.*
Imports.	£	£	£	£
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	139,346	+ 16,658	943,991	+ 75,174
Machinery	632,932	— 1,012	4,777,276	+385,694
Exports.				
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	354,405	—154,678	2,058,634	—1,133,260
Machinery	3,304,888	+173,202	22,774,443	+1,218,214

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THE

ELECTRICAL REVIEW.

VOL. LXXV. AUGUST 21, 1914. No. 1,917.

ELECTRICAL REVIEW.

Vol. LXXV.] CONTENTS: August 21, 1914. [No. 1,917.

	Page
The War and Industry	265
The Copper Position	266
The Miner and War	266
Gatun Hydroelectric Development for the Panama Canal (*illus.*)	267
Electricity Supplies for Kinematographs, by W. B. S. (*illus.*)	270
Correspondence—	
Central Testing Institution	272
Electrical Engineers and the War	272
Mysterious Behaviour of a Generating Set	272
"Two Old at Forty"	272
Manufacture of Carbons	273
The War and Trade	273
The War and the Electrical Industry	273
New Electrical Devices, Fittings and Plant (*illus.*)	274
War Items	275
Vickers Exhibit at the Anglo-American Exhibition	277
Legal	277
The Perfect System, by "Commercial"	278
Records of Progress and Completion of Manufacturing Orders	279
Business Notes	279
Notes	282
City Notes	285
Stocks and Shares	286
Market Quotations	286
Exports and Imports of Electrical Goods during July, 1914	287
Electrically-Propelled Tower Wagons (*illus.*)	288
Reviews	288
Pressure-Reducing Motor-Generator for High-Pressure Direct Current (*illus.*)	289
Mammoth Boiler Results and Projects at Detroit	290
German Exports for the Half-Year	291
New Patents Applied For, 1914	292
Abstracts of Published Specifications	292
Contractors' Column ... Advertisement page	xviii

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1914 EDITION

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

THE WAR AND INDUSTRY.

As the days pass by, and we as a nation become more silently resigned to the altered state of life that war has brought, the industrial world is showing that it fully recognises that it can best serve its country's interests at this time of crisis by keeping the wheels of industry going at full speed. Our commercial and industrial leaders are bringing their expert knowledge and experience to bear upon the situation, and by sane and sober measures are doing much to assist the Government and the banking authorities in their efforts to restore confidence, removing the effects of dislocation, and bringing the trade of the kingdom as nearly as possible back to the normal.

The inestimable service given by our Navy in these early days of the conflict, making secure for our own and others' shipping the great ocean trade routes to many parts of the world, will long live in the memory. We owe it to our Navy that credit and confidence are being speedily re-established, that the peoples' anxiety regarding food supplies has been removed, that the way is open for our industrial production to continue, and, as far as capital, labour and material will allow, to proceed at an accelerated pace handling business which under other conditions would have been executed from across the North Sea.

Timely action has been taken by the British Electrical and Allied Manufacturers' Association with a view to preventing the holding up of contracts. In our "Correspondence" columns to-day we print a copy of a letter which that Association has addressed to the principal railway companies, municipal corporations, and other large purchasers of electrical plant and apparatus in Great Britain, showing how serious may be the effect for the electrical industrial workers if advantage be taken of clauses in their contracts to suspend and delay work on account of the war. We hope that this and other appeals to the same effect will not fall upon deaf ears. Such purchasers as these ought to be better able than some others to abide by their contracts, and they should, and we believe will, see how responsible is the position in which they are placed, and how imperatively it is their duty to do their utmost to keep the hands of our workers fully occupied. We sincerely trust that those who have already felt it desirable to hold up electrical contracts will speedily find it possible to release them so that work on them may proceed.

The Government appeal to the Colonies, not only to take delivery of all orders placed, but to increase orders as far as possible for future requirements, with a view to helping our industrial population, has been well received and loyally responded to. Surely public authorities at home will not be less ready to assist! We would ourselves appeal to our readers in the far-off Colonies and foreign parts to expedite the placing of engineering and electrical contracts with English manufacturers.

While there are very clear evidences of a rapid recovery from the dislocation of industry, it seems to be necessary to again strongly urge everybody engaged in the electrical in-

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dustry to act with the full spirit of patriotism and with sanity, and by their doings show their confidence in the present position. Confidence begets confidence. We trust that there will be nobody taking unfair advantage of the moratorium—everybody who can pay should do so without delay.

A meeting of editors of trade journals representing many branches of British industry was held in the City the other day, at which great faith in the present commercial position was expressed, but patience, confidence and reasonable sacrifice were deemed essential if we were to take full advantage of the present very bright prospects. In the recommendations arrived at by this meeting the public were urged to pay prompt cash for their present requirements: retailers were appealed to not to take unfair advantage of the moratorium; manufacturers were asked to keep up their production; and banks were desired to afford all possible support to both wholesaler and retailer.

Much attention is being given to the effect of the war upon the course of international trade, and authorities in England and America are fully alive to the great possibilities of the situation, both immediate and future. In our last issue we gave information which should be of great service to those who seek to supply the wants of purchasers whose goods are now shut up in Germany. This week we give a table showing the electrical exports of Germany to different parts of the globe during the past half-year. This will convey a useful idea as to the character, volume and destination of German electrical exports in normal times.

The total imports of all kinds from Germany into the British Empire for the year 1912 amounted to £95,500,000, of which £71,200,000 came to the United Kingdom, while India and Australia took seven millions apiece, and the remainder went to other Colonies and dependencies. As a writer in one of daily papers remarks: "These are very striking figures, and the longer the war lasts, and the longer Germany is incapacitated, the greater will be the opportunity of the British trader in the Colonial export market." German trade so won is likely to be retained for a very considerable time. We hope, therefore, that British electrical firms will leave no stone unturned to secure a large share of the electrical exports that are included in this huge total. And as we have already pointed out, they will have seriously to consider how they can provide themselves with the various electrical lines for which they have hitherto depended upon Germany. These are considerations which will occupy our minds for some time to come, but in a number of cases we must not delay action. The sooner we are prepared the better.

We conclude our present observations on the situation by approvingly quoting a sentence from a leader in one of the financial dailies:—"If everyone works hard to restore normal conditions, and fashions his conduct accordingly, the normal conditions will soon return."

The Copper Position.

The outburst of the European War has put a very different complexion upon the Metal Markets, and not the least upon copper. The closing of the London Metal Exchange has necessarily involved the complete stoppage of business of an official character, and all official quotations have, therefore, been abandoned, but there has been a little private trading in standard copper, mostly for the purpose of squaring up the books of brokers and dealers whose accounts have been thrown into a state of chaos by the declarations of war voiding the contracts of King's enemies, and also in many cases rendering it impossible to get into touch with clients in France, Belgium and Russia. Never has the position been more difficult than it has been this month, and it will take some considerable time for things to regain anything like a normal appearance. There have not been any statistics issued since the middle of July, and as far as Europe is concerned, there cannot be any fresh issue until peace is declared. Hence on this side of the Atlantic the statistical position must remain an entire puzzle for an indefinite period. To add to the complexities of the situation, too, the American Copper Producers' Association have decided not to make any further issue of returns until further notice, in view of the conditions now existing in the markets of the world. This effectually precludes any information as to the statistical position in North America leaking out. The entire market, as will thus be seen, is in a complete fog. All that is positively known is that there is a wholesale shutdown in production in progress in the United States, and it is estimated by competent authorities, that to-day output there is fully 50 per cent. below that of a month ago, while an even greater falling off is possible. Some of the leading plants, such as the Great Falls smelter of the Anaconda concern, has been closed down entirely, while a restriction of production to the extent of 50 per cent. is common. There are mines which are preparing to scale down to an even greater extent, and there cannot be the least doubt of the rigorous resolve of producers to accommodate output as closely as may be to the altered conditions brought about by the war. Under the circumstances it cannot be expected that there can be much business about in refined copper. A certain amount of buying has been done, but it has been confined almost wholly to the ammunition makers, whose energies are being taxed severely by Government orders, and who in consequence have been forced to enter the market and to pay what prices were asked. There is only a limited amount of copper available, and this is to a large extent ear-marked for national purposes. There has been no desire to exact large profits on this, and what business in electrolytic copper has been done for prompt and immediate delivery, has been put through at round £68 to £72 a ton. Supplies are not coming forward from the United States with any freedom. One or two of the big German liners took in good qantities of copper, but after sailing were recalled to New York by wireless owing to the risk of capture, and there they remain waiting for the war to finish. Meanwhile there can hardly be said to be an open market price for the metal, and business is restricted to the satisfaction of pressing needs.

The Miner and War.

At the outbreak of hostilities there was some fear that the miners might show the cloven hoof, and become awkward, and certainly had they blindly followed the leaders' advice there might have been trouble, as coal for our Navy is a vital necessity, and the country was rightly indignant at the refusal of the leaders to allow the men to forgo the usual holiday in order to produce coal which was urgently needed owing to the mobilisation of the fleet. We say the leaders, because we are certain the rank and file of the miners are as patriotic as any workmen in the country. This is shown not only by the large numbers of miners who are now serving with the Regular or Territorial Forces, but by the fact that all the colliery ambulance brigades have, *en masse*, volunteered for service at home or abroad—and we are convinced that had it not been for the advice of leaders with exalted views of their own importance, there never would have been any question of the South Wales pits remaining idle. They have, however, apparently seen the mistake of such a policy, and we are glad to hear that the miners in all collieries supplying coal to the Admiralty have agreed to work on Sundays if necessary, and to work one hour per day extra.

One can admire the ideals of the leaders, but one must object to the methods they adopt towards their attainment. They savour too much of the methods of the Kaiser, and we would ask them to look into their inmost hearts, and ask themselves, do they lead, or attempt to lead, for purely altruistic principles, or is it because of the old Adam that is in most of us, the lust for power? Whatever may be the collective opinion of the miners on the views of the leaders, we may rely at any rate upon the fighting spirit of the individual to see that his King and country shall not suffer, so far as he can prevent it, and in the great trial that is before us all we may be sure the miner will be in the very front ranks bravely doing his duty.

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GATUN HYDROELECTRIC DEVELOPMENT FOR THE PANAMA CANAL.*

The permanent supply of electric energy for the Panama Canal is generated in the Gatun hydroelectric station, which is located at the Gatun spillway dam. The tremendous water storage in the artificial Gatun lake, fed by the Chagres River, not only carries vessels the greater part of the way across the isthmus on a level about 85 ft. above the oceans, and provides water for raising and lowering them gently through the Gatun, Pedro Miguel and Miraflores locks, but it also has afforded an excellent opportunity to generate electric current for lighting the Canal, for operating the gigantic gates and other locking machinery, and for towing ships through the locks.

Electric current will likewise be used for coal-handling plants at both ends of the Canal, for machine shops, waterworks, dry docks, and possibly in the future for hauling trains on the Panama railroad. To ensure continuity of service in case of accident, a steam-electric station at Miraflores, erected a few years ago to supply power for construction work, will be ready to take up the load when necessary.

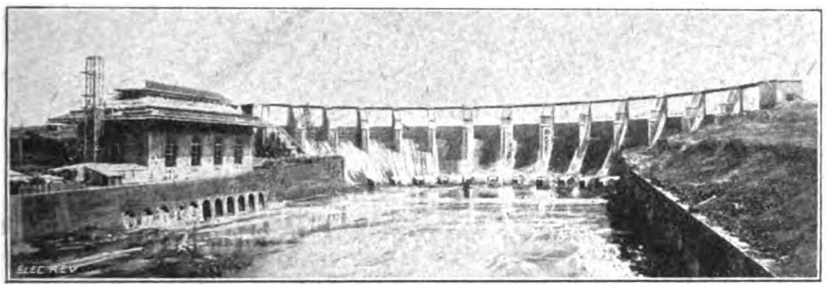

Fig. 1.—Gatun Spillway Dam, showing Fourteen Crest Gates, Ogoe Dam and Baffle Piers; Hydro-electric Station on left.

The complete equipment for the power and distribution system on the canal comprises the 7,500 k.v.a., 2,200-volt hydro-electric power plant at Gatun; the 4,500 k.v.a., 2,200-volt Curtis turbo-generator electric power plant at Miraflores for emergency; a double 44,000-volt transmission line across the Isthmus, connecting Christobal and Balboa with the two power plants; four 44,000/2,200-volt sub-stations, stepping down at Christobal and Balboa, and up or down at Gatun and Miraflores, depending on which of the two plants is supplying power; 36 2,200/240-volt transmission stations for power, traction and light at Gatun, Pedro Miguel and Miraflores locks; three 2,200/220/110-volt transformer stations for the control boards at the locks; and stations at Christobal and Balboa for the coal-handling plants, machine shops and dry docks.

The Gatun hydro-electric station has a capacity of 6,000 kw., and provision has been made to increase this to an ultimate capacity of 12,000 kw., should this amount of power be required later for the operation of the Panama railroad, the three outlet pipes in the dam having been installed along with the original pipe-lines.

The gross head available from Lake Gatun to mean tide level of the Pacific Ocean varies from a maximum of 91 ft. in the extreme flood times to a minimum of 79 ft., to which level the lake may possibly drop toward the close of the dry season. The plant is consequently designed to develop the full water output when operating under an effective head of 75 ft. For three or four months of every year there is absolutely no rainfall on the Isthmus; and during this period it is desirable to conserve the water to as great an extent as possible. Maximum efficiency was therefore demanded for the apparatus of both the water-wheel and generator manufacturers.

Water is taken from Lake Gatun through passages 12 ft. wide, fitted with wrought-iron racks 29 ft. 7 in. high, to prevent trash from entering the pipe-lines. The water is admitted into the pipe-lines through three head gates, 10 ft. 6 in. in diameter, of massive cast-iron construction, the seats where water-tightness is required being made of bronze.

Each gate is equipped with two steel stems for raising and lowering. These stems are fitted with bronze nuts working in roller thrust bearings, and the nuts are fitted with steel bevel gears arranged to be operated by a 15-h.p. motor. The gates are equipped with automatic control devices, consisting of a limit switch geared to one of the gate stems, and a float switch actuated by the water in the pipe. The action of the control is as follows, the gate being closed and the pipeline empty:—The gate motor switch is closed at the power house, starting the motor which begins opening the gate. When the gate has opened a sufficient distance to fill the pipeline in about five minutes, the limit switch opens the circuit and stops the motor.

The gate remains in this position until the pipeline is filled, and the water rises in the 36-in. diameter air vent just below the gate, when it actuates a float switch, and again closes the motor circuit, thereby causing the gate to be opened fully, when the limit switch again operates to prevent over-travel. The gate is closed by reversing the main switch at the power house, which causes the motor to operate, the limit switch again stopping the motor when the gate has reached the closed position. In case the electric power should fail, the gates can be hand-operated by two men.

Each of these gates is bolted to a pipeline 10 ft. 6 in. in diameter, with an average length of 420 ft. The pipelines are made of $\frac{3}{8}$-in. steel plates, and are covered with a layer of reinforced concrete to prevent rust. Each of the pipelines is arranged for attaching a Pitot tube testing apparatus while its unit is in service.

The principal buildings connected with the actual operation of the canal are the hydroelectric station at Gatun spillway; the gate control house at the spillway; the four sub-stations of the transmission system, and the three lock control houses. All these structures are designed along simple lines in harmony with the unbroken concrete surfaces of the adjacent engineering works.

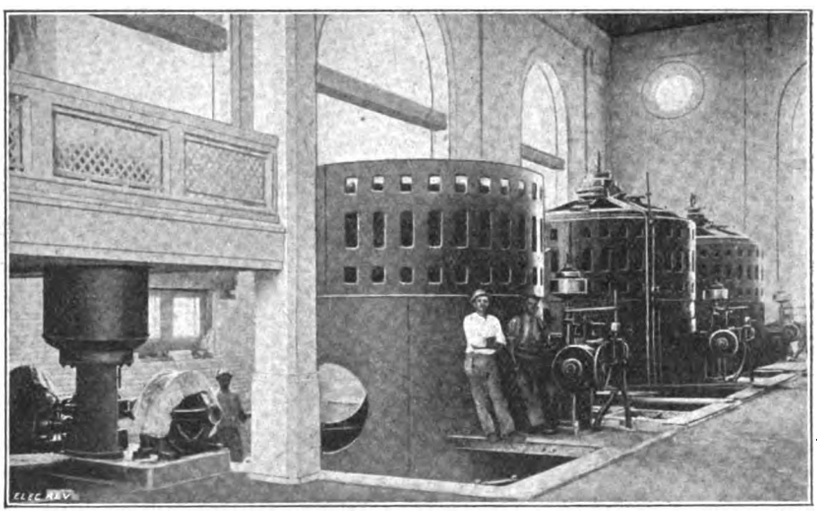

Fig. 2.—Interior of Gatun Hydro-electric Station.

The hydroelectric station measures 61 ft. by 137 ft., and has an extreme height of 74 ft.; it consists of a single room open to the roof. The turbine pit, with an area of over 2,100 sq. ft., is located 6 ft. below the level of the main floor, and is lined with white enamelled brick.

* See also Electrical Review, Vol. 74, p. 288.

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Concrete stairways at either end of the building give access to the mezzanine and second galleries, which are devoted to the switchboards, oil-switch compartments, reactance coils and other electrical equipment. Two such galleries extend the entire length of the station on the north-east side.

The three 2,000-kw. main generating units in the hydro-electric station are each driven by a special 50-in. vertical single-runner Francis turbine, manufactured by the Pelton Water-Wheel Co. Each turbine has a maximum capacity of 3,600 h.p. when operating under an effective head of

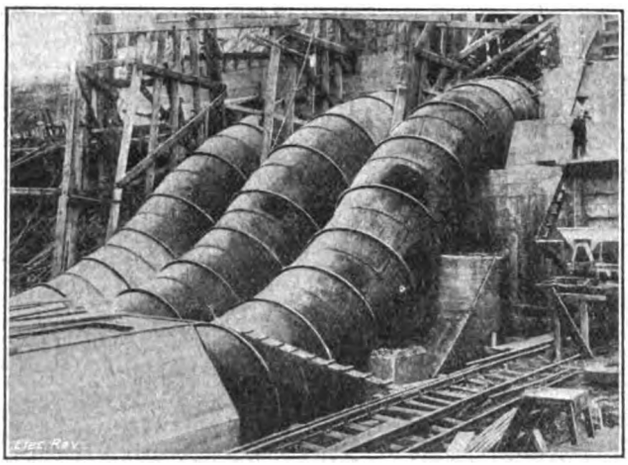

Fig. 3.—"Ogee" Curve at Gatun Hydro-electric Station, immediately below Headgates.

75 ft., and at a normal speed of 250 r.p.m. The turbines are located at such a height that the centre of the runners is 20 ft. above tail water.

The water is discharged through steel-lined concrete draught tubes, which are 71 in. in diameter at the discharge from the runners, and increase to an elliptical section

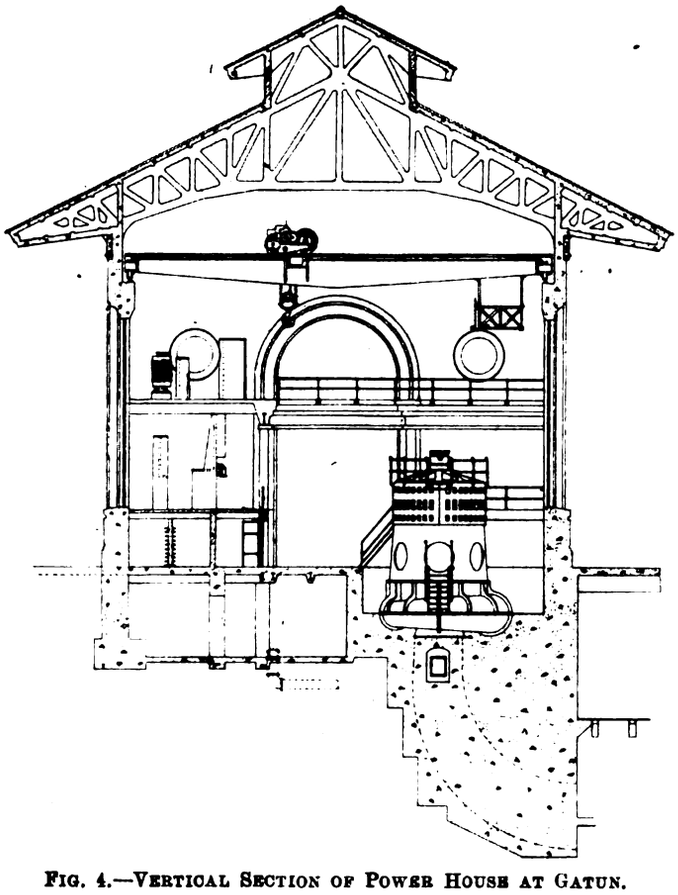

Fig. 4.—Vertical Section of Power House at Gatun.

of 9 ft. × 17 ft. at the outlets, which are horizontal, there being a 90° bend in the tubes. The linings are made of ¼-in. steel plates.

The turbines are of the spiral case type, and are fitted with heavy cast-iron distance rings which carry the generators. The weight of the revolving parts of each generator and turbine is carried on a roller thrust bearing mounted on top of the generator. The turbine is so designed that the runner exerts an upward thrust of 20,000 lb. when

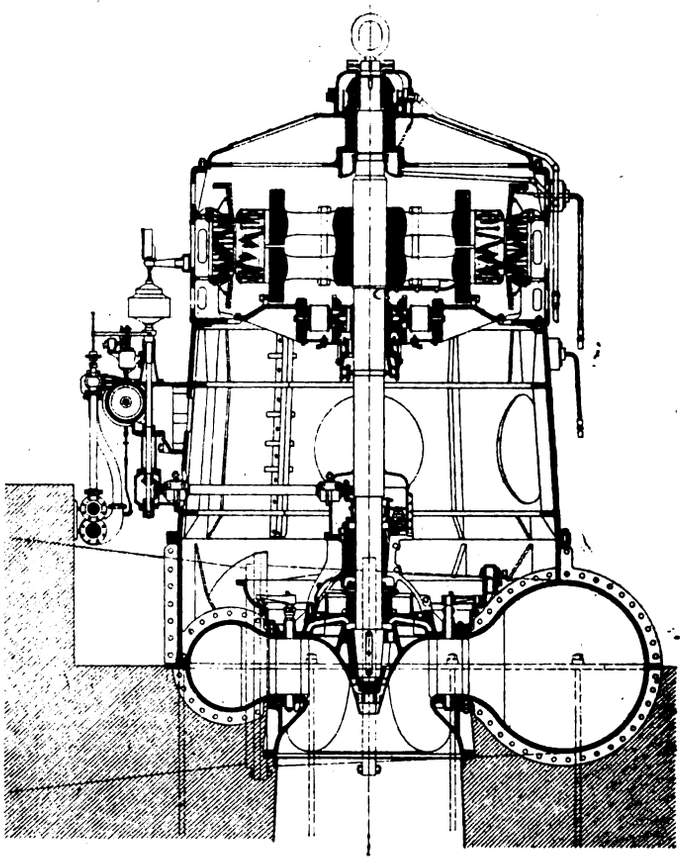

Fig. 5.—Section through Waterwheel, Generator and Exciter.

working at full capacity, thereby relieving the thrust bearing of that amount of load. Forced lubrication is provided.

The runners of the turbines are made of a special bronze and weigh approximately 7,000 lb. each. The surfaces of

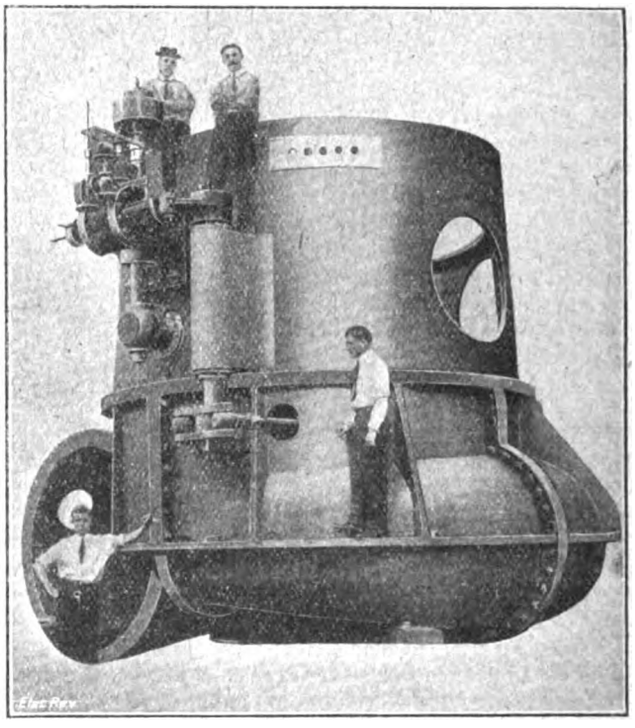

Fig. 6.—3,600-h.p. Francis Turbine for Gatun Hydro-electric Station.

the runner vanes are all hand finished, to reduce hydraulic losses.

The speed of the turbines is controlled by Pelton oil-pressure governors, driven by bevel gearing from the main

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shaft. The governors are fitted with small electric motors for varying the speed of the main units for synchronising purposes, and a device is provided on each governor for varying the permanent drop in speed from no load to full load. The pressure oil for actuating the governors is supplied by two Pelton rotary pumping units, driven by 10-H.P. motors, each pump being capable of supplying the governors on all three units.

The three main generating units are of the vertical revolving-field type, each being provided with a direct-connected exciter. The generators were made by the General Electric Co., U.S.A., and are three-phase, 25-cycle, with a guaranteed continuous capacity of 2,000 KW. at 0·8 power factor, 2,200 volts, 250 R.P.M., and with an overload rating of 2,500 KW. at 0·8 power factor for two hours. The exciters are of 50-KW. capacity at 125 volts, each capable of furnishing exciting current for two generators under maximum guaranteed load. Each unit, generator and exciter, weighs approximately 65 tons.

The generators are carried on the cast-iron distance rings furnished by the Pelton Water-Wheel Co., the stationary armatures being bolted to these rings. The thrust and upper guide bearing support consists of a very rigid iron casting, bolted to the top of the stationary armature.

The thrust bearings, manufactured by the Standard Roller Bearing Co., of Philadelphia, carry the weight of the complete revolving element.

There are two guide bearings, one immediately below the thrust bearing and the other above the water-wheel. The arrangement of the complete unit is shown clearly in the cross-sectional view.

The generators, under official tests, showed an efficiency of 95·1 per cent. at 2,000 KW.; 94·3 per cent. at

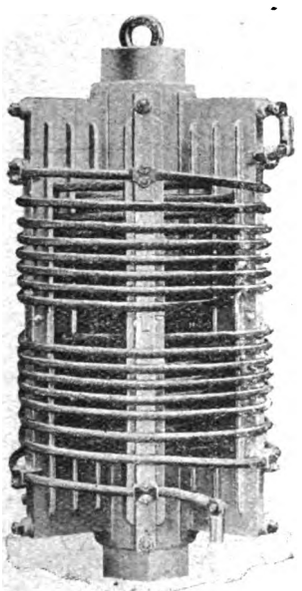

FIG. 7.—CURRENT-LIMITING REACTANCE WITH CONCRETE CORE, 25 CYCLES, 42 K.V.A., 64 VOLTS, 656 AMPERES.

1,500 KW.; and 9·25 per cent. at 1,000 KW., all at 0·8 power factor. The guaranteed temperature rises of 40° C. above room temperature of 25° C. under continuous operation at full load, and 55° C. rise after two hours' run at 25 per cent. overload, were met with an ample margin.

All of the apparatus was subjected to the most rigid and minute inspection during manufacture by representatives of the Isthmian Canal Commission. The insulation of all windings was made moisture-proof on account of the extreme climatic conditions on the Isthmus. The revolving field was given a running test at twice normal speed in the testing pit at the factory provided for this special purpose.

Current limiting reactances were provided to give 5 per cent. reactive drop at 2,500 K.V.A., 2,200 volts, three-phase, 25 cycles. While the generator windings are sufficiently rigid to stand the strain of a short circuit under full load, these reactances will reduce the shock on the windings, and will also serve to render the operation of synchronising the machines easier and safe.

In addition to the direct-connected exciters, two motor-driven exciters were supplied, each consisting of a 100-KW., 125-volt, 500-R.P.M. generator, direct-connected to a 150-H.P., 2,200-volt, 25-cycle squirrel-cage type induction motor.

On account of the great distance, the current is transmitted at a voltage of 44,000 from the power stations to both ends of the canal. The step-up transformers are, however, not located in the power plants, but in sub-stations in their vicinities; therefore, the power plants generate and distribute only 2,200-volt current. The system of connection throughout employs the double bus-bar, double-switch scheme, with provision for disconnecting any oil switch for cleaning or repairs without interrupting the circuit.

The main switchboard is of the benchboard type, with vertical rear board for relays, watt-hour meters, graphic instruments and the control battery equipment. The switchboard and all control apparatus were built by the General Electric Co. On the top of the switchboard is a second story, for the electrically-controlled generator and exciter rheostats. The first panel from the left in the benchboard controls the exciters, the next three the generators, and the remaining four the 24 feeder circuits. The system of connection is represented by dummy bus-bars of polished copper on top of

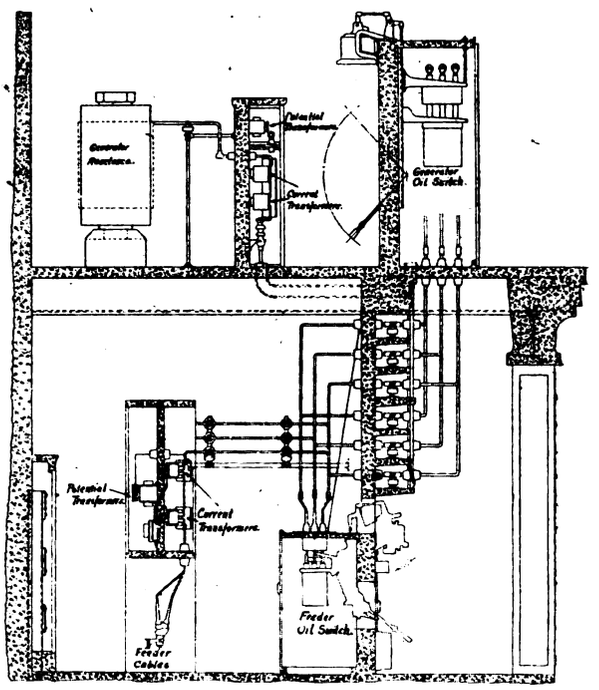

FIG. 8.—ARRANGEMENT OF SWITCHING APPARATUS IN GATUN HYDRO-ELECTRIC STATION.

the bench. The interior view of the benchboard shows the arrangement of operating bus-bars and fuses, potential buses, instrument resistances, and the channel iron risers with distributing tubes, which carry the instrument and control leads to their points of connection on the board.

A generator voltage regulator, transferable to either of the two sets of bus-bars, is installed on a separate pedestal which also carries the synchronism indicators and clock. The electrically-operated exciter switches and field switches are mounted on a separate board.

The bus-bar and switch compartments are located on two galleries. On the upper gallery are the control board near the end of the station that may be extended, the generator reactances, a compartment for generator current and potential transformers, and the generator oil switches. From the oil switches, connections are made through the floor to the bus-bars on the gallery below, on which gallery are also the feeder oil switches, and the compartment for the instrument transformers and cable bells. On the main floor just below this gallery is the cable vault with racks for the feeder cables.

All the compartments are built of concrete with flame-proof doors. The bus-bars and connections are made of solid copper rods of sufficient size to give a rigid construction even where the current is very small. After installation, the bus-bars and connections and all joints were heavily insulated with varnished cambric to make them perfectly safe.

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The complete hydraulic equipment for this installation was designed and built by the Pelton Water-Wheel Co., and all the electrical apparatus by the General Electric Co., U.S.A. The details of design and manufacture of all this apparatus were subject to the approval of the Isthmian Canal Commission's engineers. The shipping weight of the material furnished by the Pelton Water-Wheel Co., including the auxiliary electrical apparatus purchased by them from the General Electric Co., was approximately 1,000 tons.

We are indebted for the foregoing particulars and illustrations to the courtesy of the General Electric Co., U.S.A., on whose behalf they were forwarded to us by the British Thomson-Houston Co., Ltd., of Rugby.

ELECTRICITY SUPPLIES FOR KINEMATOGRAPHS.

By W. B. S.

As showing the magnitude of the kinematograph business, it is estimated that there are over 6,000 picture houses in Great Britain, three times that number in America, and between 50,000 and 60,000 cinema shows in the world. Even remote corners of Central Africa, India and China have their picture houses. In Manchester there are 94, Glasgow has 40, Liverpool 22, and even in a small town like Selby, with 9,000 inhabitants, there are four cinema houses. It is calculated also that in Britain, with its 6,000 picture theatres, employing more than 100,000 persons, over 8 million people visit these shows every week.

It is proposed in this article to deal briefly with a few of the methods in general practice of obtaining a supply of electricity for kinematograph lanterns, and to indicate some of the arrangements adopted in theatres where the system and pressure of supply from the public mains are not suitable for running a single arc efficiently.

As the cost of electricity bears no small proportion to the total running charges of a picture house, it is interesting, from a financial point of view, to see how far the electricity bill can be reduced by the installation of efficient electrical plant. Neglecting the current required for the general illumination of the interior and exterior of the house, and the energy required for illuminated signs to attract the attention of the public, all of which will depend on local conditions and the enterprise of the promoters, it will be apparent that the greatest saving to be looked for will be in connection with the method of supply to the lantern.

For the proper striking and maintenance of an arc, it is necessary to have an available drop in pressure of about 50 volts across the carbons. The strength of current required depends on the projection (*i.e.*, the distance from lantern to screen), on the lens, the density of the films, and very often on the skill of the operator. In one case 30 amperes may be sufficient, while 60, 80, 100, or 150 amperes may be necessary to give a clear picture in other cases. Coloured films, being slightly denser, require a considerably greater current than ordinary films.

In country places where no public supply of electricity is available, gas-engine or oil-engine generating sets are installed in preference to the older form of limelight. These sets may serve the purpose of lighting the building in addition to furnishing energy for the arc.

Gas-engine sets, either direct-coupled or belt-driven, have been installed in many theatres, and the results obtained quite justify their installation. The consumption of gas per unit generated by the dynamo is 30 cb. ft., so that if gas is sold at 2s. 6d. per 1,000 cb. ft., the cost per unit generated is in the neighbourhood of one penny, neglecting lubricating oil and attendance.

With oil-engine sets the cost of running is greater, an average price per unit generated with such a set being about 2d. with petrol at 1s. 1d. per gallon. Small direct-coupled oil engine sets using petrol or paraffin may be had to suit the purpose in country villages. The travelling cinema show is catered for by several firms who have portable oil engine sets costing about £160 complete with engine, dynamo, resistance, regulator, switchboard, oil-tank, circulating water tank, &c., mounted on a four-wheeled truck suitable for hand or horse haulage. The dynamo of this set is capable of delivering a current of 50 amperes at 60 volts, but larger sets may be obtained if desired.

Where a local authority gives a general supply of electricity it will be more economical and more convenient to take energy from the supply mains. The supply pressure, however, is usually much greater than the voltage necessary for the arc, so that some means of reducing the pressure must be resorted to. Where the general supply is on the direct-current system there are two methods of obtaining the required voltage.

1. By the use of resistances, and
2. By using a motor-generator set or rotary converter.

Fig. 1 shows the connections of a series resistance with three steps giving 20, 40 or 60 amperes. Allowing 50 volts

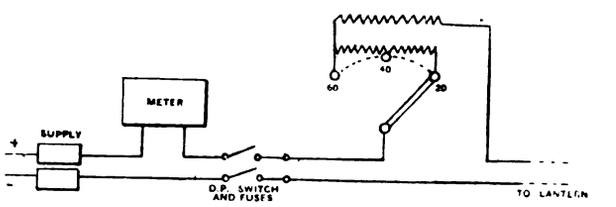

Fig. 1.—Series Resistance.

for the arc, the 60-ampere resistance coil should have an ohmic resistance of—

$$R = E/C = 200/60 = 3{\cdot}4 \text{ ohms}$$

for a 250-volt supply, and be capable of carrying this current for six hours without becoming red hot. The 40-ampere coil should safely carry this current, but as it will be used in series with the 60-ampere coil, its resistance need only be—

$$R = E/C = 200/40 = 5 - 3{\cdot}4 = 1{\cdot}6 \text{ ohm.}$$

For the 20-ampere step, a coil having a resistance of—

$$R = 200/20 = 10 - (3{\cdot}4 + 1{\cdot}6) = 5 \text{ ohms}$$

has to be added, and may be made up of much smaller gauge resistance wire than the other coils.

Fig. 2 is a diagram of connections for a parallel resistance frame with selecting switches to give from 10 to 60 amperes, in stages of 10 amperes. The ohmic resistances of the coils with this arrangement will be 7 ohms, 10 ohms and 20 ohms respectively for 30, 20 and 10-ampere steps.

The waste of electrical energy in resistances is, however, a heavy item, for, assuming a lantern to take 60 amperes at

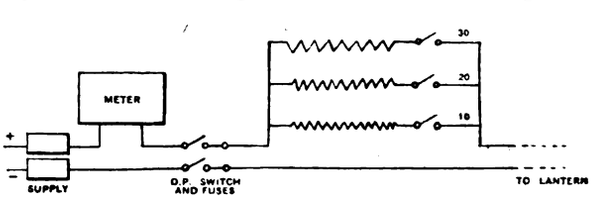

Fig. 2.—Parallel Resistance.

50 volts, from a supply pressure of 250 volts, the energy used per hour by lantern = 60 × 50/1,000 = 3 units.

The energy wasted per hour in resistance = 60 × 200/1,000 = 12 units, so that out of the total energy of 15 units per hour paid for, 80 per cent. is lost in the resistance. The efficiency of conversion is therefore only 20 per cent., and with higher supply pressures the efficiency becomes proportionately smaller.

Almost every picture house supplied from public mains has one or more motor-generators installed to more efficiently convert the energy from the supply pressure to a pressure suited to the arc in the lantern. The motor, wound for any voltage, direct or alternating current, is coupled to a generator giving the required pressure. The saving effected by a motor-generator in the before-mentioned example would be as follows :—

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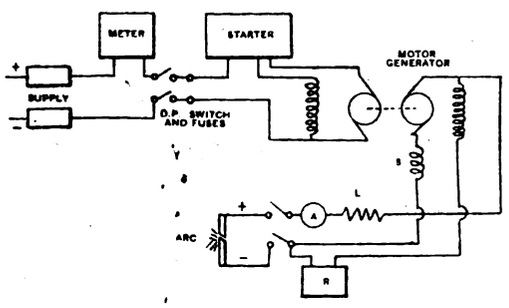
Assuming the motor to take 19 amperes at 250 volts, while the generator delivers 60 amperes at 50 volts, the—

$$\text{Efficiency} = \frac{\text{Output}}{\text{Input}} = \frac{60 \times 50}{19 \times 250} \times \frac{100}{1} = 63 \text{ per cent.},$$

so that out of a total of $4\frac{3}{4}$ units paid for per hour, only $1\frac{3}{4}$ units are lost in conversion. At 3d. per unit the cost per hour of using resistances in the example cited would be 3s. 9d., compared with 1s. 2d. per hour with the motor-generator system. Further reduction in running costs will, of course, be effected where the supply authority allows a reduced rate of charge for motor-generator supplies.

Fig. 3 gives the connections for a motor-generator system with shunt motor, and compound-wound generator. L is the line resistance to steady the current, and R is the shunt



R, regulator; S, series winding; L, line resistance.

Fig. 3.—Motor-Generator Connections.

regulator to vary the generator voltage to give variations in current to suit the particular film being passed through the lantern. Some manufacturers of this type of plant design the generator with a reverse compound winding to give a drooping characteristic curve, as shown in curve A, fig. 4. The object of the reverse winding is to cause a fall in the pressure across the arc as the carbons are short circuited, thus obviating the use of the line resistance. It is not advisable, therefore, to install a generator with a winding such as this if the dynamo supplies a lighting load in addition to the lantern. In such cases the compound winding is designed to give an almost constant pressure at all loads, as illustrated in curve B. Should the lighting load be small in comparison with the current required for the arc, the series coils on the generator may be dispensed with altogether, and the machine arranged to run as a shunt dynamo, giving a characteristic curve, as shown in curve C, fig. 4.

To obtain a higher efficiency with motor-generator sets, most of the manufacturers of this type of plant have adopted

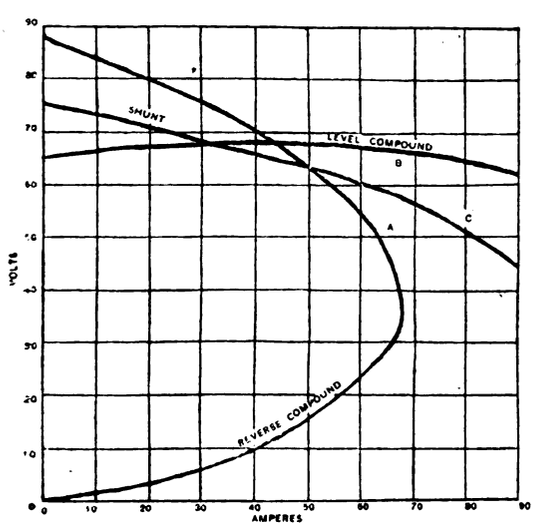


Fig. 4.—Characteristic Curves.

a system of interconnecting the motor and generator windings, and these makers claim that the sets become more automatic in operation by the use of the interconnected windings. In the "Macfarlane" auto-converter—a diagram of connections of which is shown in fig. 5—the set is made up either as two separate machines coupled together, and mounted on one bed-plate, or as two armatures on a common shaft revolving within a single long field system, there being only two outer bearings. Electrically the armature windings are in series, the fields of the motor and generator being connected in parallel across the supply voltage. The motor field is a separately-excited shunt winding, but the generator field, although also independently excited, is

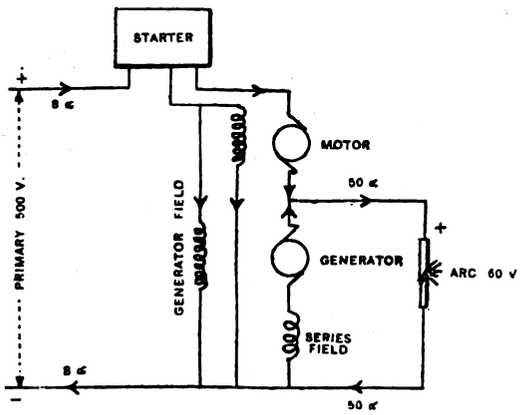


Fig. 5.—Macfarlane Auto-Converter.

opposed by a series winding carrying the dynamo current (not the arc current). The arrangement outlined allows of approximately constant current being obtained for the arc for any value of resistance in the arc circuit (fig. 6), and this is carried out by properly proportioning the values of the shunt and the opposing series windings of the dynamo field. The current flowing through both armatures supplies the current for the arc, and if the carbons in the lantern were to be short-circuited, only a current necessary to supply the no-load losses of the set will be flowing from the supply mains. At full load both armature windings are furnishing a considerable portion of the load current to the arc, but on

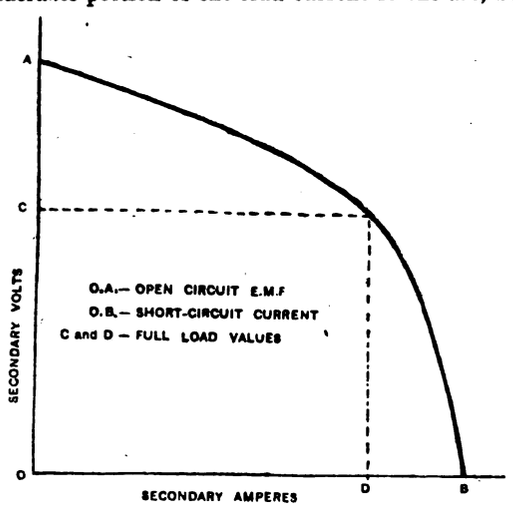


Fig. 6.—Curve of Macfarlane Converter.

very light loads the two machines are acting as motors in series. Hence, it is seen that the current in the dynamo varies from a small value at light loads to a large value on almost short-circuit conditions, and, therefore, the opposing winding on the dynamo field is connected so that it carries the dynamo current. If it is desired to have a short circuit current not greater than, say, 80 amperes, then the windings of the dynamo must be such that on short circuit the opposing series winding will wipe out entirely the effect of the permanent shunt winding, the proportion between the two differential windings being also so arranged that when the normal full load current is taken by the arc, sufficient field is induced in the generator to give the normal voltage required for the arc. The efficiency of this converter varies from 70 to 80 per cent. on full load.

(To be concluded.)

Patent Application. — Messrs. Sparking Plug Patents, Ltd., of Birmingham, are applying for leave to amend Patent No. 5,210 of 1909, granted to Bernard Hopps for "Improvements in and relating to ignition devices for internal combustion engines." See our advertisement pages to-day.

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CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Central Testing Institution.

I have read with interest the recent communications from Mr. Wordingham and from Mr. Dana Pierce, electrical engineer of the Underwriters' Laboratories of Chicago, in connection with the position of British electrical appliances in the Canadian market, and a testing institution for electrical appliances.

I would like to draw attention to one or two essentials in connection with such a proposed testing institution.

It will hardly suffice to establish an institution along the lines indicated by Mr. Wordingham, if such a testing institution is not in a position to enforce its decrees, and compel all electrical accessories manufacturers and the trade in general to install only tested and approved appliances in a proper manner.

The Underwriters (fire insurance companies) of the United States and Canada have established and maintained their own laboratories in Chicago, and all these companies co-operate in enforcing the rules and regulations of their electrical committee, who are in turn guided by the tests of electrical devices by their laboratories. We have here definite conditions requisite for the proper testing and control of electrical devices which do not appear to exist in Great Britain.

Manufacturers of electrical goods will not in all cases submit their materials for tests, nor will the trade be restrained from selling or installing any appliances which may not have been tested or approved by this central testing bureau, unless there is some definite power, either Governmental, municipal or private interest, to positively enforce their decrees. Some combination, such as the Fire Underwriters, having direct commercial gain and loss involved in, and dependent upon, the correct use of thoroughly safe electrical appliances, tested and approved by their own or some authorised bureau, would appear to be necessary.

Safe electrical appliances and their proper installation have a direct bearing on the fire risks of any building, and the U.S.A. insurance companies realising this, have established a definite set of conditions which require that only those electrical appliances which have been tested and approved by their own laboratories shall be installed, and that the installation shall be completed in accordance with their electrical committee's rules—all before any permission is given for the installation to be connected up and any insurance authorised.

If the insurance underwriters of Great Britain could co-operate in the same manner as the underwriters of the United States and Canada have done, and establish their own testing bureau, they could justify the expense involved by the increased safety in fire risks secured. It would seem that the underwriters are in the position where it would be to their interests not only to initiate, but to undertake the full establishment of, such a testing bureau and the classification and approval of all desirable electrical appliances along the lines of the Underwriters' Laboratories in Chicago, whose rules extend over Canada, and have conflicted with many English electrical appliances.

Atlantic.

August 15*th*, 1914.

Electrical Engineers and the War.

Referring to your editorial remarks on the above subject, I should like to remark that upwards of 40 replies had reached me from all parts of the country with offers of help before the I.E.E. had taken action.

However, within two hours of my receiving the particulars of the I.E.E. scheme I called on Mr. P. F. Rowell, and handed to him about a score of replies which had reached me. To those who were members of the Institution replies had been sent, but in a letter to me Mr. Rowell remarked :—"In regard to those who are not members, I do not feel justified in inviting them to fill in these forms, and if, therefore, you should send them any of the forms now sent to you, I should be obliged if you would request each one to give the name of a responsible person to whom reference may be made if necessary." I have acted as requested.

It is apparent to all that overlapping is detrimental to organisation work, hence I enclose an I.E.E. form in my replies to any query reaching me, feeling sure that any effort of mine will not be taken as an attempt to gain notoriety. I am satisfied to know that I first proposed the above organisation.

W. Ellerd-Styles.

Leytonstone, N.E., *August* 14*th*, 1814.

The following is a copy of a letter addressed to me from the War Office, and may be of interest :—

War Office, London, S.W.
August 16*th*, 1914.

Sir,—With reference to your letter dated the 9th inst. asking if the services of trained men drawn from all branches of the electrical engineering will be accepted, I am commanded by the Army Council to express their sincere thanks for the generous and patriotic offer.

The Army Council are, however, of opinion that all the energies of the country should at present be directed to the raising of the new army of 100,000 men, and they regret that until this has been accomplished they are unable to avail themselves of the services loyally offered.

I am, Sir, your obedient servant,
B. P. Cubitt.

There is no reason why we should not organise and prepare.

W. Ellerd-Styles.

Leytonstone, *August* 18*th*, 1914.

Mysterious Behaviour of a Generating Set.

Referring to Mr. Wood's experience with his 750-kw. turbo-generator—the behaviour of the machine is not quite so extraordinary as the behaviour of the attendant.

It was obvious that the connections had not changed themselves over, and therefore it was quite wrong to interfere with these.

I should think that the trouble was due to the instability of the exciter at low voltages, as would be the case if the set were designed to work in conjunction with both exciter and alternator rheostats.

If the main field rheostat was short-circuited, the alternator regulation being obtained by changing the voltage across the exciter, *i.e.*, by means of the exciter rheostat, the straight part of the exciter characteristic would be reached, when the exciter voltage would fall to practically zero. This would mean that the alternator field (also the exciter field which can be neglected) would suffer a sudden reduction in field current, and the induced voltage would discharge itself through the exciter, the effect being to reverse the polarity of the latter.

To bring the polarity back to normal, run the set up with reverse polarity with the main field rheostat short-circuited, then put in exciter resistance until the exciter voltage falls to the critical point, when the field discharge would right the polarity.

To avoid any occurrence of this trouble, the exciter should be made stable by putting liners behind the poles, or a simpler method would be to short-circuit the last steps of the exciter rheostat, so as to make it impossible to reach the critical point. This would mean that a further reduction in main field current would have to be effected by means of the main field rheostat.

W. H. D.

Manchester, *August* 17*th*, 1914.

"Too Old at Forty."

The age limit of 40, and the few exceptional cases in which it is graciously extended to 45, as we see by the advertisements, is becoming a matter of much concern among all branches of the engineering trade. In times of peace it is only now and again possible for anyone to obtain a position when he has passed the age of 45. And now, during

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the war, the Government seems only to employ men under the above age. Yet we are told there is a great need for skilled workmen! I give two instances this week where the age limit was passed, but the wage limit maintained. One of these was offered to me at 35s. per week of seven shifts of 10 hours each, all extra time as required to be thrown in. There was no limit to the number of hours, but you might be required to work above and beyond the stipulated condition. The second was at 30s. per week, and I was to take charge of station, seven shifts, and to undertake to work all hours necessary to maintain a regular supply. The engineer said that he preferred a man of 25, because he could grind a valve better than older and more experienced men. I leave this to the judgment of your readers. The latter position is now advertised, and the wages offered are 35s., with an age limit of 32. Let me give another experience in time of peace, when conditions were normal. I was selected for a position at £150 a year, although no age limit was fixed. I was asked what number of shares I would take if appointed.

Now, Sir, we over the age limit, in good health, are anxious to assist our country, but, until better conditions prevail, we are helpless. We not only see our gallant soldiers, including our own sons, in the fighting line, but the best of our trade goes to other countries. I suppose one reason for young unmarried men being preferred is because they can exist upon a wage of 25s. to 35s. per week. If this state of affairs is permitted and encouraged, where are the reinforcements of willing men to come from? Those who benefit, I think, are chiefly private employers. It is, I think, a rare thing to find either a director or manager in Municipal and Government work under the age of 45. Inexperienced men in authority are mostly responsible for this system of sweating, and the sooner experience gained by age and work is recognised, the better the country will be able to continue its industries without stoppage, under all circumstances over which we have no control. Such a recognition would be a great blessing to men over 45, not only to engineers, but to those of all classes. Many of us are strong, fully able to do all the work required, and with a richer and riper experience than we had formerly. I trust those over the age limit will think better of their behaviour towards us and give us the opportunity to prove our worth at the wage which is necessary for married men. We hear much of patriotism. Why should strong, able-bodied, skilled men in a time of emergency, be refused an opportunity of employment? They are at least as patriotic as the rest of their countrymen.

A. E. Short.

London, N., *August 17th*, 1914.

Manufacture of Carbons.

I should be very much obliged if you or any of your readers could refer me to any publication or printed matter relating to the manufacture of arc lamp carbons or electrodes.

Carbone.

August 17th, 1914.

The War and Trade.

There are many evidences of a tendency on the part of purchasers (by no means the smallest) to take advantage of clauses in their contracts to suspend and delay work on account of the war; and the members of this Association, who employ tens of thousands of working men, are already so affected in respect of contracts representing over a million pounds sterling.

Should such suspension and delay become at all the common practice, the result, for working men, would be disastrous.

One of the primary duties of every Britisher at the present moment is to maintain employment as far as ever possible; and my Council desire to appeal for the prompt and sympathetic consideration of this question by all present or prospective purchasers of electrical goods, and goods used in connection with electrical work.

Our own Government, by common consent, has set an excellent example, financially and otherwise, and has given every assurance towards allaying traders' fears.

The Colonial Governments have done the same; notably the Australian Government, who have publicly exhorted their own importers to keep up and extend trade with Britain, recognising at once the extremely important issue involved, both now and in the future.

On behalf of the Council of this Association, I commend this matter to your earnest consideration.

F. R. Davenport,
Chairman of Council, The British Electrical and Allied Manufacturers' Association.

London, W.C., *August 14th*, 1914.

THE WAR AND THE ELECTRICAL INDUSTRY.

Our correspondent in the Yorkshire West Riding sends us the following as the result of special inquiries:—

It would be difficult to find any other trade in the Yorkshire textile district in which the war has occasioned less disturbance than in the electrical industry, if it is regarded in total. The sources of raw material are, of course, restricted. In some small measure skilled labour has been called to the fighting front, but the withdrawal has been mainly of unskilled labour, which could be replaced without any great difficulty. Credit has to be extended somewhat, but is not materially shaken. Work in progress is delayed, and for the home market many orders are suspended indefinitely, but the way that orders are coming in is surprising, and indicates in a remarkable fashion the confidence which the British people have in the future of this country, notwithstanding the perils of the time, and the feeling everywhere outside of the enemy's territory that Great Britain is standing on an immovable basis.

The largest of the electrical manufacturing places in this district are now working night and day in full shifts. There is no prospect of any diminution of that activity, and though even the first call of the country for Reserves—those on the Naval Reserve—took many labourers from the test beds and other departments, the deficiency was soon made up. Inquiries are coming in practically as freely as before, and new orders are fully three-fourths of what might have been expected at this time of the year if peace conditions had prevailed. Of course, there will be certain limitations, particularly in the nearest market, that of the textile West Riding itself. Further electrification of textile mills is not within reasonable probability at present, for the staple industry of this district has been badly hit by the war. It sends goods to Germany in normal times in heavy quantities, particularly of yarn, and Germany owes it a great deal of money, as to the chances of ever getting which, perhaps, the less said the better. For want of the money due by foreign countries, mill developments must be arrested in a very large measure indeed. The only textile mills which are busy are those working on khaki. Of the others it is a gruesome fact that all who can do so are turning their attention to the production of black goods. Then, again, Corporations realise that their possibilities of rate laying must be contracted, and are now restricting their electrical orders to the narrowest possible limits, so that developments in this direction may be much restricted. *Per contra*, there are the possibilities arising from the activity of those industries engaged upon goods required in the war, the number of which, presumably, will make an ever-widening circle until peace is declared. And also it would be like shipping coals to Newcastle to remind observers of the fact that German competition in respect of anything in this country is ended for the present. *A propos* of this point, however, the extent to which orders placed in Germany before the outbreak of the war have failed in execution, and are never likely to be executed now, is a material consideration. There is, for example, the instance of the turbo-alternator ordered by the Bradford Corporation from a German firm a few months ago at a cost of about £10,000, and not delivered. War, or no war, the Bradford Corporation must have that machinery—the ordering of which from Germany, it will be remembered, roused such indignant protest from manufacturers in this country—and in all human probability Germany will never supply it. In regard to a host of orders, German competition has ceased not only prospectively but retrospectively; and though the cheap Belgian steel and German copper will no longer be available to the English electrical manufacturers, and the cost of such raw materials will probably go up 20 per cent. or more, the consumer will have no option but to pay.

Whilst on a balance of gain and loss the total effect of the war on the home market is expected to be somewhat restrictive, and the distributors in that market are rather anxious as to the effects of increased prices and long credit and doubtful solvency in the cases of some of their local customers, the brightest hopes are entertained of the over-sea trade so long as the British Fleet can continue to render the magnificent service that it had been doing for the nation up to the time of the writing of these notes. The extent to which German competition had cut out British business

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in foreign and colonial markets had not been quite fully realised here before the outbreak of war led people to examine the position rather more closely, and now it is taken for granted that, first, by effect of the actual suspension of production in Germany, and the practical, if not complete, paralysis of shipping from Germany, and later, on account of the world-wide sentiment of resentment against the German nation and the universal injury inflicted by its plunge into war, the competition from the Fatherland will be ineffective for a long time to come. It is pointed out that there is absolutely nothing in the electrical industry for which the world is dependent upon Germany or which cannot be supplied by British makers; and, therefore, so far as the open sea routes are concerned there should be no diminution of demand, but merely a concentration of requirements upon the books of British and American makers, with a large part of this increment coming the way of this country. Especially is the benefit in this direction expected to be derived from Canada and Australia, which hitherto have been largely supplied by Germany. One of the largest merchant buyers of Canada said to a traveller from this district, less than a month ago: "There is absolutely no chance of your doing business here. We are fixed up with a large German house who give first-class supplies and excellent deliveries, and we are fully contracted up with them for several years." And now that is all a thing of the past. In dynamos almost the whole of the trade below 1 H.P. has been done by the Germans, and that has been a tremendous handicap to the smaller English firms which will now be removed.

The Yorkshire electrical machinery makers are, indeed, already inundated with applications for places on the staffs by people who have been representing the German houses in this country, and recognise that their occupation has gone.

The only thing needed, in the judgment of the electrical people whom our correspondent has seen with reference to the matter, is the maintenance of confidence and credit, and in this part of the country, at any rate, there are no fears. A little fright on the part of one or two of the local banks in the first days after war broke out, has been quite overcome. It was due chiefly to the fact that the textile trade is so largely run on the basis of bills. Now that the Government have arranged to back the Bank of England in dealing with bills, confidence is fully re-established hereabouts. Sufficient assurances have been given by customers as to payment; and orders for electrical machinery and appliances are being taken freely without it being considered necessary to improve any abnormal conditions at all.

A few words only in conclusion need be said in regard to labour and employment. There does not appear at present to be the remotest fear of short time; but if diminution of labour should become necessary the general intention throughout the textile district of the West Riding is to keep all men going and so distribute the wage loss evenly over the staffs. Very little skilled labour has been withdrawn from the electrical industry for active service, either on our side or the enemy's. The great exodus of Germans from Bradford and Leeds related almost wholly to the textile houses. It is not too much to say, therefore, that so far as the industry in this district is concerned, there has been absolutely no loss of human efficiency that could not at once be made good.

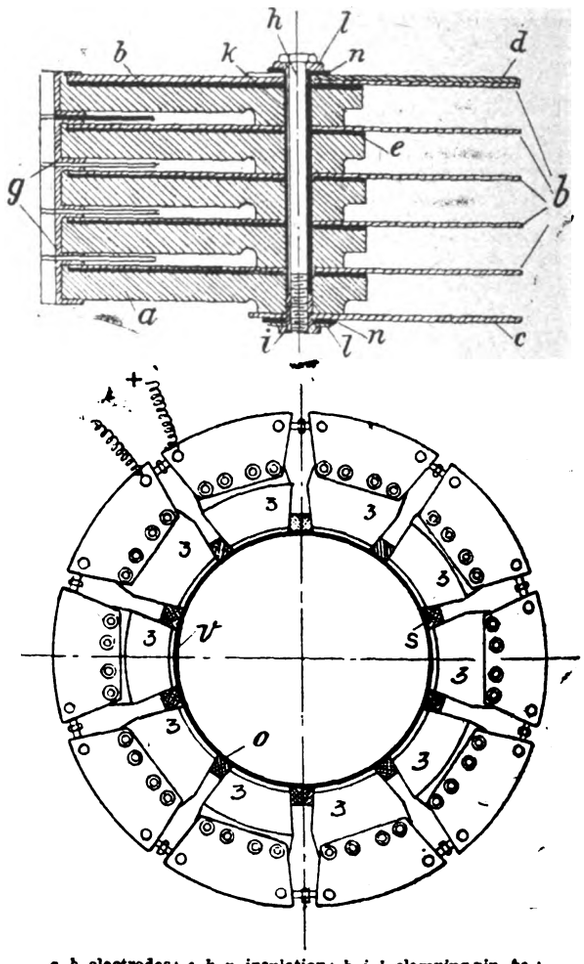
Our correspondent finds nothing but optimism among the representatives of the industry in this district in conjunction with a pronounced wonder and thankfulness that, on the face of things, affairs look so well under such a trying test, and praise is being lavished upon the Government in respect of the measures which it has taken for securing public safety and averting public panic.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

A Thermo-Electric Generator.

An apparatus has been devised by J. Marschall, of Dresden, with a view to overcoming the difficulties hitherto experienced in the thermo-electric generation of electricity and to making the system practicable on a fairly large scale. The Marschall "thermo-column" consists of an aggregate of flat cells shaped as shown in fig. 1; the inner ends of the elements, which are heated, are metallically cemented together by electrolysis, while the outer ends of unlike elements of adjacent cells make contact with one another and carry metal cooling vanes. The cells are bolted together in groups, which are nested round a central heating tube as in fig. 2, and the whole is enclosed in a casing through which air is circulated to cool the exposed ends, whilst highly-heated gases pass through the heating tube. Solid fuel may be used, burnt in an external furnace, or oil or producer gas. The cells are connected up in series or parallel-series according to the voltage required.

The positive electrode is composed of a special alloy and the negative of an alloy of copper and nickel, stamped in the form of a plate. Mica or asbestos separates the two electrodes of each cell. In an experimental apparatus 800 cells were employed, in groups of five. The external dimensions were 2 m. × 0·65 m. × 1·35 m. high. It is stated that the consumption of fuel was 2·5 kg. of lignite per KW.-hour, costing ·7d., and the apparatus is said to have cost £32 10s. per KW. of output to manufacture. Starting from these figures, the promoters build up estimates showing a yearly output of 7,500 KW., and net profits of £120,000 a year. According to Prof. Kollert, of Chemnitz, with a hot-junction temperature of 369° C., falling to 56° at the cold junction, the E.M.F. of a single



a, b, electrodes; e, k, n, insulation; h, i, l, clamping pin, &c.; c, d, auxiliary plates; v, heating tube; 3, 3, element piles.

Figs. 1 & 2.—Marschall Thermo-Electric Generator.

cell was 0·077 volt, and with a current of 28·2 amperes the P.D. was 0·0412 volt, the internal resistance, therefore, being 0·00127 ohm and the useful output per cell 1·162 watts.

Electric Drive in the Bakery.

In the bakery business, where it is impossible to secure too good a production of the manufactured article, the regular and uniform driving of the machinery, especially in the preparation of dough, is of the utmost importance. Fig. 3 shows two Vickers motors, each of 15 H.P., operating a large dough mixer and a machine specially designed for the cutting up of dough into biscuit form,

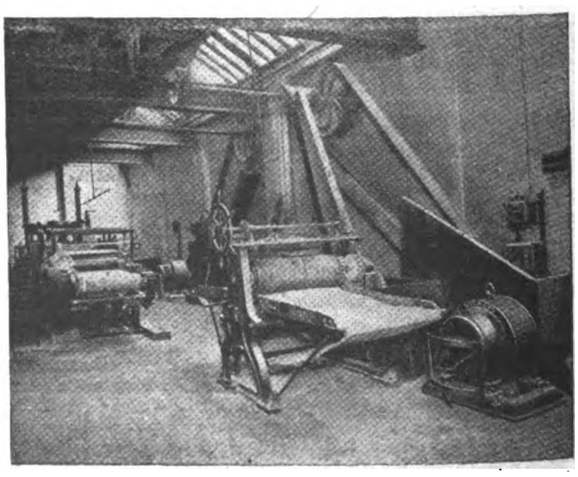


Fig. 3.—Vickers Motors in a Bakery.

and delivering same to the ovens ready for baking. A smaller Vickers motor of 7½ H.P. is also to be found in another part of the premises.

Each control gear set is of the Vickers well-known double-automatic panel type, with 100-ampere double-pole ironclad switch and fuse, and an ironclad three-way D.P. distribution box, for use in connection with the motors. All the apparatus is suitable for use on a 460-volt circuit.

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The motors and switchgear are installed on the premises of the Far-Famed Cake Co., Ltd., Bromley-by-Bow, and the whole of the installation and wiring work was carried out by Messrs. J. B. Marr & Co., of 53, Victoria Street, S.W.

Wotan Traction Lamps.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, have been engaged in the production of lamps for traction purposes for the past five or six years, and their tantalum traction lamps have been used on all the principal tramways and electric railways. They have now introduced a new Wotan helical traction lamp with a spiralised filament carried on a spider in the usual Siemens manner, but instead of being wound up and down, as has been the case previously, the spider is arranged so that equal lengths of filament are carried vertically and horizontally. By this means neighbouring lengths of filament do not run parallel to each other, as with the existing method, which is liable to cause twisting or short-circuit of the filaments owing to vibration, but are set at right angles, and no bend is greater than a right angle. In practice, therefore, it is impossible to obtain a short circuit even under the most violent jars or vibration, and the lamp is equally strong when used in any position. The new arrangement accounts for a considerably increased spherical candle-power, as the light given is practically uniform in all directions other than the cap-end. The distance between the top and bottom supports of the spider is in no case greater than ¾ in., in order to provide the lamp with a mechanical supporting strength hitherto unobtained, and it is practically impossible to break the filament or stem without breaking the glass of the bulb.

Most exhaustive tests have been carried out on these lamps under severe artificial conditions of vibration and on rolling-stock in use, and with every satisfaction.

Fig. 4.—Wotan Traction Lamp.

The Fullarton Vibrometer.

The above instrument has been introduced by Messrs. Kelvin, Bottomley & Baird, Ltd., of 16, Cambridge Street, Glasgow, to enable the engineer to measure the comparative intensity of vibration of running machinery from time to time. As with a large machine vibrating, everything about it is also in a state of vibration, an instrument is required which can be securely attached to the machine itself, and which will vibrate with it and operate independently of any fixed point.

The Fullarton Vibrometer is light (weighing 1¼ lb.), rigidly built, and so constructed that it can be easily attached to turbines, generators and such plant.

Fig. 5 shows a complete instrument ready for use. It consists of a frame C, with a spanner-shaped arm A suitable for clamping to the machine.

The frame carries a vibrating reed B, of flat metal, of known uniform thickness, clamped at the bottom H, while the carrier body on which the frame moves is provided with a spring-jaw K, embracing the reed and forming the base about which it vibrates. By manipulating the screw D, the free end of the reed is altered in length and "tuned." A millimetre scale on the side of C gives the free vibrating length of the reed, while the amplitude of vibration is measured on a moving scale G at the top of the sliding frame. Different thicknesses of reeds may be used for different speeds, and it is evident that the instrument may be used as a frequency indicator, or as a check on speed indicators attached to the machine.

The reeds are carefully calibrated for every instrument sent out, and "speed, reed length" curves supplied with each vibrometer.

In taking readings it is necessary to tune until a maximum amplitude of reed vibration is obtained, and the instrument is constructed so that it can be turned about both its vertical and horizontal axes until this is found, the angles in each case being indicated on scales provided.

With turbines which are only out of static or knife-edge balance, the vibration will be in a plane at right angles to the shaft, and the maximum will usually be found when the top of the instrument is leaning outwards from the shaft at an angle of 10° to 15° to the vertical.

With some machines out of dynamic balance the maximum resultant vibration is not in a plane at right angles to the shaft, and the instrument must be turned in a horizontal plane to adjust for this.

The vibrometer is claimed to provide a ready means of investigating vibration problems in high-speed rotary plant; folded away neatly in a case, the weight complete is 3 lb.

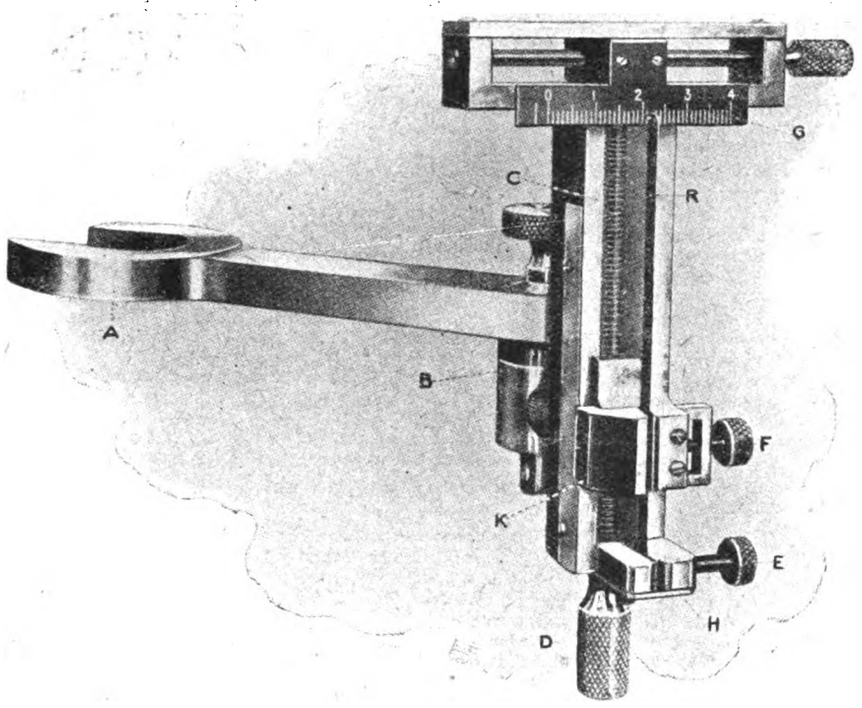

Fig. 5.—The Fullarton Vibrometer.

WAR ITEMS.

Owing to the unsettled conditions due to the war, the General Electric Co., Ltd., inform us that they find it necessary to withdraw all outstanding quotations and special terms, and may be prevented from adhering to guarantees with respect to deliveries. All their factories are being kept open, and large stocks are available.

The Walsall Electrical Co., Ltd., have had to withdraw all outstanding quotations owing to the rise in price of raw material.

Messrs. A. P. Lundberg & Sons write pointing out that they are not dependent on Continental supplies; they have no factoring interests, and are essentially an English manufacturing firm of over 32 years' standing. Their senior partner is a naturalised Englishman of Swedish birth, who has resided in this country for over 50 years; the junior partners are London born, the sympathies of the firm are entirely British, and their capital is all invested in this country.

Mr. John Pendreich, of the Pendreich Electrical Firm, Edinburgh, begs to announce that his address is as follows:—S/25511 John Pendreich, Army Service Corps, on the Staff of Supply Officer, Divisional Troops, 3rd Division, British Expeditionary Force, in France or Belgium.

Messrs. H. Hartjen & Co., state that theirs is a British firm, of which the sole partner is an Englishman born; the name alone is of foreign (Norwegian) origin.

A fund for the relief of dependants of tramway and electric supply men who are called on service has been established by about 40 tramway and electrical companies in the British Electrical Federation. It provides for the companies subscribing an amount equal to the total contributions made by the employés who remain at work. The contributions of the companies will not be less than 3d. per week in respect of every man in their employment.

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Owing to the war the Dartford coal contract for the U.D.C. electricity works has been declared off. The Council has authorised the Electricity and Tramways Committee to purchase supplies as may be necessary.

Messrs. H. Wiggin & Co., Ltd., of Birmingham and Sheffield, announce that owing to the increased price of raw materials they have been compelled to advance the price of German silver by 1d. per lb. all round, with the exception of cut out and stamped blanks.

The Yorkshire Electric Power Co. have made generous arrangements for helping the wives and children of Reservists employed by them and who have been called up for service.

Messrs. Brown & Co., of Waterloo Sawmills, Glasgow, announce that owing to the war, which is causing the cessation of shipping from ports, timber and other raw materials are not forthcoming, and as stocks in the district are exceptionally low and prices high, they are obliged to intimate an advance on present prices. Advances may continue from time to time owing to circumstances.

The Hoffmann Manufacturing Co., Ltd., of Chelmsford, Essex—an entirely British concern—is working at full pressure. Although the staff has been considerably depleted by the "Call to Arms," matters have been swiftly adjusted, so that there will be no delay in execution of bearings orders in hand, many of which are for contractors to the Admiralty and War Office.

The India-Rubber, Gutta Percha and Telegraph Works Co., Ltd, of Silvertown, have decided to pay half wages to the wives or dependants of all employés called up, throughout the period of their service with the forces, and, in addition, to find employment for them on their return.

The directors of Messrs. Ibbotson Bros & Co., Ltd., steel manufacturers, of Sheffield, are asking their shareholders to sanction the expenditure of £10,000 for providing for the needs of wives and families of employés serving in the war.

National Relief (Prince of Wales') Fund.—At a meeting of the City of London Committee at the Mansion House, on August 11th, the following resolution was unanimously passed:—"That this Committee, called by the Right Hon. the Lord Mayor to consider the question of distress arising from the state of war, urgently and respectfully appeals to all employers of labour in the City of London to do their utmost to avoid distress by providing whole or part employment for their employés."

As might have been expected, merchants and manufacturers in the United States have not been slow to recognise that they have the chance of a lifetime to secure large business in markets which they could not successfully enter previously. The New York correspondent of the *Times*, in alluding to the matter, says that the vast supplies required by the belligerent nations can be more readily obtained in America than elsewhere, as they will be free both to produce and ship goods. This, it is considered, should afford American business houses generally an exceptional opportunity for increasing their trade, especially in South American countries, by capturing a large part of that heretofore enjoyed by Germany. To this end official information is being promptly prepared for the guidance of American manufacturers, exporters and others, showing the extent of the commercial and financial dependence of South America upon Europe. It is urged, however, by those in authority that any such steps should be taken on the basis of assisting South America, that is with a view to securing immediate benefit rather than capturing permanent trade connections.

The *Times* says:—"Over 100 mills in the Welsh tinplate trade, which has Swansea as its centre, are being re-started, and this will give direct employment to over 5,000 men, and indirectly to many more. With competition from Germany eliminated, a boom in the Welsh tinplate trade is expected. Prices have already risen."

Sir Algernon Firth is reported as follows in an interview recorded in the *Daily Telegraph*:—"Very shortly there will be nothing to prevent our export trade, except to the Continent of Europe, going full speed ahead, and, if I have any suggestion to make as to the direction our activities should take, it would be that we should seek out where the Germans have been doing business up to the present, and take it from them. On this point, the statistics of exports from the German Empire, as published in our Blue Books, are worth careful study, and I intend shortly to issue a statement on this subject through the Association of Chambers of Commerce." Sir Algernon said that the future was full of hope. The Government, aided by the best men of both parties, had done marvellously well in dealing with a situation of unprecedented difficulty and magnitude, and it was for our traders now to go ahead with confidence and courage.

With reference to the important movement now on foot to render this country and some other large markets less dependent upon German manufactures, the *Standard* says that London business men are planning a well organised campaign to this end. We hope that British electrical manufacturers will take full note of what is being done in this general trade connection, and endeavour to follow it out in connection with our own particular industry. The scheme has been initiated by the National Patriotic Association, which exists primarily to prevent distress and assist recruiting, and which soon discovered that many British wholesale firms were at a standstill, as they could not obtain the German-made goods in which they dealt. The Association thereupon set itself to put these firms into touch with English manufacturers, and this plan has already met with great success. Important daily conferences have been taking place at 32, St. Paul's Churchyard, E.C., between importers and manufacturers. The former put on the table samples of the goods they have been getting from across the North Sea, and state the price they have been paying. The British manufacturers then discuss with them whether we in England cannot step in and take Germany's place. Where this is assured the threatened unemployment is, of course, at an end. What may prove finally of much more importance, is the hope that during the war we may grow used to making goods on the German system, and thus obtain a grip on the world's commerce which Germany will never in the future be able to force us to release. In the opinion of many well qualified to speak, the present war will largely solve the problem of unemployment in this country. This is, of course, only if business men here grasp the opportunity that now presents itself.

Sir George Pragnell, the chairman of the Association, is reported thus:—"Now is the opportunity for our manufacturers to get together to study German samples, prices, and methods in order that our own factories shall in future make the goods which we have hitherto obtained from Germany. Our own manufacturers should carry the war into the enemy's commercial camp, and so secure a large proportion of German trade all over the world. German manufacturers have closed their works, and it will be a long time before their factories are open again and their travellers in a position to take orders. We have now the finest possible opportunity to secure that business, and so find employment for every British man and woman. What the Germans can do we can do if we rise to the occasion. We must put down new machinery, and utilise new methods in order to secure the German trade."

The London Chamber of Commerce, through a special Committee of experts, has been considering a number of problems relating to contracts in war time, and it has issued a circular to its members respecting some of these. They relate to liability for war risks under c.i.f. contracts, the limitations in regard to dealing with the subjects of alien enemies, payments due by British firms to alien enemies, the legality or otherwise of making contracts with alien enemies, the legality or otherwise of completing during war contracts entered into with alien enemies during time of peace, &c.

A correspondent, writing to the *Near East* under the title "Electrical Goods in Turkey," says:—"Turkey has for long been a large purchaser of German wares, particularly those required for illuminating purposes. Included among them are all varieties of electric lamps and fittings, gas apparatus, and incandescent mantles of all descriptions, for which there has been an increasing demand in the Ottoman Empire for 10 or more years. A report recently issued by the French Chamber of Commerce at Constantinople points out that, with the exception of the competition of France, Germany has enjoyed practically a monopoly in the supply of electric and gas requisites for lighting purposes. Indent agents in Turkey and the Near East are cosmopolitan in their business ideas and business methods. They are just as anxious to fill orders for British as for German manufacturers if terms are anything like equal. We have authority for stating that some of our home manufacturers at least are reversing this, and that within three months Turkish buyers particularly will have price lists and catalogues printed—in their own language—which will convince them that England is still the workshop of the world, with resources even superior to those of the country with which she is now at war."

It is stated that a Territorial while guarding the Metropolitan line near Royal Oak Station was knocked down by a train. He was seriously burned by contact with the live electric rail, and died soon afterwards.

The *Times* reports that the Institution of Mechanical Engineers has offered the use of the vacant top floor (of the extension building) free of charge during the continuance of the war for the administrative purposes of the Prince's Fund. The offer has been accepted, but the Institution has been asked (and it has agreed) to allow the rooms to be used by the Office of Works for the purpose of accelerating the designs and specifications for many public works which it is intended to put in hand as quickly as possible, in order to give employment.

The Commercial Intelligence Department of the Board of Trade, 73, Basinghall Street, E.C., places itself freely at the disposal of British manufacturers in their efforts to capture German and Austrian foreign trade. The Department invites importers of articles from these countries to afford particulars of their precise nature and quality, in order that steps may be undertaken to ascertain whether similar goods can be produced in this country, and if so, where; or if not, from what neutral sources they can be obtained.

We welcome the promptitude of the Board of Trade in proceeding with a campaign to assist and supplement the efforts of British manufacturers and traders to take advantage of the present opportunity to establish themselves in foreign and Colonial markets in branches of trade which have hitherto been largely in the hands of their German, Austrian or Hungarian rivals. On Wednesday morning we received a number of documents and pamphlets, forming part of a series of similar monographs on special groups of trades, which the Board's Commercial Intelligence Branch is issuing in pursuance of this scheme, to British Chambers of Commerce, Trade Associations, and also direct to a large number of British manufacturers and merchants. The trades dealt with in the memoranda already issued are:—Cutlery, iron and steel wire, hollow-ware (enamelled or tinned), woollen and worsted piece goods, and cotton hosiery (stockings and socks).

The next instalment was to be issued in the course of Wednesday, covering electrical machinery and appliances, and cotton prints. Memoranda on a number of other trades, including, among others, furniture, pottery, paper, clothing, chemicals and dyes, certain classes of machinery, boots and shoes, gloves, and certain classes of iron and steel, will be issued in rapid succession.

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Everybody recognises how important the matter is from the point of view of preserving continuity of employment for our industrial population, to say nothing of the possible ultimate gain to British overseas trade. We understand that the issue of the circulars and memoranda is only the first step. The Director of the Commercial Intelligence Branch will be ready to receive and answer personal and written inquiries for further information with regard to particular trades and markets. The Board of Trade is also obtaining information through H.M. Trade Commissioners and Consular Officers as to the commercial and financial situation in the Dominions and foreign markets, and particulars on this subject will be circulated in the course of a few days for the guidance of British exporters. We hope that the electrical trades will take advantage to the full of this timely co-operation on the part of the Board of Trade.

It has been decided to postpone the Shipping, Engineering and Machinery Exhibition (Olympia), which was to have been held in September and October, to a period between July 13th and September 14th, 1915, which will be fixed in consultation with the Hall authorities in the beginning of 1915. The Executive Committee placed before the exhibitors two alternatives, one for the postponement as above, and another for cancellation of Exhibition on certain conditions. A large majority of the exhibitors agreed to the postponement of the Exhibition to next year.

Messrs. Marples & Leach inform us that there appears to be an impression that the Adnil Electric Co., Ltd., are solely dependent for their supplies upon German manufacturers, and they request us to reassure the trade on this point. Their Century motors are manufactured by the Century Electric Co., St. Louis, Mo., U.S.A.; of their wide range of electric fans a large proportion emanates from America, and their patent Beedle blade exhaust fans (A.C. and D.C.) are, and always have been, of English manufacture throughout. The firm have arranged to hold a good stock of British-made motors and dynamos.

The Belgian Minister in London has opened a fund to relieve the distressed families of the Belgian soldiers now in the field, who are gallantly defending their country against an unprovoked attack, and to afford help to the sick and wounded. In making this appeal to the British Public, the Belgian Minister feels sure he can count upon their sympathy in Belgium's hour of need. Contributions may be sent to the Belgian Legation, 15, West Halkin Street, S.W., or to Louis Godchaux, President of the Belgian Chamber of Commerce in London, 155, Fenchurch Street, E.C., marked "Belgian Relief Fund." All contributions will be acknowledged through the *Public Ledger*.

Germany has been exporting over £27,000,000 of goods per annum to Brazil, Argentina and Chile. A writer in the *Globe* suggests that manufacturers whose travellers have been diverted from the Continental countries engaged in the war, might consider the desirability of utilising their services wherever possible on ground hitherto worked by the travellers of the big German houses.

We suppose the Press has seldom been so unanimous as it is in its view of the opportunity for increased trade that the war will bring to the United Kingdom. The *Westminster Gazette* remarks:—"Splendid opportunities are being offered to the enterprising manufacturer in certain departments of trade, and if capital can be obtained the end of the war should see new industries firmly established in the country. . . . . The end of the war should see the English electrical industry in a far more secure position than it has occupied hitherto."

The Montreal financial correspondent of the *Times* says:—"Many Canadian manufacturers are favourably affected by the decline in imports from European countries, and will be in a position to handle the requirements of the Canadian market without meeting the usual competition, for the coming season, at least." The New York correspondent of the same paper names a number of important factories—making scales, photographic supplies, shoes, &c.—which have been shut down in consequence of the war. Cessation of exports is described as the cause in certain cases.

We regret to read that the works of Messrs. Howard and Bullough, Ltd., at Accrington, have been closed owing to labour troubles. Although the firm's Russian markets were stopped, they were prepared to go on manufacturing for stock to the extent of a million sterling until the war was over. Nearly 1,000 employés returned to work on Monday, but 500 members of the A.S.E. refused to do so until their terms were agreed to. On Monday night there were riotous attacks upon non-Unionists, and the works have had to be entirely closed, 5,000 workers being thus rendered idle. We cannot believe that the A.S.E. will be prepared to carry responsibility for what can be little short of a catastrophe at such a time.

Considerable alarm has been felt by the cable companies in the United States, according to the New York Press, owing to the reported presence near the coast, of German warships supposed to be watching for an opportunity of cutting the Atlantic cables, but so far the fear has been proved groundless, and confidence has been again restored. Apparently so far the only cable-cutting has taken place at the Azores, where the German cables land.

As we go to press, we learn that the Institution of Electrical Engineers has received about 1,000 replies from electrical men willing to place themselves at their country's disposal. These replies are being rapidly classified and indexed, and the War Office and Government departments have been advised of what the Institution is doing. A circular is being sent out to all electricity supply departments and companies, and lists have been prepared of engineers who are willing to fill vacancies in the public services.

VICKERS EXHIBIT AT THE ANGLO-AMERICAN EXHIBITION.

A usual feature of the Shepherd's Bush Exhibitions, which should this year attract more than usual attention, is the comprehensive display of war and other material made by Messrs. Vickers, Ltd.

Numerous models of war vessels, including a submarine, and examples of modern artillery are on view, and in addition, interesting specimens of metal work, including steel and various alloys—notably duralumin—occupy a prominent place.

The latest practice in high-speed drilling and accurate reaming, with vanadium twist drills and adjustable reamers made by the firm, is shown.

All the machine tools are operated by Vickers motors, with the firm's control pillars, and an electric power and lighting supply is obtained from a Vickers train lighting and ventilating plant.

This lighting equipment has been described in our columns: as an additional feature Messrs. Vickers have developed a type of electric car heater which can be used with it, and two such heaters, of 1,500 and 500 watts respectively, are shown suitable for a 24-volt circuit.

An additional feature of this exhibit is the periodic cinematograph displays, showing launches of battleships, machine shop operations at the Sheffield and Barrow Works, gunnery demonstrations, &c.

LEGAL.

Workmen's Compensation Claim.

At Northampton County Court last week, his Honour, Judge Radcliffe, K.C., heard an application in which Mabel Evelyn Eydmann, widow, made an application under the Workmen's Compensation Act, the respondents being the Premier Accumulator Co., Ltd. Applicant also claimed on behalf of Harold Eric Eydmann, an infant, as next friend.

Applicant's husband, Harold Eric Roy Eydmann was employed by the respondent as an ignition hand. It was alleged that on April 7th, 1914, he was engaged at Northampton generating station, packing up lead-lined boxes; one of them slipped and a projecting piece of lead caught his thumb, from which injury he died on May 31st. The defence was that the accident did not arise out of and in the course of his employment by respondents, also that no notice of the accident was given as required by the Act.

Dr. Pettit, who saw deceased on May 4th, said he told him he had cut his left thumb some time before. There was a healed wound, and as he was suffering from septic poisoning witness sent him home to bed. He died from blood poisoning.

Applicant said when her husband went home to dinner on April 7th, he had a bandage on his left thumb. He did not go to work after May 4th as the doctor sent him to bed. Applicant said she called at the works and saw Mr. Slatter, who said he would write to the insurance company. An appointment was made for her to see Mr. Stevens, but he was in London. She subsequently put the matter into the hands of a solicitor.

Charles Arthur James Waters, general hand employed by the company, gave evidence as to deceased cutting his thumb.

His Honour did not hold with the contention that the respondents were prejudiced through not having notice of the accident. He gave judgment for the plaintiff, and agreed compensation of £243 14s. Stay of execution was allowed upon payment of £30 into Court for the widow's pending expenses.

Licensing Motor Vehicles.

A decision affecting all traders who utilise motor vehicles in the course of their businesses was recently delivered by the Bradford stipendiary magistrate. The case concerned the Bradford Pure Ice Cream Co., Ltd. The question arose whether a motor-car used by the defendants for trade purposes came within the exemptions to duties of excise for carriages as stated in Section 4 of the Customs and Inland Revenue Act, 1888. It was not suggested that the car had been used for any other than the above purposes, or that there had not been some adaptation of the car from its original condition as a pleasure car for such use, but it was contended that the adaptation had not been enough, and that therefore the exemption did not apply.

As, in the present case, the motor-car was not constructed solely for the conveyance of goods or adapted for the conveyance of goods, the magistrate held that it was not exempt from duty, and the defendants were fined 10s. and 7s. costs.

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THE PERFECT SYSTEM.

By "COMMERCIAL."

A short time ago an article appeared in a well-known daily, with reference to the methods and system employed in the manufacture of one of the best makes of English motor-car. All the salient points in the whole business were noted; the accuracy of manufacturing detail; the series of exhaustive tests for finished chassis; the comprehensive trials through which all new departures in construction are passed before they are finally embodied in standard specications; all these were duly explained and admired by the writer. Indeed, he seemed to be sure in his own mind that these methods were as exceptional as they were admirable. Now, while we do not believe that any one firm has a monopoly of the best modern methods, whether in the motor-car or any other trade, it may be profitable to run over a few points which go to constitute what is termed "system," in order to see where we are lacking, or not in line with others.

Naturally, all will admit that different businesses need different systems; that goes without saying. Yet just as book-keeping is essential for all business people, whether they sell pills or motors, so the main ideas are applicable, in considering a factory system, to all trades. In the same trade, however, one often finds quite different systems. Some are of the simple, conservative, easy-going sort, while others are much too complex. The faults of the latter are generally that, in the first place, work is often duplicated unnecessarily, involving a larger staff, and that the very intricacy and completeness of the system tends to hinder rather than help. The whole question may be divided into three sections: Materials and stocks; orders, and methods of dealing with same; and workers and their management.

Materials and Stocks.—In the matter of what Free Traders call raw materials, most people to-day work on short stocks, with a fixed maximum and minimum according to works' normal requirements for the various articles. Supplies emanating from an outside source are more likely, as a rule, to be delayed, than those made on the premises, *e.g.*, castings, which may either be supplied by another firm, or made in one's own foundry. More latitude, both in the time allowance and the maximum for stock should, therefore, be allowed in the former case. This is very important to-day, when orders are often placed largely, if not wholly, on delivery, prices being in many cases so much the same. On the other hand, when trade is booming, and work is booked up, perhaps, for months ahead, some discrimination is necessary in requisitioning materials for immediate delivery, the assembling of which may not take place for a comparatively long period. Valuable room in shops and stores is occupied, confusion is rendered more likely, not to mention the fact that payment must be made so much earlier than otherwise would be the case. We must remember that the oftener material is bought, turned into finished goods, and sold, with the use of the same capital, the greater the aggregate earnings at the year's end.

Orders, and Methods of Dealing with the Same.—Many people seem to think that, to secure quick delivery of an order, it is only necessary to mark it "Urgent," "At once," or "Wanted immediately." In a well-conducted factory such terms fail to convey any meaning. The reason for this is that there are so many orders with definite dates of delivery—some of them very short—and others with a penalty time-limit, that as a natural consequence the remainder must perforce come afterwards in something like rotation. Therefore, no notice can be taken of any of the above or similar hackneyed phrases. All jobs required to a certain time should be followed up throughout the entire manufacture, regularly and systematically. It is almost useless to do this spasmodically, for no real time saving can be effected without continuous effort in this direction. Foremen should be consulted in turn, so that all possible arrangements can be made in anticipation of the arrival of the work in their respective shops. Missing material must be urged forward in order to obviate any loss of time, and the various processes all arranged to come to the end before the stated time expires. In some works a "chaser" is employed specially for this purpose. This leaves foremen free to attend to the work which they have, and saves them from having to run about for work which they require. As each department is ready for it, the job comes along. A works chaser must possess a practical grasp of his business, and be able to gauge to a nicety the times required for various classes of work. He must not be merely a messenger. Some one person, if not more, must look after those orders which are required promptly, and it is more economical and satisfactory, where the nature of the business permits, to engage one man solely for this work, than to have several high-salaried men spending part of their time chasing such orders. In the absence of a special man it sometimes becomes a case of everybody's business being nobody's business, and the customer is let down. In addition to the duty of following up specially urgent orders, it should be incumbent upon the works chaser to have prepared for him by the order office lists of the oldest orders unfinished. This might be done, say, every month, or twice monthly, and in this way such orders can be looked up and pushed through.

Workers, and their Management. — The methods of supervision employed over the staffs and manual workers by the responsible heads of works form a part of their whole system just as much as the methods used in connection with those matters already discussed. The manner of such supervision goes far to make or mar the success of any firm. For instance, it does not count in favour of any business system to allow a constant succession of changes in the staff. Men are trained in the special details of the work, and become accustomed to the routine, only to leave in a comparatively short time, just when they are beginning to pay for themselves. The reason of this will be seen later. This habit of constant replacement of men is a drawback to more than one firm in the electrical industry to-day. The people at fault are the heads of the firms. In some industries—perhaps even in the electrical business—there are cases where many of the employés of a firm have been in the same service up to even 50 years. Now, if long service be a virtue, as much in the firm as the workman—if it is a recommendation of the good methods and respectability of a firm, then there are some firms in Britain to-day whose reputation in the matter of solicitude for their workers will not bear the most cursory inspection. Just as the most elaborate system cannot carry with it a guarantee of a large dividend, so the firm which hedges its men about with the most restrictions, and drives them to the last minute, does not always ultimately secure the best men or the best service. Their system may be the last word in completeness, their equipment of shop, office and laboratory unequalled, their self-confidence in the merits of their products all sufficient—yet if they treat workers as machines or niggers, if they discharge one after another in a vain search after the perfect and infallible being, and expect to get him for next to nothing, they will never be much better off than their less ambitious neighbours, in spite of all their pains.

No conscientious workman needs a foreman to stand over him. He wants to be left alone with his work. When he cannot feel safe for five minutes, when his progress is interrupted by officious jacks-in-office, who question and cross-question, then the quality and quantity of his work suffer, and, especially in clerical work, mistakes are made which tend to give him a bad character. From his short experience the writer ventures the opinion that less mistakes are made when the pressure exerted upon workers is confined within reasonable bounds, than in places where the discipline is of a strict, "keep moving" variety.

To bully-rag a body of workers, either manual or clerical, as though they were a squad of raw conscript recruits, will not answer in an ordinary business house, yet there are people who would seem to model their business on a military footing, and expect identical results. Terrorism is a poor tool wherewith to run a factory. More give and take is sometimes needed 'twixt master and man. One models a system having regard to the peculiar characteristics of the trade. So one may, perhaps, profitably choose the way and means of governing workers, with a little thought as to their welfare, security of tenure, and ultimate efficiency.

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RECORDS OF PROGRESS AND COMPLETION OF MANUFACTURING ORDERS.

In every well-ordered manufacturing and construction undertaking one of the salient, and at the same time interesting, features of the executive administrative organisation centres in the efficiency of the section or department whose duty it is to see, upon the receipt of the notification of the acceptance of a successful tender, that the necessary machinery is put in motion for its fulfilment, which means, in general terms, the prompt issue of instructions to the departments or shops concerned, the noting of their requirements and progress from time to time, and generally the taking of such steps as are necessary for the efficient satisfaction of the contract entrusted to the undertaking. It will be at once recognised that the responsible head of the executive department, in order to give due effect thereto, will have installed certain arrangements or devices of which the succeeding memoranda is merely suggestive. For example, we may have a form or forms arranged on the following lines, supported by copies of specifications and instructions issued to enable the works manager to pursue each work or contract from its inception to its completion :—

Subject in brief particulars of order .....
Date received .....
Date for delivery or completion .....
Penalty .....
Number or designation of order .....

Instructions to Works.

Shops instructed.	Date instructed.	Date for completion.
A		
B		
C		
D		
E		
Cost Clerk.		
Storekeeper.		

Testing :

Particulars of Orders placed with Outside Firms for Construction or Manufacture of Parts.

Date.	Name.	Particulars.	Date for completion.

With regard to materials and stores, we may employ a form or series of sheets somewhat similar to the following, which is prepared for all materials and stores required for production. It is then passed to the storekeeper, who indicates thereon by distinctive signs whether he has the necessary material or stores in stock. As to the items not in stock, when the sheet is returned to the drawing office steps are taken to order the material required and the storekeeper advised. He is also instructed to reserve those portions and descriptions of stores which are in stock for the jobs or contracts in relation to which the drawing office inquiry has been made.

Stores and Material Form.

No. of sheets .....
Working number .....
For.....

No. of item.	Shop.	Quantity.	Quality.	Material.	Description.	Drawing letter.	Drawing No.	Pattern : size.	In stock.	Not in stock.

BUSINESS NOTES.

Cab Signalling.—The International Railophones, Ltd., of Birmingham, have sent us a brochure, by Mr. H. von Kramer, discussing the above subject, and explaining the advantages of the Railophone for the purpose.

Lead.—Messrs. James Forster & Co. report as follows under date August 15th :—"We have not sent out our usual weekly circular since the war began. The Metal Exchange being closed, transactions which have taken place have been negotiated privately. The War Office has bought a large quantity of prompt lead and early arrival lead, paying £22 to £23 a ton for it. Such purchases have resulted in a scarcity of prompt lead, for which up to £24 a ton has been paid. It cannot be said, however, that there has been great pressure on the part of consumers, who seem to be pretty well supplied, but those who wanted early lead have had to pay big prices for it. Are these prices to be maintained? We doubt it, and our reasons are :—(*a*) No lead can be shipped from Spain or America to Germany or Russia while the war lasts ; (*b*) all the lead afloat from Australia (and we know there is a large quantity) must come to this country ; (*c*) the lead sold by America c.i.f. Germany and Russia will come here. If there is no manipulation, we ought therefore to have plenty of lead and lower values. It is a strange fact that the Lead Convention controls practically all the soft lead imported into Europe, and that the sale and control of such lead, about one-third of which is produced by the Broken Hill Proprietary Co., of Australia, a British concern largely owned by English people, should be in the hands of a firm in Frankfurt, the members of which are subjects of the German Emperor. We hope that the Broken Hill Proprietary Co. will see that such an arrangement as it exists is not a patriotic one."

Ediswan Lamp versus Lightning.—During the severe thunderstorm which passed over Dublin district last week, the overhead wires of the Dublin and Lucan Electric Railway were struck by lightning. The glass support of one of the Royal Ediswan "Downlite" lamps was fused, but on examination the filament was found to be intact. This is conclusive proof of the wonderful strength of these filaments. The actual lamp is on show at the Dublin depôt of the Edison & Swan United Electric Light Co., Ltd.

Private Arrangements.—G. W. Hill, electrical engineer, 13, Park Parade, North Finchley, London, N.—A meeting of the creditors of the above was held on the 14th inst., at the offices of Messrs. H. H. Wells & Son, solicitors, 17, Paternoster Row, E.C. The statement of affairs presented, showed unsecured liabilities of £177, all of which were due to the trade, while there were preferential claims of £24 10s. The assets consisted of stock in trade estimated at £15, and book debts expected to produce £76 10s. It was reported that the debtor started trading in 1906, with a capital of about £50. He traded successfully for a number of years, but latterly had suffered through bad debts, and also sustained a loss in connection with a picture palace which he fitted up at Poplar. The solicitor stated that the present position was probably due to loss on contracts, as those engaged in that business in Finchley cut their prices very finely. The debtor wished to continue the business, as he believed he could make it pay in the future. No particulars could be given as to the trading as the debtor had not kept proper books of account. The debtor first consulted his solicitor in June, when he believed he could borrow £100 from friends. That money, however, was not forthcoming, and consequently the meeting had to be called. Several creditors had commenced proceedings. The debtor made an offer of a composition of 7s. 6d. in the £, payable as to 2s. 6d. in cash, and the balance in three months. After a short discussion it was decided to accept the debtor's offer. The following are among the creditors :—

Armorduct Manufacturing Co.	£45
Sloan Electrical Co., Ltd.	20
Jaeger Bros.	26
General Cable Co.	12

Bankruptcy Proceedings.—*Re* Trubie Moore, of 75, Headingley Mount, Kirkstall Lane, Leeds, electrical engineer.—A meeting of the creditors in the above matter has been held at the offices of the Leeds Official Receiver (Mr. H. Clifford Bowling), and a statement of affairs has been presented showing gross liabilities amounting to £165 expected to rank for dividend at the same amount, and assets estimated to produce *nil*. The only creditor in the case is the Bradford and District Bank, of Park Row, Leeds, their debt amounting to the total of the deficiency (£165), and representing the balance due under a joint and several guarantee given to the bank on August 29th, 1912, by the debtor and Frank Scott Walfork, for £500, to secure the account of the Sterling Engineering and Automobile Co., Ltd. The estate was left in the hands of the Official Receiver, and the public examination will take place on September 8th.

Frank Herbert Watts, electrical engineer, trading as "Nunn, Watts & Co.," at 40, Mincing Lane, E.C.—This public examination was held on Tuesday before Mr. Registrar Hope, at the London Bankruptcy Court. The statement of affairs showed liabilities £725, against assets valued at £172. Replying to Mr. J. B. Knight, Official Receiver, the debtor stated that having for many years been in employment as a marine engineer, he, in October, 1901, joined two others in the business of electrical and general engineers, carried on at 82, Mark Lane, E.C. He paid in £125, as to £50, his savings, and the balance a gift from a relative, for a one-third share in the business, which thereafter was conducted under the style of "Nunn, Watts & Co." In 1903 and 1904 respectively, his partners left the firm, and witness had since carried on the business alone under the old trading name, removing early in 1912, to 40, Mincing Lane, E.C. The business paid fairly well up to about 18 months ago. In May, 1913, witness entered into contracts to execute the electric installation of two picture palaces, one in the Walworth Road and the other at Romford. The cost of those works considerably exceeded the contract price, and showed a total loss of about £180, whilst later in the year he sustained a further loss of about £45 on two similar contracts. Early in April last his largest trade creditors demanded the immediate payment of their account ; he then went to a firm of accountants, who advised a deed of assignment being executed, but the principal trade creditor declined to agree to the terms and made him bankrupt. Witness attributed his failure

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and insolvency to want of sufficient capital, loss on contracts, and a loss of £200 invested in "National Enterprises, Ltd." The examination was concluded. The following are the principal unsecured creditors :—

British Prometheus Co. ..	£18	Haywood & Co., W. G.	£24
Crypto Electrical Co., Ltd. ..	55	Micklewright & Co., Ltd. ..	61
Cryselco, Ltd.	22	Hankin, P.	208
Drake & Gorham, Ltd.	24	Seagrove, Woods & Mitchell ..	16
Falk, Stadelmann & Co., Ltd...	31	Veritys, Ltd.	209
Feld Bros. & Co., Ltd.	18		

C. H. Kitching, plumber and electrical engineer, Kingston-upon-Hull.—Debtor's application for discharge was granted, subject to suspension for two years (July 20th, 1916).

Catalogues and Lists.—Messrs. Lacy-Hulbert and Co., Ltd., 91, Victoria Street, S.W.—Two-page leaflet illustrating and describing the Boreas garage air-pump and equipment for tire pumping and blowing dust.

The British Thomson-Houston Co., Ltd., Rugby.—Leaflet No. 7,632 giving particulars, prices, &c., of the B.T.H. electric quick boiling kettle. Also 8-page leaflet, No. 5,250, illustrating and describing, with prices, &c., the B.T.H. hand-operated starting compensators for polyphase squirrel-cage induction motors.

Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Copies of pamphlets No. 207, dealing with dividing boxes with mesh connections; No. 194, on rotary isolating switches; No. 1, on quick-break switches; No. 162, on fuse wire for the firm's self-aligning fuse handles; No. 187, on plug boxes; No. 93, on oil-cooled totally-enclosed motor starter; and No. 192, describing a "definite time-limit" device. These are for inclusion in the firm's catalogue, and contain illustrations, prices, and full particulars.

The Dudbridge Ironworks, Ltd., Stroud, Gloucestershire.—Illustrated pamphlet, No. 105, describing the Dudbridge petrol and alcohol engines, of 3 to 60 B.H.P. Dimensions, prices, code-words, &c., are given.

Messrs. Alfred Herbert, Ltd., Coventry.—"Monthly Review of Modern Machine Shop Practice," 1,808, Vol. 2, containing much interesting information on the use of automatic turning machines.

Temporary Assistance.—Without prejudice to the interests of those members of their staffs who are serving their country in the ranks, many firms will doubtless feel the necessity of engaging temporary assistance during their absence. In such cases they may find the International Correspondence Schools, Ltd., Kingsway, of service. We may mention also the Electrical Trades Benevolent Society in this connection.

Meter Approved.—The B. of T. has approved of the "Met." single-phase A.C. two-wire watt-hour meter, Type T.O., deposited by C. H. W. Gebhardi, of 48, Cranley Gardens, Palmer's Green, N., on October 20th, 1913.

Book Notice.—"Motion Picture Operation." By H. C. Horstmann and V. H. Tousley. London: S. Rentell & Co. Price 8s. 6d. net.

Liquidations and Dissolutions.—The Demon Vacuum Cleaner Co., Ltd.—A meeting of creditors is called for August 25th, at 14, Dale Street, Liverpool, by the liquidator, Mr. A. H. Evans.

The Electrical Supplies Co. (F. J. Allen and E. C Beman), electrical manufacturers, agents, and wholesale factors, 53, Victoria Street, S.W.—Messrs. F. J. Allen and E. C. Beman have dissolved partnership. Mr. E. C. Beman will attend to debts and carry on the business.

The National Electric Time Co., Ltd.—This company is winding-up voluntarily, with Mr. A. C. Vincent, of 9 and 10, Pancras Lane, E.C., as liquidator; a meeting of creditors is called for August 27th.

Trade Announcements.—Messrs. John Lysaght, Ltd., of Normandy Park Steel Works, Scunthorpe, Lincs., announce that as from the 11th inst. the general management of the works was taken over by Mr. P. Williams in place of Mr. F. W. Cooper.

The London Electric Firm, of Croydon, desire it to be known that they are "carrying on" as usual all their manufactures in lamp-lowering gear, winches, pulleys, wire rope, poles, brackets, &c., all of which are of British manufacture, and large stocks are kept. Searchlights also are entirely made at their works.

Messrs. Fraser & Chalmers, Ltd., of Erith, Kent, have appointed Mr. H. A. Sturgess, The Oak, Motherwell, to represent them in Scotland.

The British Electrical Plant Co., Ltd, of Alloa, N.B., have appointed as their agent in London and South of England Mr. Alan Williams, M.I.E.E., of 9, Queen Victoria Street, E.C., who also represents Messrs. Eckstein, Heap & Co., Ltd, for switchgear, and the Anderston Foundry Co., Ltd., for steam engines, air compressors, &c.

LIGHTING and POWER NOTES.

Arrowthwaite.—Proposed E.L.—The Whitehaven Colliery Co. has accepted the offer of the General Purposes Committee of the Whitehaven T.C. to light 74 houses proposed to be built at Arrowthwaite. On condition that the Committee also lights the streets by electricity, energy is to be supplied in bulk at 4d. per unit, or at 5d. per unit, including meter rent, if supplied to the houses.

Ashton-on-Mersey.—E.L. Charges.—The U.D.C. having urged upon the Altrincham Electric Supply, Ltd., the necessity for a reduction in the price of current, as a flat-rate of 6d. per unit is considered too high, the latter states that the suggested reconstruction of the company is with a view to providing for the extension of the works, and the question of reducing the price of current will then be considered.

Australia.—The Sydney City electrical undertaking gives a supply to 23 suburban municipalities outside the city itself, which owns the undertaking. During 1913 some 32 million units were sold, and the revenue was £285,742. For this year the estimated sales are 42 million units, and the revenue £370,000. The plant capacity of the generating stations is 23,700 KW.

The Sydney Council has adopted the proposal of the E.L. Committee to purchase a coal-bearing property on which to erect an electric generating plant, and tenders are to be invited.—*Australian Mining Standard.*

The City of Newcastle (N.S.W.) has decided to install additional electrical plant, at its power house, at a cost of £6,000.—*Tenders.*

Bradford.—Street Lighting.—The gas lamps on the Laisterdyke to Bankfoot tramway route have been dismantled, and electric lighting, each standard containing five lamps, is being substituted.

Canada.—The B.C. Electric Railway Co. has recently doubled its generating plant capacity, and has now available a total of 105,000 H.P.

A duplicate tunnel has been constructed from Lake Buntzen to the Burrard inlet plant, to which has been added three Doble wheels, each of 14,000 H.P. The auxiliary steam plant has also been increased from 12,000 to 20,000 H.P.

Continental Notes.—Hungary.—The Danube Steamship Co., of Buda-Pesth, has just completed the establishment of a large central electricity station at Uelezog, near Funfkirchen. The municipal authorities of the last-named town have entered into a contract to take their requirements in the way of electricity supply during the next 25 years from the new station, which will also supply current for lighting and power purposes to a number of the small towns and villages in the district.

Spain.—La Sociedad Hidroelectrica Espanola has just secured a concession to put down a plant on the River Cabrie at Enguidanos (Province of Cuenca) for the generation of electrical energy for lighting and power purposes.

Dublin.—New Loan.—The T.C. has entered into an arrangement with the Bank of Ireland to borrow £80,500, sanctioned by the L.G.B. for the development of the electricity works, at 4½ per cent.

Dundalk.—L.G.B. Inquiry.—An inquiry was held last week by an L.G.B. inspector into the application of the R.D.C. for urban powers for lighting certain roads by electricity. The U.D.C. is to supply energy at £2 10s. per lamp per annum.

Durham.—Overhead Wires.—The R.D.C. has consented to overhead wires being used for E.L. purposes at Pittington, Littletown, Cassop and Quarrington.

The Carnforth P.C. has decided to accept the tender of the County of Durham E.P.S. Co. to light the main street of Coxhoe with 50-C.P. electric lamps from dusk till 11 p.m., at 24s. per lamp per annum. The agreement is for five years.

Glasgow.—Electric Police Lamps.—The T.C. has replaced practically the whole of the bull's-eyes formerly supplied to the police force with portable electric lamps, and an additional 1,000 has been ordered for the use of the police in the recently amalgamated areas.

Gravesend.—Free Wiring.—The T.C. has deferred the proposed free wiring scheme in view of the fact that the Association of Municipal Corporations proposes shortly to promote a Bill dealing with the matter.

Great Harwood.—E.L. Order Extended.—The Council's E.L. order expires at the end of this month, and the B. of T. has decided to defer the question of revoking the order for 12 months.

Harrogate.—Supply to Knaresborough.—With reference to the application of the T.C. for permission to supply electricity in the rural district of Knaresborough, the T.C., in reply to a letter from the B. of T., has informed the Board that, in its opinion, the demand for electricity in the Knaresborough area is not sufficient to justify the T.C. applying for a prov. order for the same.

Newport.—Proposed Loan.—On the recommendation of the Electricity Committee, the T.C. has decided to borrow £16,000 for electricity purposes.

New Zealand.—Lake Coleridge Hydro-Electric Plant.—The following are the latest particulars regarding the first of the New Zealand Government bulk supply systems included in its policy of development of the water power resources of the Dominion. Construction is practically completed, and the plant will be in operation before the end of the year (1914). The tunnel, power-house, transformers and transmission lines, are built for an ultimate capacity of 6 × 1,500 KW. Of the generating units 3 × 1,500 KW. are included in the first installation. The head is 485 ft., and the tunnel area 54 sq. ft. From the tunnel

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outlet, provision is made for four 52-in. pipes to the power-house, each pipe supplying 2 × 1,500 KW. turbines. The generators are 50-cycle, three-phase units operating at 6,600 volts. The transmission line pressure is 66,000 volts, the transmission line being in duplicate, each consisting of three 7/135 aluminium wires carried on 42-ft. ironbark poles spaced at six chain intervals. The distance of transmission from Lake Coleridge to the Christchurch sub-station is 68 miles. At this point it is transformed down to 11,000 volts, at which pressure it is distributed by overhead and underground primary distributors. Contracts have been entered into with the Christchurch City Council to distribute and retail the power within the city and suburbs. The power will be sold in bulk to the Corporation at £8 13s. 4d. per KW. per annum for the first 300 KW., and £5 per KW. per annum for all over 300 KW., and is to be retailed by the city on the maximum demand system at 6d. and 1d. for light, and 1½d. and ¾d. for power, and for pumping at ¾d. per unit. A bulk supply is also to be supplied direct to the Tramway Board, the railway workshops, several mills and factories, and other local bodies, for retail distribution. We are indebted to Mr. Evan Parry, the chief electrical engineer, for the above data.

Ossett.—OVERHEAD WIRES REFUSED.—The Yorkshire Electric Power Co., which has a contract to supply the Low Laithes Colliery with electricity, has been refused permission to use overhead wires by the local authority.

Peterborough.—SEWAGE PUMPING.—The R.D.C. has applied to the T.C. for permission to take a supply of electricity from the Peterborough Traction Co., for sewage pumping.

Rhymney.—STREET LIGHTING.—It was reported to the U.D.C. on August 12th that the manager of the Rhymney Iron Co. (Mr. Rutherford), was going into the matter of the cost of public lighting in the district by electricity, and would submit an early report.

Springhead.—PROPOSED E.L.—The D.C. has decided to ask the Oldham T.C. to apply for a prov. order to supply electricity in Springhead and Lees.

Taunton.—NEW CHARGES.—The T.C. has adopted the following new scale of charges for electricity :—For lighting—Up to 25 units per quarter, 6d. per unit; between 25 and 500, 4½d.; between 500 and 1,000, 4d.; exceeding 1,000, 3d. For cooking and heating :—Up to 50 units per quarter, 2d. per unit; over 50, 1d. For power :—Up to 2,000 units per quarter, 2d. per unit; between 2,000 and 4,000, 1½d.; over 4,000, 1½d.

Wakefield.—EXTENSION OF SUPPLY.—The Electricity Committee has decided to extend the supply of electricity to premises in Aberford Road and Bar Lane, and to apply to the B. of T. for powers to supply electricity in that part of Stanley.

Willesden.—LOAN SANCTION—The U.D.C. has received sanction from the L.G.B. to borrow the following sums in connection with its electricity undertaking :—Mains, £15,000; services, £5,000; transformers, £1,000; meters and indicators, £3,500; and public lighting, £330, making a total of £24,830.

York.—OVERHEAD WIRES.—The Great Ouseburn R.D.C. has given permission for the erection, by the York T.C., of overhead wires for the supply of electricity in Acomb and Poppleton.

TRAMWAY and RAILWAY NOTES.

Australia.—The Victorian Railway Commissioners were recently informed that the contractors for the Newport power station buildings and boiler equipment expected to ship 600 tons of boiler house plant. About 650 tons of steelwork has been received. Four of the six 10,000-KW. turbine sets were recently reported as nearly completed by the makers. The erection of the overhead equipment and transmission cables is being taken in hand, and the sub-station buildings are under construction.

Bradford.—ELECTRIC HAULAGE OF GUNS.—In connection with the mobilisation of troops, Bradford Corporation tramcars were requisitioned to haul the guns of the 2nd West Riding R.F.A. On Thursday morning, last week, the tramcars hauled the guns from Lister Park to the Driglington terminus—a distance of about six miles. The experiment was entirely satisfactory, and the work was carried out expeditiously.

Continental Notes.—NETHERLANDS.—A Bill has been passed authorising the participation by the State, to the extent of about £8,300, in the capital of a company which is being formed to work an electric railway from Sittard to De Locht. The construction is estimated to cost about £83,300, and the share capital will be subscribed, in addition to the State, by several communes and by the company working the Limburg coal mines.—*Board of Trade Journal.*

Dewsbury-Wakefield.—The Yorkshire (W.D.) Electric Tramways Co. intends commencing a motor-bus service from Dewsbury to Wakefield.

Walsall.—NEW TRAMCARS.—The T.C. has authorised the expenditure by the Tramways Committee of £5,400 for new tramcars, in connection with the Bill for the extension of the tramways now before Parliament.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—Señor Americo Demaria has been authorised by Government decree to extend the telephone line in Viedma, of which he is concessionaire, to the city and district of Carmen de Patagones.—*Review of the River Plate.*

Cut Telegraph Wires.—The telegraph wires between Dover and Folkestone were cut on Tuesday night, the damage being discovered by Boy Scouts. Two employés of the Brighton Railway Co. were remanded on Wednesday for cutting telegraph wires on the line at Battersea; the motive was stated to be revenge.

Farmers and Wireless Telegraphy.—Consideration is being given by the Australian Postal Department to the suggestion that the disadvantages of life in isolated farming districts should be relieved by the installation of small wireless sets, by which communication could be obtained with a central station at the nearest town. The erection of telegraph and telephone lines has been found to be impossible owing to the great expense; even by taking advantages of fences and trees for suspending the wires, the cost is £10 or £12 a mile.

Free Telephone Calls.—The Post Office has issued a notice to the effect that, apart from calls originated over Government circuits, the only calls for which exemption from payment can be claimed are those made by Government servants on urgent Government business.

New Dutch Cables.—The Dutch East Indian Administration has laid the following cables :—Kema (near Merado) to Jorontalo (Celebes); Kema to Ternate; Soerabaja to Balikpapan (Borneo); Singkel to Tapatoean (Sumatra); Tapatoean to Sinabang (Simenloe).

South America.—According to the *Journal Télégraphique*, the Argentine Congress has voted an additional 1,000,000 francs for wireless stations on the coast and between the Argentine and the United States and Europe. Bolivia has also agreed to a contract with the Marconi Co. for the erection of wireless stations at important places in the republic.

The Post Office Telegraph and Telephone Service.—During the first week of the war crisis, the resources of the Post Office engineering staff were taxed to the utmost. Innumerable extra telephone services were demanded by the various authorities concerned, and were put in with a promptitude which reflects the greatest credit upon the department, in spite of the withdrawal of a large number of Reservists. The pressure upon both the telephone and the telegraph services has naturally been very heavy, but by working overtime and cheerfully taking extra duties, the staff have coped successfully with the rush of work. The telephone operators have given a good account of themselves, the efficiency of the service given having been highly appreciated. Last week it was rumoured that, although the Government had declared its intention to maintain business at full volume, the telephone contracts of the Post Office had been cancelled or withdrawn; we are glad to say that the department has wisely decided to proceed on the usual lines, and that telephone manufacturers need have no apprehensions on this score.

Wireless Station Wrecked.—A Government wireless station near Port Arthur (Ontario) has been wrecked. The two men who committed the outrage escaped after some shots had been exchanged.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—September 9th. Electrical goods, for the Powell Duffryn Steam Coal Co., Ltd.: Stores Manager.

Australia.—SYDNEY.—August 31st. Sydney Harbour Trust. Four electrically-operated semi-portable travelling cranes. Forms of tender from Mr. H. F. Norrie, Secretary to the Trust, Sydney.

September 14th. Municipal Council. 22,500 yd. of 33,000-volt, three-core, paper-insulated, lead-covered cable. Deposit £200. Specification, 10s. 6d., from the City Electrical Engineer; a copy may be seen at the B. of T. Commercial Intelligence Dept., London.

September 30th. Telephone instruments and parts for Postmaster-General. See "Official Notices" to-day.

ADELAIDE.—Sept. 9th and 23rd. Telephone material, microphones, protectors, &c., switchboards, bells and cells, for the Postmaster-General. See "Official Notices" July 31st and August 7th.

MELBOURNE.—August 26th. Insulated copper wire, for the Melbourne City Council. See "Official Notices" August 14th.

September 2nd. 6½ tons bare hard drawn copper cable, for the City Council. See "Official Notices" to-day.

September 23rd. 102 electric motors, starters, switchboards and wiring for installing electrical drive at Messrs. Sands & McDougall, printers. Mr. M. C. Coates, consulting engineer.—*Tenders.*

Victorian Railways Department.—October 7th. Motors and switchgear, and motor-driven air compressors for the Ballarat and Bendigo workshops.

PERTH.—September 9th. Coin attachments for Postmaster-General. See "Official Notices" August 14th.

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Belfast.—August 24th. Corporation. One electric motor tower-wagon. See "Official Notices" July 31st.

Dundee.—August 31st. Corporation. Rotary converters, switchgear. See "Official Notices" to-day.

Harrogate.—The T.C. is to obtain a motor-generator, starting switches, cable, &c., for the Harrogate Kursaal; estimated cost £67.

Kingston-upon-Hull.—August 22nd. Corporation. Electrical fittings for the Guildhall Council Chamber, &c. See "Official Notices" July 24th.

London.—L.C.C.—September 8th. Cables, H.T. and L.T., and laying stoneware ducts (tramways). See "Official Notices" August 7th.

September 8th. Reconstruction of motor-generators in the tramway southern sub-stations. See "Official Notices" Aug. 14th.

Manchester.—August 25th. Tramways Committee. Tenders for cast-iron pipes for heating purposes. Particulars from Mr. J. M. McElroy, General Manager, 55, Piccadilly.

Middlesbrough.—September 12th. Corporation. Three electric motor-driven sewage pumps, priming pumps, metering arrangement, pipework, overhead travelling crane. See "Official Notices" August 14th.

New Zealand.—September 30th. Traction battery for the Dunedin City Council. Specifications from the Borough Electrical Engineer.—*N.Z. Shipping and Commerce.*

Oldham.—August 24th. Corporation. Three economisers and three induced-draught fans and motors. See "Official Notices" July 31st.

August 24th. Corporation. Storage battery, reversible booster and switchgear. See "Official Notices" August 7th.

Oldmachar (Aberdeen).—August 24th. Electrical installation at St. Machar's Cathedral, for the Heritors of Oldmachar. Specifications from Messrs. Kelly & Nicol, architects, 367, Union Street, Aberdeen.

Rochdale.—Council. Static transformers for 12 months. Mr. C. C. Atchison, Electricity Works, Dane Street.

South Africa.—August 31st. 22 electric motors for the Salt River workshops, for the Administration of the South African Railway. Copies of specification from the Secretary to the Tender Board, S.A.R., Headquarters Office, Johannesburg.—*Brit. and S.A. Export Gazette.*

Spain.—August 31st. The municipal authorities of El Cerro (Province of Huelva) are inviting tenders for the concession for the electric lighting of the town for a period of 20 years.

Swansea.—August 24th. Corporation. Overhead travelling crane (about 8 tons lifting capacity), for Uplands sub-station, for the T.C.; Corporation Electricity Works, Strand.

Wigan.—August 24th. Corporation. Tramway rails. Mr. A. T. Gooseman, Borough Engineer, King Street West.

CLOSED.

Aberdeen.—Mr. R. Stuart Pilcher, the general manager of the Corporation Tramways, reported that he had been in communication with the contractors for the new cars recently delivered as to the price at which they would be prepared to supply and equip six additional cars, and had received the following quotations:—

Car bodies.—Brush Electrical Engineering Co., £2,742.
Motors.—Ditto, £1,060.
Electrical equipment.—British Westinghouse Electric & Mfg. Co., £462.

It was recommended that these offers be accepted for six additional cars of the "Pay-as-you-enter" type.

Australia.—The following tenders have been accepted:

Postmaster-General's Department, South Australia:—
Five sections trunk-line switchboard, with equipment, £1,332.—Western Electric Co. (Aus.), Ltd.

External Affairs Department:—
Electric power plant, £184.—Siemens Bros. Dynamo Works, Ltd.

Railway Department, Sydney:—
Specification 484. One 1,000-kw. sub-station unit.—Australian G.E. Co.
Two 1,000-kw. ditto.—British Westinghouse Co.

Harbour Trust, Sydney:—
Electric travelling cranes, for Woolloomooloo Bay.—Warburton, Franki, Ltd.

Victoria Railways Department:—
One 35-h.p., D.C. motor, for State coal mine, £134.—Cowlishaw Bros.

Public Works Department:—
Electric lighting installation at the Registrar-General's building, £358.—Acme Electric Co.
75-h.p. motor, £140; 50-h.p. motor, £80.—Australian G.E. Co.
—*Australian Mining Standard.*

Swan Hill (Vic.) Water Trust:—
Electric pumps and equipment, £489.—I.-R., G.-P. and Telegraph Works Co., Ltd.
—*Tenders.*

Bradford.—Mr. Charles Bell has received from the Education Committee the contract for an electric installation for the large hall of the Bradford Technical College, including half-watt lamps and special fittings.

Basingstoke.—The T.C. on August 13th accepted the tender of Messrs. Leader & Co., for wiring the generating station, at £78; and that of Messrs. Milson & Son, for wiring the Town Hall, at £77.

Harrogate.—The T.C. has ordered a fuel economiser from Messrs. Goodbrand & Co.

Southport.—The T.C. has accepted the tender of Messrs. Heenan & Froude for a refuse destructor, at £4,999.

Sunderland.—The T.C. has accepted the following tenders:—

Cables.—British Insulated & Helsby Cables Co., and India-Rubber, Gutta-Percha and Telegraph Works Co.
E.H.T. switch and meter cabinet.—British Thomson-Houston Co.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, August 22nd. Visit "Chronicle" Printing Works, Withy Grove, Manchester.

Association of Mining Electrical Engineers.—Saturday, August 22nd. Visit Wallsend and Hebburn Coal Co.'s Pits.

ELECTROLYTIC REFINING.

By G. BASIL BARHAM, A.M.I.E.E.

Over 50 per cent. of the world's production of copper is refined by electricity, the total weight of electrolytic copper handled annually approximating to half a million tons. It was recognised some time ago that the electro-metallurgist would find it most profitable to give his attention to the electrolytic refining of metals, and in no other branch of the science has such great progress been made, whether viewed from a theoretical or a commercial standpoint.

In connection with copper, not only is the actual refining profitable in itself, but the rough metal contains from 1 to 1½ per cent. of other metals as gold, silver, nickel, lead, antimony, bismuth, and the like. The recovery of these is a source of income which is not to be despised, as will be realised when it is mentioned that the value of the gold and silver alone recovered during the electrical refining of copper in one country is known to exceed £3,500,000 per annum.

When copper is being refined electrolytically a current of suitable strength is passed from an anode of the metal to be dealt with, through a bath of acidulated sulphate of copper, to a convenient cathode, on which the pure metal is deposited. Any gold, silver or other metal present does not pass over, but falls with other impurities to the bottom of the vat from which they are periodically removed. When the refining of bullion is being carried out an action the reverse of that described is carried out; the precious metal is deposited on the cathodes and the copper and other base metals fall to the bottom. In the Siemens and Halske process the solvent for removing the gold in an impure state from the already crushed ore is potassium cyanide, suitably diluted. This is known as the leaching solution from which the gold is ultimately recovered, by means of electrolysis. The anodes are of iron, and in order that the Prussian blue which will be formed shall be retained, they are covered with stout linen bags. The cathodes are of sheet lead, from which the gold is finally recovered in the cupola. Gold obtained in this way may be refined again electrically by using the ingots as anodes. The solution should contain 25 grammes of chloride of gold and 40 cubic centimeters of hydrochloric acid per litre,

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the acid being in the purest possible form. The cathodes are thin sheets of pure gold. When the current is caused to flow, gold and platinum pass into the solution in the form of chlorides, and gold is deposited on the cathode plates. Any silver present is formed into silver chloride and forms a slime on the bottom of the vat. It is necessary for the solution to be kept at a temperature of from 60 to 65 degrees whilst the vat is at work.

The practice is for the gold anodes to be about one-sixth of an inch in thickness, and they may contain as much as 15 per cent. of silver. Whilst the refining is going on the current density is gradually decreased, and within 24 hours it will be found that some 80 per cent. of the gold has been deposited on the cathodes, 10 per cent. will still be on the anodes, and the remainder, with the silver and other impurities, will be in the sludge. A point worthy of notice is that in this process only an inch and a quarter separate the anode from the cathode in the vat which is almost invariably of porcelain.

The gold is deposited in a crystalline form, and has to be thoroughly washed before being melted down into ingots. As in the case of silver where the same crystalisation takes place, many methods have been tried to prevent it, as it necessitates frequent removals of the deposit, especially in the case of the latter metal. Also, a greater distance has to be allowed between the anode and cathode than would otherwise be the case. It has been proposed to use gelatine in the electrolyte to prevent the crystals forming, and improved methods of circulating the solution have been devised. By these means some improvements have been effected in the case of silver, and under such conditions it is said that a smooth, homogeneous deposit of the metal can be obtained.

After the gold cathodes are removed the solution is treated chemically in order to remove the platinum, palladium, and other metals present, together with the balance of the gold. This method of electrolytic refining is in use in the United States mint, where the plant consists of seven cells, measuring 13in. by 10½in. by 8in. A current of 100 amperes at 4.5 to 5 volts is passed through the baths, and the plant has a capacity of 5,000 oz. of fine gold per week.

Electrolytic refining of silver is carried out by processes depending on the use of ingots of at least 95 per cent. pure silver. The bath is of nitrate of silver with nitric acid. In order to prevent the loss of slimes, the anodes are enclosed in linen bags. The cathodes are of pure silver arranged as in gold refining, in the form of thin strips. When the current passes, silver is deposited on these in the form of crystals, and the gold and other impurities are collected in the slimes bags. If copper is present in the silver the process becomes more complicated from a chemical point of view, as this metal passes over with the silver after a time. It does not, however, become immediately deposited on the cathodes but is first changed into copper nitrate, contaminating the solution until a certain point of saturation is reached when a deposit of copper commences to form on the cathodes.

The Moebius vat is usually employed for the work where quantities have to be dealt with, although there are at least two other processes which are commercially successful. The Moebius vat in its original form was similar to that is use in copper refining, but in the later patterns the cathode takes the shape of a silver band which passes horizontally through the solution. A scraper is fixed at one end of the vat in such a manner that the band rubs against it as it travels with the result that the silver deposit is removed as soon as it forms, the crystals being delivered into a closed collecting vessel by automatic means. Porous trays are fixed above the travelling cathode and in these the anodes are placed. Consequently these can be conveniently handled, removed, or replaced during the refining without causing any interruption to the process. From particulars given it appears that the plant at this rennery consists of 48 vats, measuring each 14ft. by 16ft. by 7ft. deep. It has a capacity of 24,000 oz. of silver per day, the generating plant supplying 220 amperes at 90 volts. A still larger plant is laid down at the works of the American Smelting and Refining Company, where there are 144 vats requiring a generating plant with an output of 62 kilowatts.

The Moebius system will recover gold when existing in such small quantities as two-tenths of a part per 1,000 parts of silver, and the working costs are as low as 0.062d. per oz. dealt with.

In another system for refining silver by electrolytic methods the anodes are in the shape of thin square slabs. These are covered with linen and are placed horizontally, fixed in a wooden frame, which hangs so that it is just covered by the electrolyte. Slabs of Acheson graphite cut to a uniform thickness of half an inch are laid on the floor of the vat, and upon these the silver crystals are deposited, frequent removals of the deposited metal being necessary. The E.M.F. is 3.8 volts and a current density of 25 amperes per square foot of cathode area, which amounts to 8 square feet in all, is employed. The current consumption works out at 31.5 watt-hours per oz. of silver deposited.

Another metal which is largely being refined by electrolytic methods is aluminium, the method consisting of the electrolysis of alumina in a bath of fused fluorides, the electrodes used being of pure carbon. Difficulties were at first encountered owing to the tendency of the electrolyte to decompose under the action of the current, whilst a further trouble was to render the mineral deposits of alumina sufficiently pure for treatment, but these difficulties have now been successfully overcome.

There are many other metals, as lead and iron, which can be dealt with electrolytically, but sufficient has been said to show that the electro-chemist is able to choose, in the case of impure anodes, which metal shall be deposited on the cathodes and which shall pass over as slimes or sludge.

NOTES.

Educational Notices.—Crystal Palace School of Practical Engineering.—The new course will commence on Wednesday, September 9th. A notice on the matter appears among our advertisements to-day.

University College, University of London.—Faculty of Engineering. The 1914-15 Session begins on Monday, October 5th. Particulars are given in our advertisement pages to-day.

Appointments Vacant.—Leading hand in armature shop, for Bolton Corporation tramways; junior assistant engineer, for Newcastle-upon-Tyne Electric Supply Co. (15s); charge engineer, for Erith U.D.C. (40s. to 50s.); fitter-driver, at Severalls Asylum, Colchester (35s.); cable-jointer and overhead linesman, for Aberdare U.D.C.; charge engineer, for Paisley Corporation; junior assistant electrical engineer (£80), for Oldham Corporation; junior assistants (25s.), for Cleveland and Durham Electric Power, Ltd. See our advertisement pages to-day.

X-Ray Apparatus for War.—On behalf of Lady Chavasse, Dr. Hall Edwards, the well-known Birmingham X-ray specialist, ordered an X-ray apparatus for the Bromsgrove Hospital. This instrument her ladyship has now placed at the disposal of Dr. Hall Edwards for use in the war. Two other sets of apparatus are also at the disposal of the doctor.—*Birmingham Daily Post.*

A "Sewage" Gas Engine.—A gas engine at the Parramatta, N.S.W., sewage pumping station is operating satisfactorily on sewer gas generated in the septic tanks. Mr. Walshaw, the engineer, who is responsible for the idea, expresses himself as satisfied that there is a sufficient supply of gas to justify the installation of electric generators.—*Commonwealth Engineer.*

British Association.—It appears from a paragraph in the *Times*, that the British Association New Zealand meeting has been cancelled, and that members will return home after visiting Brisbane and Melbourne.

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Electrical Competition with Germany and Austria-Hungary in Neutral Markets.—Since our "War Items" pages went to press we have received from the Board of Trade Commercial Intelligence Department a document of some 48 pages giving from official sources a vast quantity of statistical and general information respecting the exports of electrical appliances and apparatus from these countries in recent years. It discusses the principal markets in which our enemies have been electrically active, and quotes extracts from reports by British Trade Commissioners in the leading Colonies, and a host of Consuls bearing on their progress. Much of the material appearing in this publication has, of course, already been published in the pages of the ELECTRICAL REVIEW, but we commend the present valuable collection of information to the prompt attention of all British firms who are interested in the movement for securing to this country Germany's electrical export trade.

Inquiries.—"Electricus" asks for the names of manufacturers of electrical apparatus for applying to mechanical milking machines for dairy purposes, and any other information on the matter.

Helium in France.—According to communications made to the French Académie des Sciences by MM. Mouren and Lepage, quite a number of French natural springs contain considerable quantities of helium. In many springs in the Côte d'Or helium is present to an extent of 10 per cent., the other gases being nitrogen and argon, crypton, xenon and neon. The Carnot spring in Santenaz yields 17·845 litres of helium yearly.

Electric Vehicles and the War.—Writing on the sudden requisition of horses and motor vans for military purposes, and the fears of a shortage of petrol, our contemporary, *Motor Traction*, mentions that there has been something like a boom in Edison battery vehicles. The experience gained by Messrs. J. Lyons & Co. with the 2-ton electric van recently purchased has been so satisfactory, that they placed an order with Edison Accumulators, Ltd., for all the vehicles of whatever kind they could spare, and seven ranging in capacity from 5 tons to ½ ton, were ordered for immediate delivery. Another urgent order was received from the Great Western and Metropolitan Dairies, Ltd., who recently acquired a 2-ton Edison electric, for two further similar vehicles. Other orders were also received, and we gather that in one day every Edison "electric" that could be made ready for immediate service was disposed of, including some which were brought back from a demonstration tour. We may add that this sudden accession of popularity of the electric vehicle in a time of stress is due largely to its inherent advantages. An increase in the price of electrical energy is unlikely, while the price of motor spirit is at least uncertain; the electric requires, on the whole, less skilled attention than either petrol or steam-driven vehicles, and repairs are a much simpler matter. Moreover, looked at solely from a commercial point of view, the so-called mileage limitation of the electric—which covers sufficient miles for the majority of town businesses—is an all-important advantage, as such vehicles are unlikely to be requisitioned for other than local use by the military authorities. Certain trades must be maintained in any emergency, and it is probable that the use of the electric vehicle in such cases, while preventing wholesale dislocation of business, would induce the military authorities to provide their own transport equipment on a more generous scale than hitherto.

Wayleave Rentals.—The electrical engineer of a Colonial electricity supply undertaking sends us a copy of an account rendered by a local municipality to his Council, which he regards as the most atrocious thing he has ever seen in the way of rental for overhead mains. All the runs are short. Rent charges on electric cables, year 1914:—

	£	s	d
Bennett & Son	0	5	0
Imperial Pictures	0	5	0
Marquett's, Ltd.	0	5	0
Howard	0	5	0
Mullens & Co	0	5	0
N.S.W.A. Water Co.	0	5	0
McNaughton & Son	0	5	0
Healey	0	5	0
Main line	1	2	6
	£3	2	6

Electric Lamp Development.—In the *Electrical World* of July 11th Mr. E. H. Waldo, after referring to the fact that Sawyer and others were working with nitrogen and other gases in lamp bulbs about 1880, pointed out that work had been done much earlier along the same line. One of the first investigators to produce an incandescent lamp was W. R. Grove, the inventor of the "Grove" cell. Faraday had proposed "inclosing wire in a tube for the purpose of being able to ignite a longer portion of it." In 1840 and 1841 Grove was using for lighting his laboratory an incandescent lamp which embodied some of the principles of our latest lamps. He used a metallic filament.

"Not knowing how to reduce tungsten powder to a wire, he used platinum as the best metal available for a filament, and arranged the wire in the form of a helix, the spirals of which were brought as close together as possible, 'as each aids by its heat that of its neighbour, or rather diminishes the cooling effect of the gaseous atmosphere. The wire should not be too fine, as it would not then become fully ignited. The helix form offers the advantages that, the cooling effect being lessened, a much longer wire can be ignited by the same battery. By this increased length of wire, the battery fuel is economised, while the greater light is afforded. By the increased heat the resistance is still further increased and the consumption still further diminished.' Here we see not only the metallic helix, but also the beginning of an attempt for a high-resistance lamp later worked on by Edison.

"Grove's lamp was made by inverting over water a beaker within which the filament was placed, the insulated leading-in wires dipping under the edge of the beaker. Grove realised, however, that the result could be accomplished better by placing the wire in a glass globe into which the conducting wires were sealed.

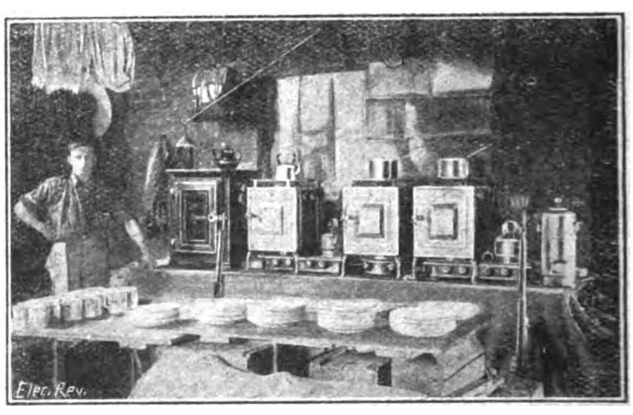
"The form of the latest nitrogen-filled tungsten lamp was even more closely approximated than this, for, realising the effect of different gases on radiant heat, Grove tried filling his lamp at approximately atmospheric pressure with a number of different gases, hydrogen, carbon dioxide, oxygen and nitrogen. As nearly as he could observe the candle-power was the same in oxygen, nitrogen and air, using in each case the same battery, which consisted of two or three pairs of Grove cells. He measured roughly the power consumed, and discovered that with nitrogen and air less power was used than with the other gases; hydrogen and carbon dioxide, besides taking considerably more electrical power, gave very much lower candle-powers.

"We see then that more than 70 years ago very many of the ideas contained in the latest lamp development had been tried and noted. Very soon after this, Starr patented his carbon-filament vacuum lamp. The work on incandescent lamps since that time has been largely a repetition of the earlier attempts, alternating between metallic and carbon filaments and between vacua and nitrogen atmospheres.

"Another type of lamp which has come into use comparatively recently, the mercury-vapour lamp, was employed as early as 1861, when signals were flashed from Fort Washington to the White House, using the lighthouse lantern with the mercury-vapour lamp as a source of light. And in 1862 Geissler tubes (vacuum-tube lighting) were proposed for mine illumination."

Lack of Lecturers.—At a meeting of the Newcastle-on-Tyne Education Committee on the 12th inst., the Lord Mayor (Mr. Johnstone Wallace), as chairman of the Rutherford College Sub-Committee, presented the report, which contained the following recommendation:—That owing to the lack of suitable applications for the post of Lecturer in Electrical Engineering, this appointment be not made at present, but that it be readvertised at a commencing salary of £180, instead of £160 as previously offered. The Lord Mayor said the class of man responding to the last advertisement was not just the type of man they required, and they decided to readvertise at a slightly higher figure in the hope that they might get more suitable applicants. This was agreed to.

Electric Cooking.—We have received the accompanying view of an electric cooking equipment in use by some of our troops, from Mr. W. A. Vignoles, borough electrical engineer of Grimsby. Presumably the fog of war has descended in the Grimsby area; at any rate, we are unable to give any details, official or otherwise, but our readers can, no doubt, be trusted to recognise certain well-known electrical cooking apparatus in the view.



ELECTRIC COOKING FOR TROOPS AT GRIMSBY.

The Edison & Swan City Showrooms.—In our last issue on page 247, in describing the Edison & Swan United Electric Light Co.'s new City headquarters, in the last paragraph we inadvertently referred to them as the new Victoria Street premises; this should, of course, have been "Queen Victoria Street premises," as mentioned earlier in the article.

Panama Canal Opened.—Reuter reports that the Panama Canal Zone celebrated the opening of the Canal on August 15th. The first vessel passed through the Gatun locks in 70 minutes.

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OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. R. V. WEARE, manager of the Chichester Electric Supply Co., was married on Saturday last to Miss Kate Farr.

MR. CHARLES FURNESS, Blackpool's electrical engineer, left on August 12th, for Eysden, Holland, near the Belgian border, to bring home his 14-year old daughter, who, with another girl, was at a convent school. Mrs. Furness was delighted, on August 13th, to report a telegram from her husband announcing that he had arrived at Folkestone, along with their daughter and other children, safely from Holland.

The Swansea Council on Friday decided to advertise for a borough electrical engineer, at a salary of £500 per annum. Mr. C. A. L. Prussmann has held the position for the past 10 years, but is now relinquishing the post.

Tramway Officials.—In view of the war, proposals made at Ashton to increase the salary of MR. ERNEST HOLT, tramways manager, by £50 per annum, and the salary of MR. APPELBEE, electrical engineer, by £50 now, and a further £50 next year, have been withdrawn.

General.—The marriage was solemnised at Christ Church, Blackburn, last week, of MR. ALBERT ISHERWOOD, electrical engineer, and Miss Elsie G. Senior.

At Christ Church, Henley, on August 11th, the marriage took place of MR. FRANK SWINDLER, of the electrical staff of Messrs. Whipp & Bourne, of Castleton, Rochdale, and Miss Jane Soothill.

MR. J. G. BALSILLIE, Commonwealth engineer for radio-telegraphy, has notified the Postmaster-General that he does not intend to offer himself for reappointment after his three years' engagement, which expires in September next, as his private practice will require the whole of his attention.—*Commonwealth Engineer.*

MR. S. G. SMITH, late of the staff of Messrs. Cole, Marchant and Morley, of Bradford, has been appointed assistant foundry superintendent to the British Westinghouse Co, Ltd., of Trafford Park, Manchester.

Golfers in the electrical world and members of the Electro-Harmonic Society will be interested in the current issue of *The Secretary*, which contains a full-page photograph of Mr. W. E. Lane, the first holder of the Morrison McLeod challenge cup presented to the Chartered Secretaries' Golfing Societies.

Obituary.—The death took place last week, at the Doncaster Military Depôt, of MR. EDGAR ARMITAGE (48), of Staincliffe. The deceased had been employed by the Yorkshire (Heavy Woollen District) Electric Tramways Co., Ltd., ever since that company commenced operations. He went with the Dewsbury Detachment of the 4th King's Own Yorkshire Light Infantry to Doncaster, in response to the mobilisation orders, but on parade on the day following his arrival at Doncaster, Mr. Armitage did not feel well. He was taken to hospital, and died later in the day.

The death is recorded, at the age of 51 years, of MR. CHARLES CORDINGLEY, proprietor and editor of publications connected with the motor trades, and organiser, many years ago, of motor-car and other exhibitions at the Agricultural Hall.

Indian Engineering states that the death has occurred of MR. D. S. CLAYTON, manager of the Electric Telephone Co. in Madras, who arrived there two years ago from Calcutta.

NEW COMPANIES REGISTERED.

Universal Electric Canoe Co., Ltd. (137,387).—This company was registered on August 8th, with a capital of £1,000 in 990 ordinary shares of £1 each and 200 deferred shares of 1s. each, to carry on the business of electric canoe, launch and boat builders, manufacturers of propelled canoes, boats, ships and vessels, &c. The subscribers (with one share each) are:—E. Dunkels, Woodhurst, Maidenhead, Berks., gentleman; A. Wilder, 62, Market Street, Maidenhead, Berks., boat builder; J. M. Wilder, Glen Roy, Ray Mead Road, Maidenhead, Berks, boat builder; H. J. Wilder, Glen Roy, Ray Mead Road, Maidenhead, Berks., boat builder. Private company. The number of directors is not to be less than two or more than five; the first are E. Dunkels and A. Wilder (both permanent); qualification, £3. Registered office, 1, Park Street, Maidenhead.

E. M. Evans & Son, Ltd. (137,390).—This company was registered on August 12th with a capital of £3,000 in £1 shares (1,000 6 per cent. cumulative preference), to take over the business of an electrical engineer and contractor carried on by J. H. Evans at 1 and 5, Lever Street, Manchester, as E. M. Evans & Co. The subscribers (with one share each) are:—J. H. Evans, Chetwynd, Woodford, Cheshire, electrical engineer and contractor; U. Tinker, 19, Mornington Street, Chorlton-on-Medlock, Manchester, cashier. Private company. J. H. Evans is permanent governing director, subject to holding £750 of the shares allotted to him under purchase of agreement. Registered office, 1, Lever Street, Piccadilly, W.

J. Davis & Co. (Southampton), Ltd. (137,379).—This company was registered on August 11th, with a capital of £2,000 in £1 shares, to carry on the business of electrical and general engineers and contractors, suppliers of electricity, manufacturers of and dealers in railway, tramway, magnetic, galvanic and other apparatus, &c., and to adopt an agreement with T. Davis. The subscribers (with one share each) are:—F. W. Griffith, 19, Elgin Avenue, W., clerk; T. Davis, 71, Bedford Place, Southampton, electrical and mechanical engineer. Private company. The number of directors is not to be less than two or more than six; T. Davis is permanent governing director, subject to holding 666 shares. Registered office, 71, Bedford Place, Southampton.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Newcastle and District Electric Lighting Co., Ltd.—Particulars of £80,000 debentures, created July 31st, 1914, and secured by trust deed of even date filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Certain specific plant and machinery, benefit of certain obligations, undertaking and property (other than specifically charged premises and uncalled capital), and all money resulting from compulsory sale under Provisional Order or Act of Parliament. Trustees: B. C. Browne, jun., and T. W. Thompson.

Corona Lamp Works, Ltd.—Issue on July 29th, 1914, of £5,600, part of a series of which particulars have already been filed.

Venner Time Switches, Ltd.—A memorandum of satisfaction to the extent of £500 on July 18th, 1914, of debentures dated July 10th, 1911, securing £5,000 has been filed (amount outstanding £3,500).

CITY NOTES.

Tyneside Tramways and Tramroads Co.

AT the annual general meeting of the above company, the CHAIRMAN, in moving the adoption of the report (see ELEC. REV., page 258), stated that the receipts were £15,553, or £986 more than in the corresponding period of last year. At the meeting for the corresponding half-year he had to report an increase of £1,049, so that the present increase was not quite so good. The £986 was made up of £406 on ordinary traffic, £42 workmen's traffic, and £537 for other traffic. The actual receipts were 10·48d. per car-mile, against 9·94d. in the corresponding half-year, and 9·26d. for the half-year before. The costs amounted to 6·58d. per car-mile, as against 6·27d. per car-mile, an increase of ·3d. per car-mile. This latter increased expenditure was almost entirely accounted for by the gradually increasing amount which they spent for repairs and maintenance, an expenditure they were charging to revenue. They were also providing a reserve fund, and proposed to add to it £1,430. The reserve now stood at £17,526, against £14,538 at the corresponding period of last year. The directors had decided that as it was an entirely cash business they were engaged in, and as they had a large number of small shareholders, they did not think it right to change the date of the payment of the dividend. It was their duty to endeavour to carry on the business of the country as nearly as possible on ordinary lines. In conclusion, the chairman said the expenses incurred in safeguarding the company in regard to the Newcastle-on-Tyne Parliamentary Bill had been provided for and taken off the profits of the last half-year.

MR. G. E. HENDERSON, vice-chairman, seconded, and the report was adopted.

The dividends having been formally approved, the meeting terminated.

South Metropolitan Electric Light and Power Co., Ltd.—The transfer books are closed from August 18th to 31st for the preparation of warrants for interim dividends payable as usual on 31st inst. in respect of the 7 per cent. cumulative first preference and 6 per cent. cumulative second preference shares.

Manaos Tramways and Light Co., Ltd.—The directors report that for the year ended April 30th the receipts from the tramways were £87,028, as against £106'148 for the previous year, and from the lighting department £44,395, as against £44,148. The results are not considered unsatisfactory in view of the depression prevailing in Brazil generally, and particularly in the Amazon. The State is heavily in arrears in payment for the street lighting. The Federal and the Municipal Governments' current accounts are also seriously in arrear, but other collections have been well maintained. Under the circumstances the directors cannot see their way to recommend the payment of a dividend. To the balance of £14,426 remaining after payment of debenture interest and sinking fund should be added the amount of £3,435 brought forward, making a total of £17,861. This the directors recommend should be dealt with thus:—Transfer to contingencies reserve, £8,000; transfer to renewals reserve, £6,000; leaving to be carried forward £3,861.

Tyneside Electrical Development Co., Ltd.—The directors have declared an interim dividend of 5 per cent., less income-tax, payable on August 31st.

Hadfields, Ltd.—An interim dividend of 1s. per share, tax free, on the ordinary shares, has been declared for the half-year ended June 30th.

Hydro-Electric Power & Metallurgical Co., Ltd.—At the meeting of first mortgage debenture-holders held on Wednesday, the resolution referred to on page 258 of our last issue was adopted.

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STOCKS AND SHARES.

Tuesday Evening.

With the Stock Exchange closed and Consols at 70, to say nothing of a moratorium which possibly may be extended beyond its due date of September 4th, it may be supposed that affairs in the neighbourhood of Throgmorton Street are none too flourishing. Members find their occupation gone. A great number are at York House, working voluntarily for the Prince of Wales's National Fund. Others have gone to the front, and some still stroll up and down the street, to the admiration of all who are not themselves in khaki. A few are engaged in buying horses for the Government, and a much larger body adopt the sensible course of rusticating in the country on as little as they can per diem. The question of reopening the markets remains fraught with danger, not to the Stock Exchange alone, but to the community at large; and the House authorities have to take into consideration many minor chains of circumstance of which the outsider can have little conception.

The main difficulty concerns itself with the stocks open on Continental account with London houses. The French and German interests cannot be expected to pay, and, therefore, any resumption of open markets would set free a very torrent of selling from those in whose hands the stock now rests. It is quite problematical to what extent bankers are prepared to continue existing loans, much less to negotiate fresh money. Good news from the theatre of war, if it held out reasonable hope of peace ensuing, would afford the most powerful stimulus that could be desired by those who want the Stock Exchange to re-open, if only from the point of view of knowing what their securities are worth. Until this comes, it is difficult to see how markets can be started, except under conditions which, as already hinted, might precipitate panic.

Business, on a very limited scale indeed, is being carried on; and we know of one firm of brokers, for instance, whose expenses average £200 a week, who have taken the lordly sum of £3 15s. in commission since the Stock Exchange closed on July 31st—the said expenses being reduced by £2 or £3 a week through money saved on postages and stationery. The collapse followed six months of hard times for investors and stock markets, so that, when business was suspended, many leading quotations had already undergone severe shrinkage before the beginning of the war.

It is our annual practice at this season to set out short comparative tables of the fluctuations which representative electrical stocks and shares have experienced since New Year's Day; and, although the House is closed, there is an exceptional interest attaching to the process now, inasmuch as quite a large percentage of the prices in electrical stocks and shares actually show rises, compared with seven months ago, as the following examples illustrate:—

Stock or share.	Dec. 31st, 1913.	July 30th, 1914.	Rise or fall.
Metropolitan	46	31½	— 14½
Metropolitan District	33	19	— 13
Central London Deferred	62½	42½	— 20
British Insulated	8	10½	+ 2½
British Westinghouse Pref.	1⅛	1 1/16	+ 1/16
Callender's	11	12	+ 1
Henley's	13	15	+ 2
Babcock & Wilcox	2 5/16	2⅜	— 1/16
City of London Ordinary	17	16	+ 1
County	12	12	..
Kensington	7⅞	7½	— ⅜
St. James'	8⅜	9⅛	+ ⅜
Westminster	8½	8⅝	+ ⅛
Brazil Traction	83½	58	— 25½
Mexican Light and Power	44	45½	+ 1½
Shawinigan	135	125	— 10
Mexico Trams	66½	62½	— 4
British Electric Traction 7 per cent.	53¾	55½	+ 2
Anglo-American Telegraph Pref.	105⅜	108	+ 2½
Eastern Extension	12¼	12⅜	+ ⅛
Eastern Telegraph	125⅝	130⅝	+ 5
West India and Panama	2⅛	1⅜	— 1/16
Marconi	8 5/16	1 1/16	— 1¼
Globe Telegraph	10⅝	11½	+ ⅞

It seems extraordinary that, out of the two dozen securities which we took purely at random, save in the way of drawing examples from five principal sections, more than half should have rises to their credit. But of course it is only fair to add that the current quotations are largely nominal. Buyers could no doubt get on in nearly every case at the above figures, or possibly a little less; though what sellers would be able to get for the same shares it would be difficult to say.

As with other matters in which people were a little demoralised upon the first shock of the war, the question of deferring dividend payments has been settled by most companies agreeing to distribute their profits in the usual way. Delay has occurred in certain cases, and in a comparative few the money is to be withheld for the time being. But the contention advanced here last week, that great hardship would be inflicted upon numbers of relatively small investors were dividends not to be paid, is now so generally recognised that the public can reckon upon getting its regular dividends this autumn, in spite of the war.

MARKET QUOTATIONS.

Owing to the war, the prices given below are, of course, only nominal.

Wednesday, August 19th.

CHEMICALS, &c.		Latest Price.	Fortnight's inc. or Dec.
a Acid, Hydrochloric	per cwt.	..	..
a ,, Nitric	,,	..	..
a ,, Oxalic	per lb.	..	..
a ,, Sulphuric	per cwt.	..	..
a Ammoniac Sal	,,	..	..
a Ammonia, Muriate (large crystal)	per ton	..	..
a Bleaching powder	,,	£10	£3 15 inc.
a Bisulphide of Carbon	,,	..	..
a Borax	,,	..	..
a Copper Sulphate	,,	..	..
a Lead, Nitrate	,,	..	..
a ,, White Sugar	,,	..	..
a ,, Peroxide	,,	..	..
a Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	..	..
a Potash, Caustic (88/90 %)	per ton	..	..
a ,, Chlorate	per lb.	7d.	3½d. inc.
a ,, Perchlorate	,,	9d.	5½d. inc.
a Potassium, Cyanide (98/100 %) (for mining purposes only)	,,	..	..
a Shellac	per cwt.	..	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers	,,	..	..
a ,, Recovered	,,	..	..
a ,, Lump	,,	..	..
a Soda, Caustic (white 70/72 %)	,,	7d.	3½d. inc.
a ,, Chlorate	per lb.	..	..
a ,, Crystals	per ton	..	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£86	..
b ,, Wire, in ton lots (1 to 14 S.W.G.)	,,	£107 6 8	..
b ,, Sheet, in ton lots	,,	£113	..
b Babbitt's metal ingots	,,	£80 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8½d.	1¾d. inc.
c ,, Tube (brazed)	,,	10d.	½d. inc.
c ,, ,, (solid drawn)	,,	8½d.	1¼d. inc.
c ,, Wire, basis	,,	8⅝d.	1⅝d. inc.
c Copper Tubes (brazed)	,,	10d.	⅝d. inc.
c ,, ,, (solid drawn)	,,	10d.	⅝d. inc.
g ,, Bars (best selected)	per ton	Nom.	..
g ,, Sheet	,,	Nom.	..
g ,, Rod	,,	Nom.	..
d ,, (Electrolytic) Bars	,,	£72	£9 10 inc.
d ,, ,, Sheets	,,	£90	£8 inc.
d ,, ,, Rods	,,	£78	£9 10 inc.
d ,, ,, H.C. Wire	per lb.	9⅜d.	1 1/16d. inc.
f Ebonite Rod	,,	4/6	..
f ,, Sheet	,,	4/-	..
a German Silver Wire	,,	1/7	1d. inc.
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	3/1	1¾d. inc.
i Iron Pig (Cleveland warrants)	per ton	52/11	1/7 inc.
i ,, Wire, galv. No. 8, P.O. qual.	,,	£16	£2 inc.
g Lead, English Pig	,,	Nom.	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	4d. to 2/6	..
e ,, ,, ,, medium	,,	3/- to 5/-	..
e ,, ,, ,, large	,,	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	,,	Nom.	..
p Phosphor Bronze, plain castings	,,	1/1 to 1/3½	..
p ,, ,, rolled bars & rods	,,	1/0½ to 1/3	..
p ,, ,, rolled strip & sheet	,,	1/2½ to 1/5½	..
e Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	Nom.	..
g Tin, Block (English)	,,	Nom.	..
n ,, Wire, Nos. 1 to 16	per lb.	2/3	..
p White Anti-friction Metals	per ton	£44 to £194	..
k Zinc, Sh's (Vieille Montagne bnd.)	,,	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edwa d Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

W. T. Henley's Telegraph Works Co., Ltd.—The directors have declared an interim dividend on the preference shares at the rate of 4½ per cent. per annum, less income-tax, and on the ordinary shares at the rate of 10 per cent. per annum, free of income-tax, for the half-year ending June 30th last, both payable September 1st.

Bell's United Asbestos Co., Ltd.—A financial daily states that the directors, owing to the present financial situation, have postponed the payment of an interim dividend on the ordinary shares. The half-year's trade has been satisfactory, and with the resumption of normal conditions, a distribution may be expected.

Bank Rate.—The Bank Rate is 5 per cent., to which it was reduced on August 8th.

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EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JULY, 1914.

In contrast with the returns for the preceding month, the July figures for electrical exports and imports reached values well in excess of the average figures for the first half of the year.

The exports of British material were valued at £564,291, which compares with £462,231 in the previous month; the increase was, however, mainly due to a large telegraphic export to British West Africa, which increased the June telegraphic total of £72,355 to £175,287 in July. Machinery exports also increased by roughly £12,000, but in other directions the returns show some falling off, notably in exports of goods and telephonic material, and, to a less degree, cable exports.

The imports, valued at £291,244, nearly reached the highest recorded total this year, and compare with £261,770, the value for June; amongst the sections showing increases were the machinery, cable, telegraphic and telephonic imports. The re-exports only reached a total of £19,478, the lowest figure recorded this year. Our best customer during the month was British West Africa, owing to the circumstance mentioned, and otherwise trade with India, Japan, Argentina, Canada and Australia attained respectable proportions.

In the light of recent events, it is not surprising that German imports into this country jumped up by some £30,000 to £168,250 in July, before the declaration of War; Belgian imports also doubled, while the American figures show a decrease.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	843	720	171	...	326	121	18,111	908	...	88	395	5,658	27,341
Germany	3,631	1,091	37	...	283	8	6,550	800	...	282	26	111	12,819
Netherlands, Java and Dutch Indies ...	670	945	207	...	32	105	1,246	335	11	...	48	253	3,852
Belgium	791	144	37	19	116	29	11,447	4	390	...	4,092	257	17,326
France	292	...	2,795	...	39	25	10,665	16	...	159	147	3,183	17,321
Portugal	800	69	19	12	...	...	486	...	17	...	594	56	2,053
Spain, Canary Isles and Spanish N. Africa...	898	426	53	...	...	999	3,385	...	394	91	210	...	6,456
Switzerland, Italy and Austria-Hungary ...	1,286	140	271	...	58	513	3,029	22	10	331	...	2,353	8,013
Greece, Roumania, Turkey and Bulgaria ...	693	99	481	...	...	...	500	...	...	25	642	1,715	4,155
Channel Isles, Gibraltar, Malta and Cyprus...	44	47	12	12	...	46	...	...	7	10	35	122	335
U.S.A., Philippines and Cuba	202	...	920	236	...	15	1,067	...	...	...	40	313	2,793
Canada and Newfoundland	403	1,429	967	673	...	139	10,727	3,074	1,830	4	397	19,907	39,550
British West Indies and British Guiana ...	173	77	410	139	...	10	196	...	46	15	...	154	1,220
Mexico and Central America	22	...	44	...	...	...	214	...	...	38	...	...	318
Peru and Uruguay	363	...	...	33	...	...	3,423	207	100	42	325	35	4,528
Chile	134	96	7	61	...	...	822	975	71	...	...	650	2,816
Brazil	530	341	445	67	20	81	10,484	98	...	...	99	732	12,897
Argentina	7,293	8,239	4,544	598	514	3,866	11,198	323	2,277	66	850	5,884	45,652
Colombia, Venezuela, Ecuador and Bolivia...	...	...	...	...	...	...	13	...	...	...	...	411	424
Egypt, Tunis and Morocco	116	258	110	176	...	5	1,017	41	1,607	...	...	316	3,646
British West Africa	75	426	101	71	...	21	129	45	107	...	89	95,524	96,588
Rhodesia, O.R.C. and Transvaal	1,139	26	512	815	45	14	2,506	170	149	18	54	516	5,964
Cape of Good Hope	2,654	2,418	95	638	72	299	5,007	2,328	573	...	1,678	219	15,981
Natal	822	2,857	116	259	117	6	2,173	...	181	24	418	41	7,014
Zanzibar, Brit. E. Africa, Mauritius & Aden	555	375	438	86	...	32	343	61	167	12	36	243	2,348
Azores, Madeira and Portuguese Africa ...	91	479	39	34	...	50	1,089	270	644	...	48	77	2,821
French African Colonies and Madagascar ...	9	...	59	...	...	...	...	...	...	...	...	...	68
China and Siam	1,426	971	478	...	...	721	2,059	97	199	15	173	...	6,139
Japan and Korea	480	650	...	4	...	298	15,682	...	366	20	775	28,399	46,674
India	4,885	17,335	3,611	1,613	467	357	25,945	10,558	4,517	334	5,336	3,768	78,726
Ceylon	507	152	110	99	44	46	287	100	284	...	48	83	1,760
Straits Settlements, Fed. Malay States and Sarawak	1,637	1,168	494	31	75	83	7,146	102	757	8	826	1,162	13,489
Hong Kong	610	390	146	47	...	168	1,017	...	1,072	...	...	454	3,904
West Australia	276	4,155	120	276	14	...	1,411	...	19	...	645	677	7,593
South Australia	295	399	154	76	26	179	231	4	16	...	...	304	1,684
Victoria	1,138	7,199	573	1,574	93	1,583	3,982	220	543	...	676	269	17,850
New South Wales	1,588	3,986	1,441	1,269	607	268	7,348	995	942	56	2,387	755	21,642
Queensland	395	100	72	258	...	...	1,293	...	23	39	1,766	62	4,008
Tasmania	...	...	...	10	...	...	75	...	...	...	14	100	199
New Zealand and Fiji Islands	744	2,962	694	803	268	...	4,498	776	1,250	...	3,805	524	16,324
Total, £	38,510	60,169	20,783	9,989	3,216	10,087	176,801	22,529	18,569	1,677	26,674	175,287	564,291

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	570	...	...	...	...	...	3,332	18	2,323	...	7,662	13,905
Germany	4,653	23,955	5,038	10,188	5,922	2,060	95,775	...	5,043	6,708	8,908	168,250
Holland...	10	25	...	213	683	...	5	...	...	184	...	1,120
Belgium	1,125	12,262	...	178	78	26	5,980	50	128	30	2,435	22,292
France	581	107	311	134	290	878	161	105	2,455	2,845	604	8,471
Switzerland	535	7,113	...	40	1,055	6,981	...	...	213	...	203	16,140
Italy	87	5,580	...	...	...	...	22	...	...	...	596	6,235
Austria-Hungary	16	2,457	...	245	6	347	...	107	...	...	...	3,178
United States	4,391	1,189	2,235	...	31	91	11,941	27,578	1,095	38	1,986	50,575
Total, £	11,918	52,688	7,584	10,998	8,065	10,383	117,216	27,858	11,257	9,805	22,394	290,166

Additional imports: Spain: Electrical machinery, £50; carbons, £646. Turkey: Electrical machinery, £10. Canada: Electrical goods, £142; fittings, £30; arc lamps, £5; meters, £18; machinery, £177.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above... ...	10,663	815	...	508	246	...	5,157	...	808	277	1,004	19,478

TOTAL EXPORTS: £564,291 TOTAL RE-EXPORTS: £19,478 TOTAL IMPORTS: £291,244

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

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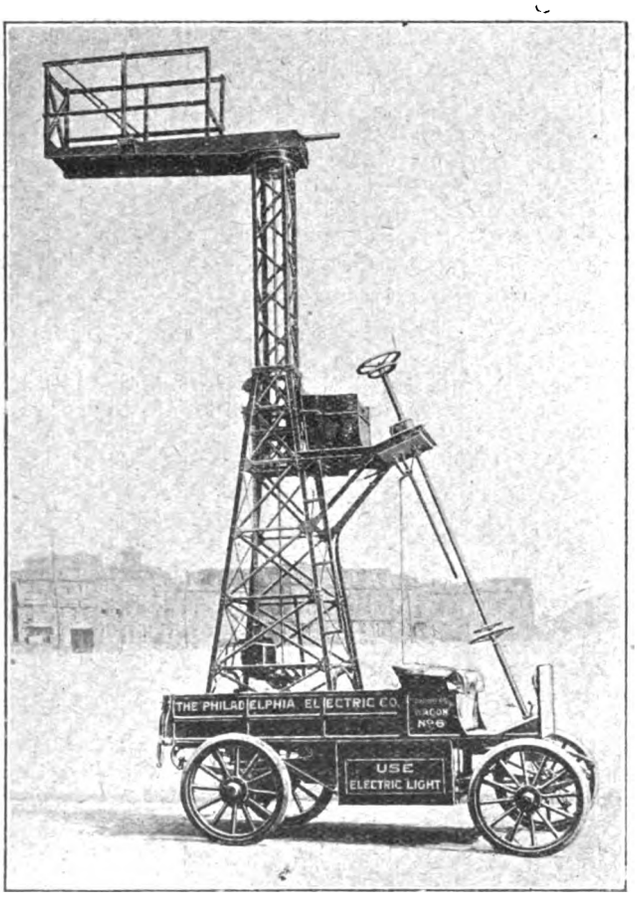
ELECTRICALLY-PROPELLED TOWER WAGONS.

It seems fairly obvious that if an electric light or power company has faith in its own commodity, it should utilise it to the fullest possible advantage, and hence the use of electric motive power for driving the cars or other vehicles employed in the service of such companies seems to be a natural result. For some reason or other, however, this procedure appears to have made a greater headway in the United States than it has in this country, and hence the electrically propelled vehicle belonging to the electricity supply authority is yet somewhat of a novelty. We illustrate below the tower wagon utilised by the Philadelphia Electric Co., in connection with arc lamp trimming, in order to show that such utilisation of electric energy is not merely a possibility, but is becoming a matter of standard practice. The figure shows the tower wagon at its fullest extension.

For the safe operation of power vehicles of this description, it is essential that all necessary apparatus shall be in a position which is easy of access. Also the mechanism has to be strong, simple, and easily operated. These problems have been met very



American Electric Tower-Wagon for Arc Lamp Trimming.

satisfactorily by the Commercial Truck Co. of America, whose works are at Philadelphia, this company having adopted, in preference to other types, a steering wheel mounted on an inclined column with a control wheel immediately below, as shown in the illustration. In order that the car may be equally well controlled by a man on the upper platform, the extension of the steering rod is carried upward and backward to the top position, a duplicate steering and control wheel being mounted in that position. The controller is of the continuous torque type mounted on the chassis and forming the base of the steering column. Its position places it in the most desirable place for inspection, leaving the space under the seat available for loading and other purposes. The controller gives three speeds forward and two reverse, without breaking circuit between points, making the acceleration smooth and without sudden jerks or strains on the gearing and tires. The steering gear is mounted on the frame immediately below the controller, the steering shaft passing through the latter.

The drive or reduction gear from the motor to the rear wheels is the Hindley type worm and gear. By the use of this type of gear, it is possible to transmit the power from the motor to the rear wheels by a single reduction, thus avoiding complication and the large number of parts necessary where double reduction is employed. The rear wheels are mounted on taper roller bearings entirely independent of the driving mechanism, and are driven by floating shafts engaging the outer end of the wheel hub, the inner ends of which slip by means of squared ends into the hubs of bevel differential gears. The whole mechanism is immersed in oil, giving a minimum of wear, and noiseless operation.

The rear construction, consisting of the motor, gear casing, axle housing and gear wheels, with the gearing and driving shafts, constitutes a complete power equipment which is readily removable for inspection and repairs. All parts of the driving unit are set in a fixed and unalterable relation to each other. Ample braking capacity is provided in the internal expanding brakes. The brake is controlled by a foot-lever, and is reinforced by an electric emergency brake, and either of these is ample to hold the vehicle under any condition. The battery used is of an improved lead type or Edison type giving 85 volts, the capacity being adjusted to suit the service requirements. In the 500-pound wagon it is of 16 amperes' capacity, while in the 1,000-pound wagon it is rated at 22 amperes. The rated speed is 15 miles per hour, and the mileage is 40 to 60, depending on the battery equipment. It is to be hoped that with the extending use of electric light and power in this country, we shall shortly see more of these vehicles in ordinary use upon our roads, and it will be a good thing if the electricity supply authorities of Great Britain give a decided lead in this direction.

REVIEWS.

Practical uses of the Wave Meter in Wireless Telegraphy. By J. O. Mauborgne. London: Hill Publishing Co. Price 4/2 net.

This useful and interesting little work has for author a first lieutenant in the U.S. Army who was formerly an instructor at one of the U.S. Army Signal Schools. Being originally issued for instruction purposes it has been amended and revised with assistance from several well-known U.S. experts in radio-telegraphy. Good and useful information will therefore be looked for in the book, and in this the reader will not be disappointed. There is, however, a tendency to stretch the applications of wave meter methods beyond their legitimate scope in some instances, while in a few others there is a lack of explanatory matter. One instance of the former occurs on page 44, where it is proposed to measure the resistance of the spark gap in a transmitter on the assumption that the decrement of the circuit is the sum of the decrements due to the calculable high frequency resistance of the inductance spiral and the spark gap resistance. Such an assumption not only omits the condenser losses but also fails to take account of the losses occurring in various parts of the oscillating electromagnetic field about and around the transmitter, whereby I^2R losses are produced by induced currents in neighbouring conductors and dielectric losses in any imperfect insulators in which an alternating electric stress may be created. Lack

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of explanatory matter in regard to the adjustment of a sending station to make it comply with U.S. laws is evidenced on pages 46 and 47. In the first place it is not clear why the hot-wire ammeter in the antenna circuit should indicate the "radiation" from the antenna. In the second place it is not made clear why the wave length which gives the largest reading on this instrument may be assumed to give the most powerful radiation, especially in view of the fact that an excessive inductance in the antenna will enhance the antenna resonance and will also reduce the radiation.

In view of legislation in the United States on the subject of transmitter decrements, wave meter determinations of this quantity assume an importance which they would not otherwise possess; the matter is therefore dealt with in some detail in the work under review. In this connection an expression of opinion on such legislation may not be out of place. As in this country, there appears to be in the United States also, too great a tendency to legislate first and put the assumptions made to proof afterwards. The object of the legislation is to minimise interference, and for some ill-defined reason an altogether undue proportion of interference troubles have been ascribed to large transmitter decrements. The assumption is made that a transmitter will affect a distant receiver in the same manner as it affects a wave meter in close proximity. This can be readily proved to be quite unsound. Moreover, the methods of measuring decrements are not by any means above suspicion in regard to the degree of accuracy at present attainable. For instance, among several other criticisms which might be made of such methods as are described in this book, not only do the inconsistencies of most spark transmitters coupled with slowness of response in the quantitative wave meter appliances used, render an unwholesome amount of "averaging" necessary, but quite different results are obtained from the two main slopes of a resonance curve. For the latter reason the author recommends striking a further average between these two results. The truth of the matter is that the methods of measurement are not yet sufficiently developed to justify their use in reference to legislation.

Descriptions of several forms of wave meter and kindred appliances are given, but a number of those in common use in this country are not included. The work covers 67 pages and index with 42 illustrations.

J. E. T.

Elementary Magnetism and Electricity. By Cyril M. Jansky, B.S., B.A. London: Hill Publishing Co., Ltd. Price 6/3 net.

This is a further volume of the Industrial Education series prepared in the Extension Division of the University of Wisconsin. It has been prepared for use in correspondence instruction, and is intended for individual or home study, consequently we should expect to find it free from the grosser slips and inaccuracies to which text-books of all kinds are subject, since such mistakes are certainly more excusable, or at any rate are more easily rectified, when a book is to be used by a class-student under the guidance of a teacher than when it is intended to be used without a teacher.

However, the "Recapitulation" of Chapter I contains the following: "*Like* poles *attract* and *unlike* poles *repel*," and on page 121 we have the statement: "The coulomb is the unit quantity of electricity and is the quantity of electricity given by one ampere in one *hour*." To pass from these glaring errors we are at once struck by a multitude of inconsistencies, of which the following are typical: Page 20, par. 2—"Magnetism is the name of an *assumed substance* producing attraction or repulsion between pieces of iron by action at a distance"; page 20, par. 3—"Magnets are bodies possessing the *property* of magnetism." Magnetism is therefore both a substance and a property—subtle but unconvincing. Magnetic Induction is defined as a "process," while Electro-Magnetic Induction is a "principle." In paragraph 9, on page 20, we read that the "strength of a magnetic field is usually represented graphically by the number of lines per square centimeter in a plane at right angles to the field"; in paragraph 7, on the same page, a magnetic field is defined as the "region or space which is permeated by a magnetic influence"—we are left to imagine the state of mind of an unaided student who attempts to construct *a plane at right angles to a region of space.* Of course the author's meaning may be clear to the reviewer, but to the student who is receiving his first lessons on magnetic fields such obscurity of definition must necessarily cause loss of time and temper.

The book contains an unusually good collection of worked examples, but even here exception must be taken to the example on power on page 197. "Niagara Falls are about 160 feet high. It is estimated that 700,000 tons of water pass over them every minute. If all the energy of this water could be utilised what horse-power could be developed?" Answer: 6,787,878 H.P. We have ourselves worked this problem (with 2,000 lb. to 1 ton) and obtain the result 6,787,878.78 H.P.! Perhaps it did not strike the author that if his approximate height of Niagara was only one inch in error his calculated H.P. would be just over 3,000 out.

The inclusion of pretty pictures of Wireless Stations and Westinghouse Electric Locomotives does not atone for the numerous errors and still more numerous inconsistencies contained in this book. The illustrations and arrangement are good, but a careful revision of the whole book is necessary before it can be recommended to students.

P.H.S.K.

Le Théorie du Rayonnement et les Quanta. Paris: Gauthier Villars. Price 15 fr.

In the autumn of 1911 a conference was held at Brussels, under the auspices of M. Solvay, to consider and discuss certain controversial problems on physics and radiation, in the light of modern research. The gist of what took place is contained in a volume of 456 pages, bound in paper covers, and printed in French. The representative character of the assembly may be gathered from the names of some of the participants—Lorentz, Nernst, Planck, Rubens, Sommerfeld, Wein, Warburg, Jeans, Rutherford, Brillouin, Curie, Langevin, Perrin, Poincaré, Einstein, Hasenöhrl, Onnes, and Knudsen. To the physicist the contents of the volume will be found to be of much interest.

PRESSURE-REDUCING MOTOR-GENERATOR FOR HIGH-PRESSURE DIRECT CURRENT.

In the pressure-reducing motor-generator devised by P. Amsler in 1912 for use in train lighting on high-pressure systems, a distinct direct-coupled motor and generator were used, the circuits being as in fig. 1. The high-pressure machine was separately excited from the secondary low-voltage circuit, shunt characteristics being secured in the high-pressure motor while obviating connection of its field windings to the high-pressure circuit. Three 1,200/115-v. converters of this type were installed by Messrs. Brown Boveri for train lighting on the Biasca-Acquarossa line (Tessin), and similar sets have been in use for two years on the 1,500/1,800-v. Weydelstein railway (Bavaria). A number of sets, also used exclusively for lighting, are in use on the Tavannes-Noirmont railway (Switzerland). The operation of the first sets to be installed was so satisfactory that Messrs. Brown Boveri have adopted Amsler motor generators as standard on all their D.C. railway systems (using 1,200 volts or higher pressure), and use the low-pressure secondary current not only for lighting, but also for heating and for fan and air pump motors, etc. High-pressure

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circuits and apparatus are thus limited in number and extent, and reliability of working is enhanced.

In order to save space and weight, Amsler motor-generators are now built within a common cylindrical yoke-housing carrying a ball-bearing at each end and arranged specially to ensure efficient cooling. A 2-KW. set constructed on the new system weighs 30 per cent. less than a 1.25-KW. set of the original type; its housing being only 370 mm. in diameter and 770 mm. in length, such a machine can be accommodated easily beneath even small rolling stock.

The new type of machine (described and illustrated in *Elek. Zeitschrift*), is built for continuous outputs of 2, 5, 10, 18, 28 or 40 KW., primary pressure 1,500 to 2,500 volts, secondary pressure 30 to 330 volts, according to size of machine. The

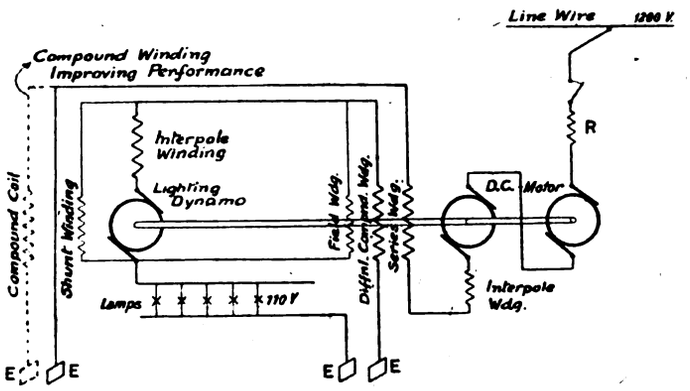

FIG. 1.

4-pole 40-KW. machine weighs 3,410 lb. and is designed for 1,000 r.p.m., but can be run considerably faster with corresponding increase in output. All motor coaches on the Chur-Arosa and Nyon-Morez railways (2,000-2,200 volts, line pressure) are equipped with these pressure transformers.

The ratio of pressure conversion is independent of variations in line pressure, and the latter are proportionately reproduced in the secondary pressure. An automatic Brown Boveri speed regulator may be used to hold the secondary pressure quite constant, the connection of the group being then as in fig. 2. All new locomotives on the Berner Oberland railway are being equipped on this system. The units actually installed comprise H.T. motor, fan and L.T. dynamo. Between 1,300 and 1,700 volts line pressure, the speed of the set and hence the fan delivery and dynamo voltage are held constant by the automatic regulator. The latter controls the dynamo excitation, and the differential compound winding of the motor is omitted since its function is performed by the voltage regulator; otherwise operation is as in fig. 1. All shunt windings are excited from the low-pressure side; the interpole and main series windings (carrying primary current) are connected to the earthed side of the armature. The armature winding alone requires high-tension insulation and is protected by mica preparation tested to 9,000 V. A.C.

Any desired fraction of the motor output may be utilised mechanically, but a fan is not required to limit the maximum speed of the motor, since the latter has shunt characteristics. In this respect the Amsler system is distinguished from cer-

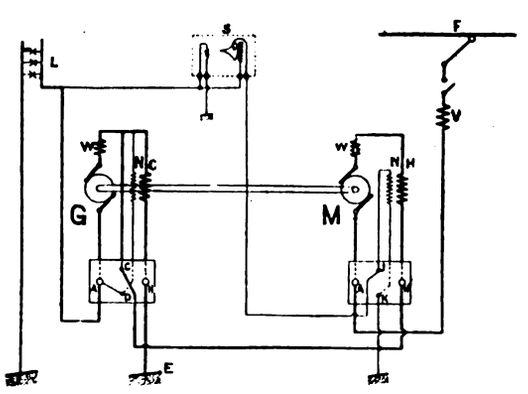

FIG. 2.

tain American systems which either (1) use a H.T. series motor with a relatively powerful fan dissipating sufficient energy to maintain practically constant dynamo pressure at all outputs; or (2) excite the H.T. motor by a small secondary battery. There is seldom useful application for the large fan required by the former alternative, and the disadvantages of an auxiliary storage battery are well known.

The Amsler sets give no excessive sparking either at the moment of connection to the H.T. line or during normal working (a 40-KW. 2,200-V. set was tested up to 3,500 V. with 20 per cent. current overload, giving satisfactory commutation throughout). Acceleration is very rapid, the starting current rising momentarily to 6 or 7 times normal; it is immaterial whether the dynamo be loaded or light during starting. To obviate current surges, a permanent series resistance R. (fig. 1) may be used with small sets; this resistance is short-circuited automatically by a dynamo-pressure relay to save losses in larger sets.

Similar motor-generator sets may be used advantageously to supply traction motors without series resistance. Further information relating to their application in this connection will shortly be forthcoming.

MAMMOTH BOILER RESULTS AND PROJECTS AT DETROIT.

THERE are now nine 2,365 H.P. Stirling boilers installed in the Delray station of the Detroit Edison Co., and experience in their operation shows that they are as reliable as turbo-generators. There are three sources from which trouble may be expected—the boiler proper, the furnace brickwork, and the stoker. If properly supervised, the boiler need introduce no shut-down hazard. From October, 1912, to November, 1913, there were but two tubes replaced in seven boilers whose average age was two years. The front tubes are worked exceedingly hard, and it is proposed to use distilled water for make-up, since even 1-16 in. scale may cause trouble. The heat required to distill water would be recovered by using the main turbine condensate for cooling the stills, hence the cost of distillation would be negligible. Furnace brickwork is limited to four furnace walls using underfeed stokers. The fallibility of the stokers is not great; ordinary repairs include replacement of burnt tuyeres and dump plates, etc. One-side firing (and half boiler ouptput) is practicable temporarily in case of serious burn-out. In the Delray station, the boilers have been ready for service 95 per cent. of the time considered, 98 per cent. of the five full-load days of each week, and 100 per cent. of the peak-load periods (4 to 6 p.m.). At no time has it been compulsory to put a boiler out of commission. The boilers are down for ten or fourteen days at nine or ten months' intervals for cleaning and general overhaul.

The Detroit Edison Co. is now building a power plant to contain six 20,000 KW. turbines served by twelve boilers, *i.e.*, 10,000 KW. per boiler with no spares. Though experience shows the chances of forced boiler shut-down to be remote, the contingency has been considered. At normal full load, the two boilers supplying a given turbine unit will operate at approximately 191 per cent. of builders' rating (on 10 sq. ft. heating surface per boiler H.P.). If one of six boilers working at this rating should fail, the other five would operate at 235 per cent. rating and maintain full output. The settings and auxiliaries are being designed to permit continuous operation at 255 per cent. rating (*i.e.*, three boilers taking the full load of four).

The overall boiler and furnace efficiency of a Taylor stoker-fired unit at Delray varies from 81 per cent. at 90 per cent. rating (equivalent evaporation 3.1 lb. from and at 212° per sq. ft. heating surface per hour) to 77.5 per cent. at 215 per cent. rating (equivalent evaporation 7.45 lb.), hence as many boilers as possible are run at 90 per cent. rating during light-load periods and peak-load is carried by increasing the boiler rating. This flexibility is particularly valuable in tiding over sudden thunderstorm peak-loads. The average day load at Delray will be 63,000 KW. this summer, and the boilers then operating at 100-125 per cent. rating will take 30 per cent. increase in load with little effort.

The policy adopted has been to reduce the stoking staff to a minimum, increasing the responsibility of each man and employing only first-class firemen. A gauge board and control point are provided for each boiler. A water tender (man) on a gallery at the top drum level looks after the boiler feed, but otherwise the fireman is entirely responsible. Each man operates two stokers and a head fireman is in charge of six or eight units. Eight-hour shifts are worked, and ordinary and head firemen are paid 1s. 8d. to 1s. 10½d. per hour respectively. The cost of firing averages only 0.0038d. per KW.-hr. Boiler dampers are shifted at the control point; the throttles of the blower turbines are extended through the floor and 18-point controllers are provided for the stoker motors. The latter are d.c. interpole machines with 4 : 1 speed regulation; the power required by the stokers is very variable and it is difficult to make an engine govern satisfactorily with so wide a controlled speed range. On the gauge boards are pressure gauges connected to the superheater inlet and outlet; gauges showing the draught under the fire, at the damper and at the top of the combustion chamber; and CO_2 meters. The fireman is guided primarily by steam requirements as shown by a pilot steam gauge and a steam flow meter. Furnace conditions are judged by the CO_2 recorder, the air pressure required for a given boiler load and the colour of the gases as they tumble over the first baffle. Air pressure and stoker speed are hand controlled and the company's prejudice (says Mr. J. W. Parker before the American Society of Mechanical Engineers) is against automatic control. Circulation in these boilers is so rapid that the water level in the top middle drum often stands two feet or move above that in the outside drums; this makes automatic regulation of feed unsatisfactory on variable load.

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Best results are believed to be secured by encouraging intelligent interest on the part of the firemen. At Delray, an average of 13.5 to 14 per cent. CO_2 and 0 to 0.2 per cent. CO is found in the flue gases. Periodic dumping from the stokers often disburbs good conditions, and a revolving grate continuous dumping device is being tried with good results.

Allowing for overhauling at intervals of eight months, it is estimated that the average cost of maintenance (including stokers, settings and boilers) is 0.0017d. per KW.-hr.—the plant capacity being 120,000 KW. and the annual load factor 36 per cent. In the last two units installed at Delray, the setting walls are built slightly concave on the fire side. It is hoped that this vertical arch construction will prevent bulging in of the brickwork.

As at present built, the Delray boilers are limited to about 275 per cent. rating, since unburnt gases then commence to get into the superheater pass (though the combustion chamber is 28ft. in height), and though secondary combustion occurs, the overall efficiency decreases. Another limitation is the drop in pressure through the superheater, the automatic check valves and boiler stop valve. At 210 per cent. rating, the drop in the superheater and check valves is 21 lb., and at 255 per cent. rating it is considerably greater.

GERMAN EXPORTS FOR THE HALF-YEAR.

The following table shows the exports of electrical goods from Germany during the half-year just closed; figures for the first half-year of 1913 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1913. Kilogs.	1914. Kilogs.	Inc. or dec. Kilogs.
Dynamos, electric motors, transformers, &c., weighing up to 25 kg.—			
To Great Britain	31,000	39,000	+ 8,000
„ Austria	57,000	63,000	+ 6,000
„ Russia	99,000	87,000	— 12,000
„ Other countries	187,000	191,000	+ 4,000
Total	374,000	380,000	+ 6,000
Ditto, weighing from 25 kg. to 100 kg.—			
To Belgium	88,000	114,000	+ 26,000
„ France	100,000	128,000	+ 28,000
„ Great Britain	147,000	109,000	— 38,000
„ Holland	112,000	95,000	— 17,000
„ Austria	266,000	218,000	— 48,000
„ Russia	217,000	353,000	+ 136,000
„ Spain	97,000	88,000	— 9,000
„ Other countries	460,000	447,000	— 13,000
Total	1,487,000	1,552,000	+ 65,000
Ditto, weighing from 100 kg. to 500 kg.—			
To Belgium	310,000	280,000	— 30,000
„ France	156,000	148,000	— 8,000
„ Great Britain	357,000	440,000	+ 83,000
„ Italy	194,000	158,000	— 36,000
„ Holland	251,000	260,000	+ 9,000
„ Austria	279,000	236,000	— 43,000
„ Russia	391,000	651,000	+ 260,000
„ Spain	274,000	173,000	— 101,000
„ Brazil	286,000	177,000	— 109,000
„ Argentina	189,000	203,000	+ 14,000
„ Other countries	996,000	1,073,000	+ 77,000
Total	3,683,000	3,799,000	+ 116,000
Ditto, weighing over 500 kg.—			
To Belgium	1,133,000	652,000	— 481,000
„ France	542,000	397,000	— 145,000
„ Great Britain	640,000	1,348,000	+ 708,000
„ Italy	863,000	2,103,000	+1,240,000
„ Spain	1,270,000	667,000	— 196,000
„ British South Africa	625,000	514,000	— 111,000
„ Japan	1,204,000	1,042,000	— 162,000
„ Argentina	831,000	580,000	— 251,000
„ Brazil	610,000	377,000	— 233,000
„ Norway	412,000	476,000	+ 64,000
„ Russia	832,000	1,381,000	+ 549,000
„ Holland	530,000	619,000	+ 89,000
„ Other countries	2,737,000	3,103,000	+ 366,000
Total	12,229,000	13,259,000	+1,030,000
Arc lamps.—			
To Great Britain	33,000	20,000	— 13,000
„ Russia	68,000	38,000	— 30,000
„ Argentina	46,000	22,000	— 24,000
„ Austria	27,000	9,000	— 18,000
„ Other countries	122,000	64,000	— 58,000
Total	296,000	153,000	— 143,000
Accumulators.—			
To Denmark	171,000	524,000	+ 353,000
„ Holland	381,000	309,000	— 72,000
„ Sweden	503,000	254,000	— 249,000
„ Japan	201,000	28,000	— 173,000
„ Argentina	537,000	852,000	+ 315,000
„ Chile	371,000	436,000	+ 65,000
„ Other countries	1,030,000	813,000	— 217,000
Total	3,194,000	3,216,000	+ 22,000
Cable.—			
To Belgium	1,520,000	4,236,000	+2,716,000
„ Holland	2,650,000	4,334,000	+1,684,000
„ Norway	1,871,000	1,217,000	— 654,000
„ Sweden	744,000	1,101,000	+ 357,000
„ British South Africa	1,008,000	368,000	— 640,000
„ Japan	2,024,000	290,000	—1,734,000
„ Argentina	4,134,000	3,936,000	— 198,000
„ Chile	386,000	601,000	+ 215,000
„ Other countries	6,894,000	4,486,000	—2,408,000
Total	21,231,000	20,569,000	— 662,000
Metal-filament lamps.—			
To Great Britain	69,000	54,000	— 15,000
„ Austria	84,000	91,000	+ 7,000
„ Russia	98,000	159,000	+ 61,000
„ Italy	69,000	95,000	+ 26,000
„ Spain	48,000	34,000	— 14,000
„ Argentina	54,000	32,000	— 22,000
„ Brazil	43,000	28,000	— 15,000
„ France	59,000	46,000	— 13,000
„ Japan	21,000	70,000	+ 49,000
„ Other countries	381,000	337,000	— 44,000
Total	905,000	946,000	+ 41,000
Telephone appliances.—			
To Great Britain	62,000	53,000	— 9,000
„ France	31,000	26,000	— 5,000
„ Russia	60,000	58,000	— 2,000
„ Italy	50,000	56,000	+ 6,000
„ Other countries	224,000	249,000	+ 25,000
Total	427,000	442,000	+ 15,000
Electric light, power, &c., appliances.—			
To Belgium	627,000	1,059,000	+ 432,000
„ Great Britain	481,000	996,000	+ 515,000
„ Austria	912,000	1,176,000	+ 264,000
„ Russia	1,118,000	2,207,000	+1,089,000
„ Spain	584,000	315,000	— 269,000
„ British South Africa	179,000	181,000	+ 2,000
„ Japan	204,000	230,000	+ 26,000
„ Argentina	697,000	843,000	+ 146,000
„ Brazil	382,000	233,000	— 149,000
„ Chile	242,000	700,000	+ 458,000
„ Italy	661,000	791,000	+ 130,000
„ Switzerland	408,000	404,000	— 4,000
„ Other countries	2,503,000	4,893,000	+2,390,000
Total	8,998,000	14,028,000	+5,030,000
Electric meters.—			
To Great Britain	143,000	117,000	— 26,000
„ Italy	168,000	231,000	+ 63,000
„ Austria	191,000	230,000	+ 39,000
„ Russia	242,000	309,000	+ 67,000
„ Spain	119,000	117,000	— 2,000
„ Argentina	130,000	77,000	— 53,000
„ Other countries	516,000	726,000	+ 210,000
Total	1,509,000	1,807,000	+ 298,000
Batteries.—			
To Great Britain	162,000	220,000	+ 58,000
„ Holland	51,000	75,000	+ 24,000
„ Russia	50,000	34,000	— 16,000
„ Sweden	40,000	72,000	+ 32,000
„ Switzerland	46,000	71,000	+ 25,000
„ Other countries	263,000	349,000	+ 86,000
Total	612,000	821,000	+ 209,000
Finished armatures and commutators.—			
To Belgium	104,000	148,000	+ 44,000
„ Great Britain	200,000	254,000	+ 54,000
„ Italy	201,000	138,000	— 63,000
„ Austria	281,000	175,000	— 106,000
„ Russia	232,000	545,000	+ 313,000
„ Japan	202,000	131,000	— 71,000
„ Argentina	100,000	122,000	+ 22,000
„ Other countries	890,000	908,000	+ 18,000
Total	2,210,000	2,421,000	+ 211,000

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	1913. Kilogs.	1914. Kilogs.	Inc. or dec. Kilogs.
Insulating tubes of paper.—			
To Belgium	165,000	163,000	— 2,000
,, Russia	192,000	119,000	— 73,000
,, Sweden	200,000	168,000	— 32,000
,, Switzerland	419,000	63,000	— 356,000
,, Italy	168,000	84,000	— 84,000
,, Other countries ...	704,000	699,000	— 5,000
Total ...	1,848,000	1,296,000	— 552,000
Electric signalling apparatus.—			
Total ...	499,000	592,000	+ 93,000
Wireless telegraphy apparatus.—			
Total ...	125,000	206,000	+ 81,000
Electric medical and dental appliances.—			
Total ...	257,000	421,000	+ 164,000
Heating and cooking apparatus.—			
Total ...	146,000	191,000	+ 45,000

Kilog = 2.204 lb.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this Journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,258. "Rotary field magnets." W. P. Thompson. August 7th. (Aktiebolaget Ljungströms Angturbin, Sweden). (Complete).

18,261. "Motor starting rheostat." G. M. Johns. August 7th. (Complete).

18,276. "Electric fuses or cut-outs." A. H. Railing & A. J. D. Krause. August 7th.

18,277. "Means for connecting electrical conduits to their fittings." A. Myers and L. Myers. August 7th.

18,280. "Apparatus for detecting the presence of fire-damp and other gases in connection with the use of the electric lamp or battery." W. Gaudie and G. Wilkinson. August 7th.

18,281. "Ventilation of alternating-current dynamo-electric machines." G. A. Juhlin. August 7th.

18,286. "Multiple electric needle-holder for epilation purposes." C. Blakeney (trading as Catherine Stanley Blake). August 7th.

18,290. "Writing or copying telegraph system." A. G. Bloxam. August 7th. (Telepantograph-Ges.m.b.H., Germany). (Complete).

18,302. "Electric hoisting-apparatus." A. H. Colley. August 7th.

18,317. "Lighting electric lamps." F. Westwood. August 7th.

18,353. "Starters for electric motors." Siemens Bros. Dynamo Works, Ltd., & E. Schupp. August 7th. (Addition to 5,514/14). (Complete).

18,368. "Electric relays." British Thomson-Houston Co., Ltd. August 7th. (General Electric Co., United States).

18,369. "Incandescent electric lamps." Allgemeine Elektricitats-Ges. August 7th. (Convention date, August 1st, 1913, Germany). (Complete).

18,380. "Electric power." H. L. Todd, R. Wellesley, and H. F. Pattinson. August 7th.

18,396. "Cooling-arrangements for dynamo-electric machinery." Siemens Bros. Dynamo Works, Ltd., & E. O. Kieffer. August 7th.

18,397. "Percussion tools." Siemens-Schuckertwerke G.m.b.H. August 7th. (Convention date, August 8th, 1913, Germany). (Complete).

18,408. "Radio-dynamic control of gyroscopes." J. H. Hammond, junr. August 7th. (Convention date, August 14th, 1913, United States). (Complete).

18,418. "Electric sign flashers." L. J. Schrubb. August 7th. (Complete).

18,435. "Electrically-propelled drill." H. A. Whiteside. August 7th.

18,440. "Mechanical apparatus for retarding the tripping-mechanism of automatic electrical circuit brakes." G. F. J. Dandridge. August 8th.

18,442. "Electro-magnetic unlocking and unscrewing apparatus for miners' lamps." O. Oldham. August 8th.

18,464. "Prepayment electricity meters." Landis & Gyr, Ltd. August 8th. (Convention date, August 9th, 1913, Switzerland). (Complete).

18,465. "Excess voltage devices for protecting electrical circuits." Siemens-Schuckertwerke G.m.b.H. August 8th. (Convention date, August 21st, 1913, Germany). (Complete).

18,466. "Control of searchlights, guns, or the like from a distance and means therefor." Siemens Bros. Dynamo Works, Ltd. August 8th. (Siemens-Schuckertwerke G.m.b.H., Germany). (Complete).

18,476. "Manufacture of tungsten filaments for electric incandescent lamps." E. R. Grote. August 8th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

9,103. Railway Safe-running Devices. A. R. Angus. April 17th. (April 17th, 1912.)

13,976. Electric Signalling Systems, suitable for Party Line Telephone and like systems. Automatic Telephone Manufacturing Co. and H. H. Harrison (partly Automatic Electric Co.). June 17th.

14,218. Transmitters for Submarine Sound Signals. Signal Ges. June 19th. (June 24th, 1912.)

14,498. Method of and Means for Detecting Dangerous Atmospheres in Mines and for Operating an Alarm therein. G. Schauli. June 23rd. (January 23rd, 1914.)

16,696. Telephone Machine Switching Systems. Western Electric Co. (F. T. Woodward acting for Western Electric Co.) July 21st.

16,725. Device for Starting and Stopping Submarine Syrens. Signal Ges. July 21st. (July 29th, 1912.)

17,265. Electrically-illuminated Letters, Signs, and the like Devices. H. Hirst and B. H. Jenkinson. July 28th.

17,337. Signalling, Regulating and Controlling Street Traffic, and the method of its application for such Traffic. T. W. S. Firth and J. N. C. Kennedy. July 28th.

17,688. Electric Cooking-apparatus. M. J. Railing and G. Maurice. August 1st.

18,412. Regulation of Variable-speed Dynamo-electric Machines. A. H. Midgley and C. A. Vandervell. August 13th.

19,205. Method of Electrically Operating Railway Signals. R. Meakin. August 25th.

19,209. Illumination of Chart Tables. E. P. Fletcher. August 25th.

19,803. Heating Water by Electricity. H. Trenferry and A. Kingman. September 2nd.

20,654. Galvanometers or the like. Cambridge Scientific Instrument Co., and W. H. Apthorpe. September 12th.

22,503. Switches for Electric Self-starting Devices and Lighting Circuits for Motor Vehicles. T. W. Tattersall & J. W. Tattersall. October 6th.

23,715. Elements for Electric Heating Devices or Radiators. R. A. S. Paget. October 20th.

24,327. Apparatus for Magnetizing Permanent Magnets. S. C. Newton. October 27th.

24,565. Electric Heating Element. S. E. Foster. October 29th.

24,928. Switching Apparatus for Telephone Exchange Systems. Western Electric Co. November 1st. (F. I. Woodward, acting for Western Electric Co.)

25,129. Electrically-operated System of and Apparatus for Automatic Signalling on Railways. E. W. Bottle. November 4th.

25,659. Telephone Repeaters. Western Electric Co. November 10th. (F. T. Woodward, acting for Western Electric Co.).

26,734. Method of and Apparatus for Controlling Guns or other Mechanisms from a Distance. E. Schneider. November 20th.

27,050. Electrical Processes for Rivetting and Apparatus therefor. Siemens & Halske Akt.-Ges. November 24th. (November 22nd, 1912).

27,163. Retrievers for Trolley Collectors on Electric Traction Systems. F. A. Wasson. November 25th. (May 12th, 1913).

27,424. "In and Out" Indicators and the like. A. G. V. Elder. November 28th.

27,669. Metallic Bodies Adapted for Sealing into Glass and the like. B. E. Eldred. December 1st.

27,771. Electric Glow Lamps. E. A. Kruger & K. Sannig. December 2nd.

28,633. Switching Devices for Electric Installations. Siemens Bros. Dynamo Works. December 11th. (Siemens Schuckertwerke Ges.).

29,096. Automatic Signal-register to Automatically Indicate Colliery and other Signals to Colliery Enginemen and others and also to Automatically Release Signals when complied with. W. Littlewood. December 17th.

1914.

196. Electrical Coupling Devices for Railway and other Vehicles. L. Boirault. January 3rd. (Divided Application on 21,480/13. September 23rd).

3,900. Mounting Bracket for Electric-switches and the like. A. Heckt. February 14th. (February 14th, 1913).

4,583. Metallic Conduits for Electric Conductors. C. F. Burton, Slater H. Burton, & C. F. Burton. February 23rd.

6,037. Electric Filament Lamps. E. Vass, L. Máteh, & F. Burger. March 10th.

7,482. Electric Ignition Lighting and Starting Systems for use with Internal-combustion Engines on Motor Vehicles. R. Varley. March 24th. (Divided Application on 8,679/13. April 12th).

7,686. Connecting Devices for the Leads from Portable Secondary Batteries. Robert Bosch (Firm of). (June 7th, 1913). March 26th.

9,970. Retrievers for Trolley Collectors on Electric Traction Systems. F. A. Wasson. April 22nd. (May 12th, 1913. Divided Application on 27,163/13. November 25th).

12,483. Circuit Arrangements for Automatic or Semi-automatic Telephone Installations. Siemens & Halske Akt.-Ges. May 20th. (May 20th, 1913. Addition to 16,538/13).

13,883. Railway Safe-running Devices. A. R. Angus. June 8th. (February 13th, 1913. Divided Application on 9,090/13. April 17th).

13,884. Railway Safe-running Devices. A. R. Angus. June 8th. (February 13th, 1913. Divided Application on 9,090/13. April 17th).

13,916. Railway Safe-running Devices. A. R. Angus. June 9th. (February 13th, 1913. Divided Application on 9,103/13. April 17th).

14,189. Railway Safe-running Devices. A. R. Angus. June 12th. (February 13th, 1913. Divided Application on 9,090/13. April 17th).

German Exports of Electrical Products, 1914.—

H.M. Vice-Consul at Leipzig (Mr. R. M. Turner) reports that the value of the exports of German electrotechnical products during the first six months of this year was 146,230,000 marks, as compared with 127,770,000 marks in the first half of 1913. During this period 20,569 metric tons of electric cable, officially valued at 16,900,000 marks, were exported, as compared with 21,231 metric tons, valued at 18,260,000 marks, in the first half of 1913. It is probable that the real diminution in value was somewhat larger, as the orders were in many cases only obtained by granting considerable price concessions. The exports of submarine cables ceased almost entirely, dropping from 2,261 metric tons to 44 metric tons. The exports of dynamos during the first six months of this year amounted to 18,991 metric tons, valued at 29,170,000 marks, as compared with 17,773 metric tons, valued at 26,430,000 marks, in the corresponding period of last year. The increase was particularly noticeable in dynamos weighing over half a ton. Electrical appliances for lighting and power transmission were exported to the value of 42,570,000 marks during the first half of this year, as compared with 25,230,000 marks during the corresponding period of 1913. The exports to Belgium, Austro-Hungary and Russia were particularly large. The exports of metal-filament lamps were also considerably larger in quantity, but the value was lower on account of severe price-cutting; 20,900,000 lamps, valued at 19,220,000 marks, were exported during the period under review, as compared with 19,500,000 lamps, valued at 19,600,000 marks, in the corresponding period of 1913. Mark = 11·8d.—*B. of T. Journal.*

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THE

ELECTRICAL REVIEW.

VOL. LXXV. AUGUST 28, 1914. No. 1,918.

ELECTRICAL REVIEW.

Vol. LXXV.] CONTENTS: August 28, 1914. [No. 1,918.

	Page
The Influence of Engineering on Race Removal	293
Lead	294
Coded Messages and Export Trade	295
War and Trade	295
Some Notes on the Electric Vehicle Equipment of the London Fire Brigade (*illus.*)	296
Electricity Supplies for Kinematographs, by W. B. S. (*illus.*) (*concluded*)	297
Correspondence—	
Electric Cooking Apparatus	299
Wireman or Electrical Fitter?	299
War and the Electrical Industry	299
British-Made Magnetos for British Motor-Cars	300
War Items	301
Legal	303
New Electrical Devices, Fittings and Plant (*illus.*)	304
The Prince's Relief Fund	306
Telegraphs and Telephones in China	306
British-Made Carbons	307
Business Notes	308
Notes	311
City Notes	313
Stocks and Shares	314
The Carnarvon Wireless Telegraph Station (*illus.*)	315
British Association—	
Irrigation Dams and Hydro-Electric Power (*illus.*) ...	317
Temperature Cycles in Heat Engines	319
Irrigation Works in Italy	319
The Capacity of Radio-Telegraphic Aerials	319
Foreign and Colonial Tariffs on Electrical Goods	319
New Patents Applied For, 1914	320
Abstracts of Published Specifications	320
Contractors' Column ... ... Advertisement page xviii	

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THE INFLUENCE OF ENGINEERING ON RACE REMOVAL.

AN interesting passage in "The Dawn of History," by Prof. J. L. Myres, refers to some of the earlier migrations prompted by economic necessity, of the tribes which populated the Arabian desert. The effect of these nomadic tribes upon surrounding and comparatively civilised nations was profound, and led to the foundation of new sets of social conditions.

Students of modern problems concerning the races of the world will detect in more than one quarter a very similar movement at the present day, masked by certain modified modern influences, and at present only in its beginning. The ultimate result will probably be very much the same, involving changes in the geographical distribution of races, which, up to the present, have been associated with certain fixed zones, and the putting into a state of flux many of ethnological distinctions which have hitherto defined humanity.

Even at the present day we are abandoning such old-fashioned distinctions as "savage," "barbarian," and similar terms describing cultures with which we are only imperfectly acquainted, and are beginning to classify the races of the earth according to their stage in civilisation, defining them as either "backward" or "forward" nations in development. It must not be forgotten in discussing this point that some of the races which we were accustomed to regard as backward have developed a forward impetus to an extent which would be amazing if we did not remember that the seeds of modern civilisation have dropped into practically virgin soil, as illustrated in the case of Japan. Conversely, if we are to believe a tithe of the accounts which are now coming to hand during the progress of the present war, a nation which is presumably civilised is capable of acts which are crude in their savagery.

It may at first seem that all this is entirely foreign to engineering, but in reality the engineer, next to the linguist, is probably the most potent factor in this world change. He is also a man who will be most directly affected in its later stages. One or two illustrations may be given. The mission of the European nations during recent times has been to spread what is known as civilisation, which is a mode of life and the collection of tenets, and, incidentally, the sale of goods, which our particular branch of the human race has developed during a rather strenuous period of development. In spreading civilisation, the European branch has influenced other forms of civilisation, some of which antedate our own, in some cases causing trouble, while in other cases the change has been wrought without friction. One of the main causes of the Indian Mutiny was, we believe, friction between two cults which did not understand each other. A later development, however, may be noted. The railway, when introduced into India, assisted the devout Indian in his journeys to his sacred places, thus swelling the profits of the railways and fostering his own religion. The effect on the nations of India

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of the introduction of the railway, an entirely engineering product, has, however, been to convert a practically fixed population with village life largely developed, into one which is rapidly becoming accustomed to the idea of travelling, with the result that Indians are now to be found in various parts of the world in great numbers. It is only necessary to refer to recent troubles in South Africa, and the deadlock which still more recently occurred in a Canadian port, to emphasise the new difficulties which the countries under our own dominion are realising as a result of this new mobile force of humanity being thrown upon the world's markets.

Humanity can be classed in one respect into two main divisions, those who are opposed to, and those who are actively engaged in, forwarding what we know as civilisation. Both are affected by the new conditions. Compare, for example, the great Boer treks with present day advantages. To quote from the earlier pages of Fitzpatrick's "Transvaal From Within," the Boers, "rich and poor, old and young, went off as in the days and in the fashion of Moses or Abraham. They went without leave or help of the Government; secretly or openly they went, and they asked nothing but to be left alone." . . . .

"Two parties, men, women and children, numbering 98 in all, pioneered the great trek. Of these, 26 survived fever and fighting, loss of provisions, wagons, and cattle, and a long weary tramp from Zoutpansberg to Delagoa Bay, and were rescued and taken thence to Natal, and two children were carried off by the natives. The survivors were three women with their 12 children—seven orphan children and four youths. Not a single grown man escaped." To-day Delagoa Bay, Salisbury, Bulawayo, and Cape Town are name-places on a railway map. With the opening up of the interior in this way, the line of frontiersmen has undoubtedly been pushed forward, and with it our civilisation; but, on the other hand, the same railway which takes the whites northward can bring the Kaffirs south. The problem of Kaffir control has always been one of the outstanding difficulties of South Africa.

Turning to other parts of the world, America and Australia cannot but take note of the growth of the Japanese, and that this growth is characterised by the utmost virility is shown by the position which the Japanese have taken in Korea, and the effective support they are giving us in the present crisis. Russia knows very well indeed what contact with another civilisation means, and in the interior of China we have the first stirrings from their age-long slumber of millions upon millions of human beings, hardened by long privations and schooled by keen-edged necessity. What will happen when the railways, acting as mobilisers to humanity, pour the contents of China across Europe and the world?

It must not be forgotten that with the railway come other branches of engineering activity and the products of these branches. Electrical engineering has transformed the standard of comfort expected by civilised nations. It would be impossible to enumerate the forces of engineering, but their sum total is to introduce to the formerly fixed and backward nations, new ideals of luxury, and therefore new cravings which cannot be satisfied by the primitive life which they have hitherto led. The result is that driven on by their new aspirations and appetites, with an easy means before them of transferring themselves to all parts of the globe, a vast movement of race is already beginning, and is likely to attain proportions that at present we do not at all realise. In this respect then, electricity, steam, and petrol are likely to play a part in changing the character of the earth's human distribution, which was certainly never realised by the engineering pioneers, and is only dimly beginning to be grasped by the average man to-day. Far-seeing statesmen have already, we believe, caught sight of the future, but it is one thing to see and another to legislate. From the book to which we referred at the commencement it can be gathered that the ravages committed by the early nomadic tribes would have been far more severe than they actually were if the Arabs had at that period in their civilisation obtained the mastery of the horse Substitute to-day for the horse the locomotive, the motor-car, the torpedo, the flying machine, the telegraph, telephone, dynamo, and motor, in the hands of men who only yesterday handled the spear and the primitive plough, and we obtain some vision of the mobilising influence of engineering on the races of the world. When we see nations which we thought were under the peaceful restraints of inter-commerce flying at each other's throats on a few days' notice, in a dispute with territorial issues, in a war so largely assisted by engineering products, one is compelled to wonder what will be the ultimate effect of modern race migration upon the world.

Lead.

The declaration of lead as contraband of war, and the reserving of important quantities of metal which were available for Government purposes, had a very stimulating effect upon the prices ruling, and private business was reported at as much as £24 a ton for immediate delivery, but this proved to be the apex, at all events for the time being, and the extent of the advance undoubtedly bred some distrust, for the general opinion was that the rise had been quite overdone. This, in fact, proved to be the case. Meantime the Metal Exchange is closed to trading, and quotations are all nominal. The early apprehensions were all in favour of an entire suspension for a time of imports of lead from abroad, but as time has gone on it has been seen that these fears lacked solid basis. British vessels can come and go practically without hindrance within the limits of all the seas, except those between here and Northern Europe, though it is true that there have been some isolated cases of the destruction of vessels on the Atlantic trade routes. The escapades of these errant German cruisers will surely, however, be circumscribed by degrees. Their object is clearly enough not to fight, but to prey on commerce and show a clean pair of heels when a British cruiser puts in an appearance, as witness the recent brush between the *Bristol* and the *Karlsruhe*. Hence no important difficulty is expected to be met with now in obtaining lead from the countries of production. There is another factor at work, however, which may exert a definite effect upon the course of values before the war is over, and that is the complete suspension of operations in the Australian Broken Hill field. The extraordinary difficulties involved in financing commercial operations is held to be responsible for this, but another possible explanation, though one mixed up with the first, is that the mines there, although British to the core, are controlled by German interests in so far as the treatment of their ores and concentrates are concerned. This introduces a new element into the position and one quite apart from all questions of finance. The fact that such an arrangement should have been in force between German and British interests has been the subject of frequent comment, and it is impossible for it to be continued after the war is over. Not only have the Australian producers indicated, suspended production, but there has been a pretty general shut-down amongst the Spanish mines and smelters, partly because of the difficulty experienced in financing operations, and partly because of the withdrawal of French engineers from certain of the works to join the colours. There is thus an apparent considerable falling off in the quantity of lead available for the satisfaction of the world's needs. Australia last year is estimated to have turned out 116,000 tons against 107,000 tons in 1912, while Spain in 1913 is credited with 202,000 tons, compared with 186,000 tons in the previous year. Too much attention, however, should not be paid to this aspect of the question, for while output in the directions indicated has been shut down, the United States mines and smelters are well engaged, and there appears to be progressive improve-

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ment in Mexico. Lately again there have been plentiful offers of lead from New York, but financial conditions have been too unfavourable for any business to be effected. With a more normal rate of exchange, there is no question but that there might easily be a resumption of selling of American lead to the European markets, but this stage has not yet been reached. There are indications, too, that the Mexican production is being forced, and this is a matter of the utmost importance. For the present the extreme stringency of prices has given place to a much easier tendency, following the satisfaction of the more urgent needs. War consumption must be materially less than that in times of peace.

Coded Messages and Export Trade.

At a moment when British firms are making exceptional efforts to do business with the Colonies, it is, to put it mildly, a little hard that they should be placed so greatly at a disadvantage by the ban that the censor has had to put on coded messages. The necessity for extreme caution few will question at a time such as this, but our industrial and commercial firms which have for years made a regular practice of conducting considerable business with far-off Colonies in coded form find themselves faced with very big expense and loss of secrecy through sending messages in plain English, or possible delay if they adopt the deferred message rate. We are not surprised, now that the daily Press is devoting almost as much space to the Trade War as to the War itself, to see letters in the *Times* from several firms who feel the hardship very keenly. An East India merchant urges the reduction of cable charges for plain word telegrams, permission to use registered telegraphic addresses, and permission amongst British subjects to use codes to and from the East, as measures that would be of great assistance in "restarting the whole of commerce," so that "these money-making machines" can be utilised as quickly as possible. A firm of Anglo-Argentine exporters strongly appeals to the authorities to try and find some other way of preserving a strict censorship without prohibiting commercial code messages. It lays stress upon the importance which business firms attach to secrecy, and mentions the possibility of an ordinary clerk in a cable company's office in a far-off market disclosing the contents of a plain message to his personal acquaintances or to the competitors of the sender. The proposition is advanced that British firms of good standing and unblemished reputation should be allowed to continue coding their cablegrams, if necessary under a guarantee given by, say, two other similar firms or bankers. He suggests that "a signed literal translation of each message might accompany it for the censor's information on this side, and replies received in code might be decoded by the addressees in the censor's office before delivery. The code would, of course, be produced whenever required, but the multiplicity of private codes would make it impracticable to file a copy of each in the censor's office." We have no doubt that these suggestions have already come under the notice of those responsible for the duty of censorship. While under existing circumstances we can hardly be too careful, it seems to us that, with suitable safeguards, facilities might be granted to the hundreds of firms of unquestionable reputation in the business world who are known to the cable companies to make a regular use of certain codes in time of peace. But if for national reasons the ban cannot be removed, is it unreasonable to suggest that it would be an act of loyal co-operation with commercial firms in keeping industry in operation if the great cable companies were to accept a much reduced fee per word from those who are well known to them as having temporarily to abandon their usual methods, and who are obliged to cable messages in detail? Much of their traffic has only been built up because codification has been possible, and consideration to their regular customers at this juncture might not come amiss.

War and Trade.

Reports that are coming to hand from the great engineering centres of the kingdom give little occasion for gloom. It was inevitable that so great a shock should overwhelm most things for a time, but after recovery from the first effects those responsible for the industry have calmly and confidently endeavoured to accommodate themselves to the altered state of affairs, making necessary adjustments here and there. From some of the manufacturing districts comes the news that electrical works are already receiving business from both home and abroad which would not have come to them a month ago. The feeling seems to be fairly general that as soon as matters become more settled, and insurance and freight rates are lowered, our electrical firms will have a very busy time. In the Manchester district, as, indeed, almost everywhere, a certain lack of confidence still makes itself felt, and the atmosphere is not improved by the fact that the mills are on short time or closed.

Some firms in the neighbourhood of Manchester are, of course, busy with Government work—the making of shells among other things. The *Manchester Guardian*, in discussing the position, says that in spite of the rush of engineering artisans to the Labour Exchange, the engineering position is wonderfully good, and has fair prospect of remaining so, or even improving. At the moment employment is very unequal, and any approach to uniformity cannot yet be expected. Some works which, caught in the early panic, took drastic measures to reduce working hours and staff, have found that their action has not been justified by the subsequent course of events, and they are now returning to more normal conditions of working. "In some cases the reductions were in part due to the action of some banks in restricting withdrawals. This restraint is now easier, and if the braking action of the moratorium can be removed, will largely appear. There has been a marked revival in general confidence, and consequent inquiries in connection with new business. This hopeful tone is a most welcome indication of business prospects during, perhaps, the next six months." The writer goes on to state that electrical engineers and steelmakers are foremost among those who are feeling the advantage of the withdrawal of German competition.

From various directions we are receiving inquiries asking where it is possible to obtain in England or in neutral countries particular lines of electrical manufactures previously obtained from Germany. We print several such inquiries in our "Notes" pages to-day. We shall do our best, both privately and by publicity, to assist to bring together the willing British manufacturer and the seeking customer—that is one of the great objects of our life, as a paper, and always has been so, but we believe that the existence of this inquiring spirit will prove to the trade, if any proof were necessary, that at this stage it is more important than ever that the manufacturing ability and resources of the British electrical industry should be given the fullest possible publicity, special emphasis being laid upon any particular capacity for handling new and special lines. Trade and other journals have their own trials at this time. Mr. Thomas Russell, the president of the Society of Advertisement Consultants, said the other day that the paralysis of industry and the slump in advertising were due to panic. He expressed the view that the only way to get confidence back was by advertising, and that everybody who ceased advertising was creating unemployment. Mr. Gordon Selfridge, who is conspicuous among general business men for maintaining his advertising, says that he is not just now doing business for profit, but "to hold the nation together." Electrical firms by keeping going as fully as possible are, as we have already stated, assisting the nation, but they are also in the position to help themselves in some directions by availing themselves of newly-opened opportunities such as we have mentioned above. This should be a powerful inducement to them to keep themselves in the full glare o the footlights.

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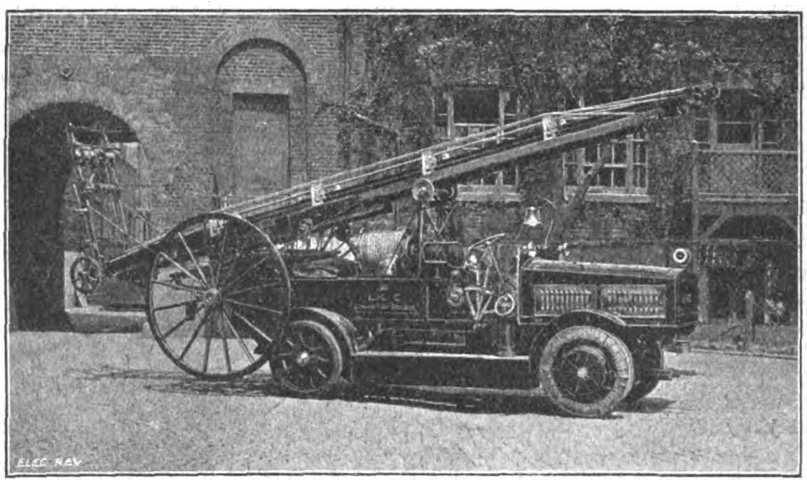
SOME NOTES ON THE ELECTRIC VEHICLE EQUIPMENT OF THE LONDON FIRE BRIGADE.

Following the information we were able to publish in the Review of August 14th with regard to the fleet of electric motor vehicles used by the Fire Brigade of Berlin, and the running and maintenance cost of the same, we are this week able to give some up-to-date details with regard to the motor equipment, and more particularly of the electromobile portion of the same, of the London Fire Brigade, the area under the protection of which, according to the paper read last year by Divisional Officer A. D. Dyer, A.M.I.C.E., before the International Association of Fire Engineers, in New York, extends to no less than 117 sq. miles.

As was pointed out in our Berlin article, the German authorities devoted considerable attention to the question of the best form of motor fire engine, and have finally decided in favour of electrically-propelled vehicles, fitted with petrol-actuated pumps, some petrol-electric machines being also used. In London, machines in which the same petrol motor is utilised both for vehicle propulsion and pump-operating purposes have been chosen, and although the early trials were not very successful, the progress made by petrol fire engine builders has been such that a high standard of efficiency has now been reached, the modern machines being fitted with large engines, developing 65 H.P. at 1,100 revolutions, and centrifugal pumps having an output of 500 gallons per minute, at a working pressure of over 120 lb. per sq. in.



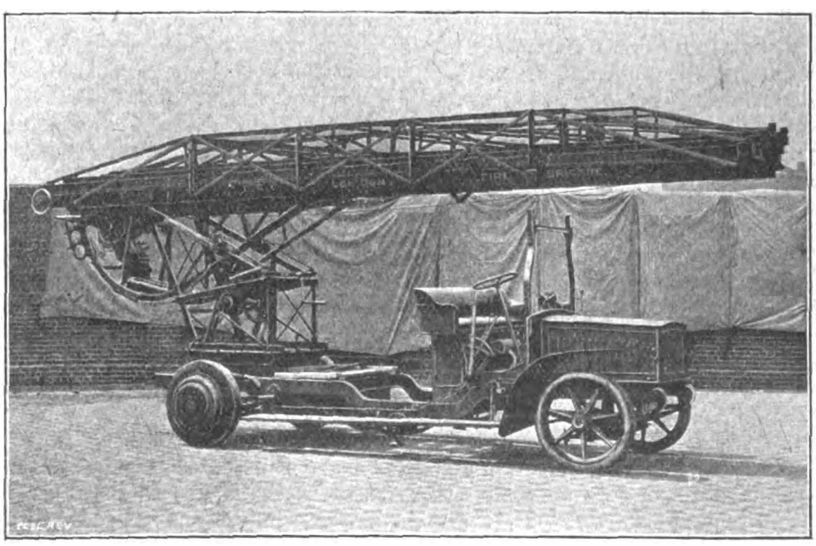
Electric Escape Van; London Fire Brigade.

With regard to the petrol motor escape vans, the first supplied only gave moderate satisfaction, as manufacturers generally, had had no experience in the running of vehicles weighing, with load, about 5 tons, at speeds exceeding 20 miles per hour. Indeed, prior to 1910 it was considered necessary to have one spare petrol escape van for every one on duty, in order to maintain an efficient service, whereas now, only one spare in five escape vans or pumps is deemed necessary.

Later some trials were made with electrically-propelled escape vans, these proving so satisfactory that eventually it was decided to adopt them, in a measure, as a standard for life-saving appliances in localities where the gradients are moderate. In the more hilly districts of London the stations are equipped with petrol-motor escape vans, fitted with engines of about 50 H.P., some petrol-electric vehicles, that is, machines with petrol engines as the prime mover, with electrical in place of mechanical transmission of the power to the road wheels, being, also, now on order.

The first electrically-propelled fire appliance was put into service in London in February, 1911, or about 3½ years ago. At the present time the London Fire Brigade has a total of 15 such vehicles, 11 being officially designated as escape vans and four as motor turntable ladders. Including the headquarters of the Brigade in Southwark Bridge Road, three stations are provided with two electric vehicles each, the remainder being allotted singly to different stations.

One of the vehicles is known as the Simonis, but the majority are of the Cedes type. The latter are equipped with series-wound motors mounted in the hubs of the front road wheels, which are thus driven direct without the intervention of any gearing, the Cedes Co. claiming an efficiency of from 78 to 85 per cent. for their motors, which are rated at 15 electrical H.P. The power is provided by a battery of 84 Tudor cells of a capacity of 200 ampere-hours at a 6-hours' discharge rate, giving a normal running output of about 30 H.P. The cells are carried in trays, either under a bonnet in the front of the driver or just to the rear of the forward wheels below the driver's seat. The machines can run about 30 miles on one charge if necessary, but owing to the nature of the service they stand fully charged ready to give out the maximum output on receipt of a call. There are electric brakes on the front wheel motors, which are valuable in emergencies, whilst two hand and foot controlled mechanical brakes on the rear wheels are sufficient under ordinary circumstances. The controller is of the series-parallel type, with seven notches for three forward speeds, two reverse motions and two brake positions. All the contact fingers of the controller are interchangeable and can be removed without the use of any tool. The danger of burning out of the device is thus avoided, for should a finger burn out, it can be replaced by another in two or three seconds.



Simonis Electric Turntable Ladder; London Fire Brigade.

The weight of an electric escape van ready for running, but without ladders, hose, and small gear, and men, does not exceed 3¾ tons, the total weight of the van complete being about 5¼ tons. The test requirements of the electric escape vans are that they shall be able to maintain a speed of 25 M.P.H. on the level with a full load of ladder, equipment and firemen, or 29 M.P.H. with men and equipment, but without ladder. They must be able to climb a gradient of 1 in 20 at 14½ to 16 M.P.H., while the battery must be capable of enabling a distance of 30 miles to be run on one charge at 20 M.P.H. In practice, these speeds can easily be exceeded, from 28 to 29 M.P.H. being reached on the level, with plain tires, and from 26 to 27 M.P.H., when non-skids

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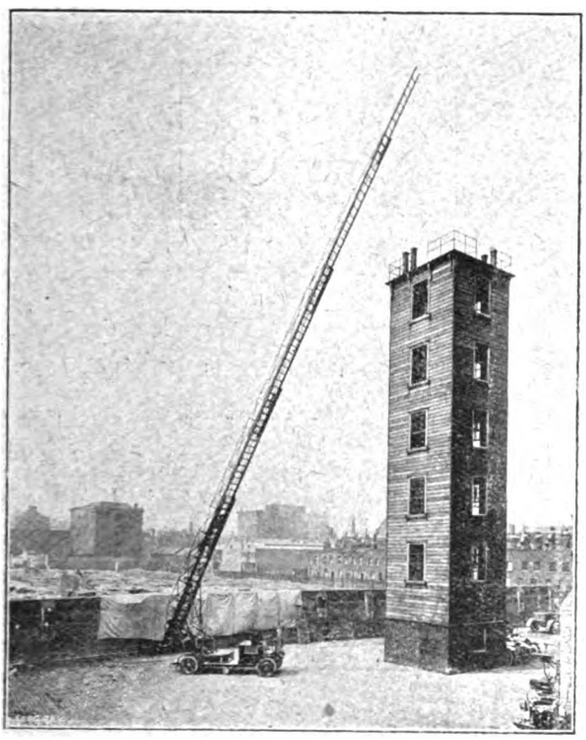
are fitted. The escape vans carry a ladder capable of being extended to at least 50 ft., and are also furnished with supplementary ladders, hose and tools for getting to work from hydrants, and a cylinder holding about 30 gallons of water, fitted with 180 ft. of rubber garden-hose for extinguishing small fires. This type of appliance, the crew of which is on duty night and day, is ready for an instantaneous turn-out, and only attends fires on the ground immediately protected by the station, the distance it may travel to fires rarely exceeding one mile.

The electric motor turn-table ladders are kept at the stations in localities where there are many high or warehouse buildings. These appliances, whilst intended, generally speaking, for attending local calls, are considered available in case of serious fires in high buildings within a radius of about five miles. Owing to their weight, which, complete in fire-attending order, ranges from $5\frac{3}{4}$ to 6 tons, it is not considered necessary to specify that the electric motor turn-table ladders, which can be safely used as water towers to a height of 60 ft., shall travel at more than 20 miles per hour, but with plain tires they can attain 27 M.P.H., or, with non-skids, 25 M.P.H. Several of these machines are fitted with 5-H.P. electric motors for raising the ladders, some to a height of nearly 100 ft., an operation which is accomplished in the rapid time of 10 seconds. The



Fully-extended Turntable Ladder, London Fire Brigade.

motor, which takes its current from the vehicle battery, serves as a brake when lowering the ladder. One of the accompanying illustrations shows an electric motor turn-table ladder in its travelling position, while another depicts the same machine with the ladder extended.

From the introduction of heavy motor fire-fighting machines capable of high speed, the problem of providing some satisfactory means of preventing skidding has, as has been the case in Berlin, been the cause of considerable study and experiment. Some mitigation of the difficulty was secured by utilising chains festooned diagonally across the tires, but considerable damage was caused to the rubber, which, when worn, allowed the chains to come in contact with the steel rims. This caused the non-skid chains to break, and allowed the loose ends to tear the mud-guards. Other devices were tried to check the tendency to skidding, such as studded leather covers and transverse bands of steel-studded balata belting fitted into slots cut into the rubber of the tire. The latter were found to be most effective when the tires and bands were new, but gave endless trouble when partly worn. One appliance has run for a year without non-skids, but with soft rubber tires of flat tread and extra wide section, single on front wheels and twin on rear wheels. Although no skidding has taken place, there is still some doubt if motor fire brigade machines can be safely run under all conditions in London without some non-skid attachment. Mechanical front wheel brakes were tried on the appliances supplied by different manufacturers in 1910, in order, it was hoped, to obviate the effects of skidding, but whilst satisfactory results were obtained on tests they were found unsuitable in practice, and have now been removed, rear wheel or differential brakes having been fitted in lieu.

The difficulties with regard to skidding formerly experienced have, however, now been fairly overcome; first, by careful training and the continued experience of drivers; secondly, by allowing greater cross-section in tires, 5-in. solid rubber being now used; and thirdly, by using extra heavy leather steel-studded covers fitted on two wheels only—on the off-side front wheel and the near-side rear wheel—this corresponding exactly with the practice now followed, after similar experiments, in Berlin.

The batteries are looked after by the Brigade staff alone, and, so far, have proved very satisfactory. Indeed, the battery maintenance costs have up to the present time been restricted to the renewal of the positive plates of the accumulators of one vehicle only. It may, therefore, be said that costs under this heading are only just commencing, but they are not expected to be heavy, as the officials report that by properly looking after them, they anticipate no trouble. No spare batteries are kept on hand, but, of the fleet of 11 escape vans, two are always held in reserve to take the place of any temporarily out of service at any of the stations. No spare electric motor turn-table ladder is at present available.

Current for battery charging is taken from the public supply mains in the district in which the stations are situated, the rate paid ranging from 1d. to 2d. per unit. Like most users of electric vehicles, the Brigade has experienced difficulty in getting current at a suitable voltage. Only about 30 amperes is required for the batteries, and the maximum voltage is 240, but very few electric supply authorities in London furnish current under 400 volts, and, therefore, either a good deal of current has to be wasted in charging, or a motor-generator set must be put in, the latter meaning a considerable expense.

Whenever an electric vehicle goes out, its battery is immediately put on charge on its return, each of the stations being equipped with charging boards and leads to enable the charging operation to be carried out without trouble, and with the vehicle in position for immediate service. Hitherto it has been the practice to discharge the batteries down to 1·9 volts, and re-charge them once a month. This operation is done by actually running the vehicles on the road in the neighbourhood of the stations, and as no indications of sulphating have been detected, it has been decided to increase the intervals of discharge and charge to six weeks; this will mean a slight decrease in the annual cost of current, which at present amounts to approximately £8 per vehicle.

(*To be concluded.*)

ELECTRICITY SUPPLIES FOR KINEMATOGRAPHS.

By W. B. S.

(*Concluded from page* 271.)

The Electrical Company's auto-connected motor-generator also has its motor field and dynamo field connected across the supply pressure, but a shunt regulating resistance to vary the arc voltage is connected in series with the generator field as in fig. 7. As in the "Macfarlane" machine, no line resistance is necessary, thus minimising the losses on the set. Fig. 8 shows the connections for the same firm's rotary converter, which consists of one armature with two windings, and two commutators, but only one field system, the latter being connected across the supply pressure. No regulation of the arc voltage is possible with this machine, so that a

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variable line resistance must be connected in series with the arc.

Messrs. Crompton & Co. have had on the market for many years a converter suitable for searchlight work, and this

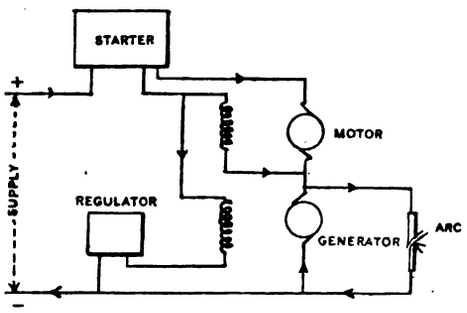

Fig. 7.—Motor-Generator (Auto-connected); Electrical Co., Ltd.

machine, known as the "C.M.B. converter," has been adapted for kinematograph purposes where the ratio of conversion is small. The connections are indicated in fig 9. A single armature and specially large commutator are used, and these revolve within a single field system having two sets of field coils, and two pairs of brush gear. These series windings oppose the shunt windings so that a drooping characteristic curve results as in fig. 6, p. 271. This machine is self-regulating within limits, the small shunt regulator being

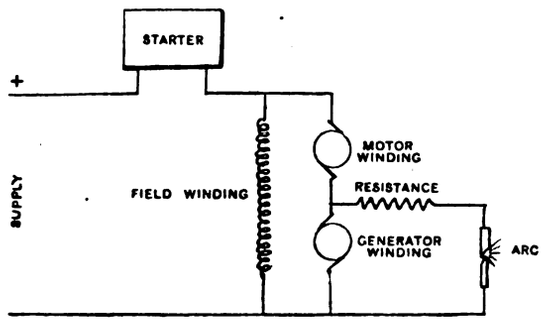

Fig. 8.—Rotary Converter: One armature, two windings, single field.

connected to one of the special windings to enable the current to be reduced to any value to suit the film in the lantern. A line resistance is not required.

It is well known that an arc run from an alternating current supply gives rise to excessive flickering and consequent "dancing" of the pictures, and, where possible, the

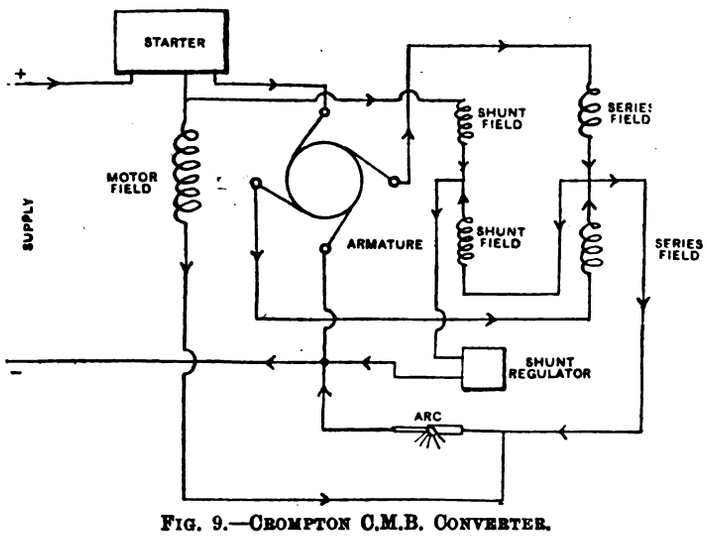

Fig. 9.—Crompton C.M.B. Converter.

alternating current should be converted to direct current. Motor-generators constructed of A.C. motors coupled to D.C. generators are often installed, while, in other cases, rectifiers are used. The electrolytic rectifier is an adaptation of the "Nodon valve" shown in fig. 10.

The method consists in employing four rectifiers per phase, coupled in such a way that both halves of the supply wave are utilised. The four cells in the diagram, C_1, C_2, C_3 and C_4, are made up of lead-containing vessels, each containing a rod of aluminium alloy and an electrolyte of ammonium phosphate solution. Under certain conditions of potential difference, the cells exhibit a greater resistance to the passage of current in one direction than in the other. A low resistance is offered between the lead (the anode) and the aluminium (the cathode), so that an appreciable current passes in this direction only, through each cell. The cells are therefore connected in such a manner that the two left-hand cells are in series, and they are connected in parallel (but with poles opposed) to the two right-hand cells, which are also connected in series. The alternating current is fed in at the centre points E and F of each of the pairs of cells, and the direct current is drawn from the junctions C and D of the parallel arrangement. Consider a current leaving the transformer by the terminal A at some instant; since the cell will only allow current to pass from lead to aluminium, the current will pass through C_3, then through the direct-current load and back to terminal B by way of C_4. An instant later the current has reversed, and leaves

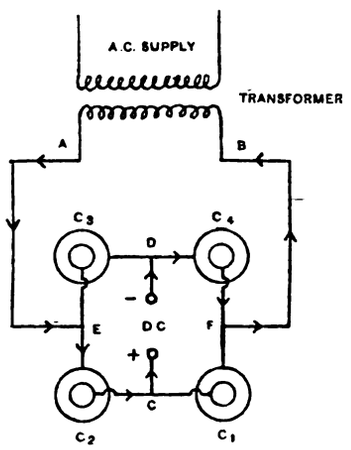

Fig. 10.—Electrolytic Rectifier: Gratz's Method.

the terminal B of the transformer, traverses C_1, then the direct-current circuit in the same direction as before, and returns to terminal A through C_2.

The mercury arc rectifier depends for its action on the property of ionised mercury vapour of conducting electricity in one direction only. The rectifier is usually in the form of a glass container, into which are sealed two iron or graphite anodes and one mercury cathode, and one starting electrode. The container is filled with mercury vapour. To ionise the vapour the mercury in the cathode and starting electrode are brought together and separated by tilting

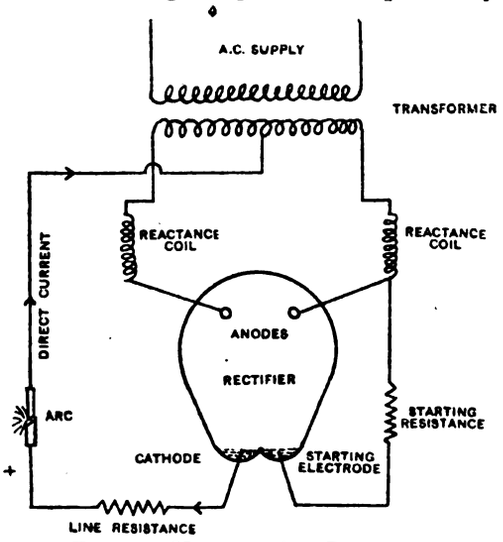

Fig. 11.—Mercury Arc Rectifier.

the container, thus drawing an arc. When this has been done, current will only flow from one of the anodes to the cathode and not in the reverse direction. In order to maintain the action, a lag is produced in each half-wave by the use of a reactance coil, and hence the current never reaches

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its zero value. Fig. 11 shows the connections for a mercury arc rectifier for a single-phase supply. They may also be provided with three anodes for three-phase supplies; 15 to 25 volts drop takes place in the bulb, and the energy lost thereby is transformed into heat and a light is emitted. The light is sometimes made use of for display purposes outside the cinema building. The efficiency of the mercury rectifier varies from 50 to 90 per cent., and the difficulties attendant on its use are leakage from one anode to another, and the maintenance of vacuum in large sizes of bulbs. A line resistance is inserted in the direct current circuit to regulate the supply to the cinema arc. Bulbs are manufactured suitable for a current of 30 or 40 amperes, and for larger currents several rectifiers are connected in parallel. The operation of the rectifiers is noiseless, and the life of the bulbs averages 2,000 hours, so that spares require to be kept in readiness for emergency.

As a motor-generator or a rectifier requires attention from time to time, its reliability cannot be entirely depended on. It is therefore wise that a stand-by plant should in all cases be installed in case of breakdown. This may take the form of a second motor-generator or rectifier, a resistance frame, a secondary battery or a gas engine generating set.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Electric Cooking Apparatus.

I trust you will forgive me taking up a little of your time and space in your journal. The matter is in relation to the radiant controversy over a conundrum, *i.e.*, the Venner cooker.

I should be indeed sorry to take our readers back over the disputed ground. It would be much too painful and enervating. What I should like answered regarding the Venner apparatus has neither to do with radiation, gastronomical science, nor even the oil vent. The question is, and it has been overlooked, the renewal of the elements in the case of breakdown (we will not call it a burn out).

According to the description of the cooker the only access to the oil chamber containing a film of oil and unit is through the oil vent, the other parts of the apparatus being sealed. Is it proposed to revert back to the ancient Egyptians, and inject a fluid into the oil chamber which would dissolve the element, the whole being withdrawn through the vent in the same way that the Egyptians dissolved the matter in dead bodies before embalming?

Of course, some people may suggest it is quite an easy matter to cut away the bottom of the vessel, replace the element and solder a metal disk in position, but with oil at a temperature of 460° F., with a possibility of running up to 600° F., I think I should feel more secure in purchasing a new cooker in place of renewing the elements.

Therefore I shall feel happily delighted if one of your readers can enlighten me on the above matter.

Ptah.

Melbourne, *July 14th*, 1914.

[We fail to understand the fourth paragraph of the above letter. Would our correspondent renew a burner on a gas stove with the gas on?—EDS. E.R.]

Wireman or Electrical Fitter?

The City and Guilds Institute have done much to improve the examinations in electric wireman's work, as last session's papers prove, but there is ample scope for bringing the syllabus more into line with the requirements of this branch of the profession. In view of this fact, I would suggest that domestic and intercommunication telephones should be included, as most contractors have to tackle telephone installations at different times, and they expect their wiremen to be able to install such apparatus, to locate faults, and if possible to remedy same. The practical classes would help the men considerably, and the class room could be utilised to explain necessary details, as regards principles of construction, fault localising, testing, &c.

There is one other point I should like to raise, and that is the question of title. The word "wireman" as applied does not, in my opinion, do justice to the skilled artisan who is entrusted with the numerous details encountered in present day electrical installation work. The definition is too narrow. Especially where the individual has succeeded in passing the C. and G. exams. and obtaining the "Full Technological Certificate in Electric Wireman's Work."

I suggest that "electrical fitter" is more appropriate, and that the subject in the C. and G. prospectuses should be entitled "Electrical Distribution, Fitting and Wiring." An analysis of the final paper of last session would justify this description. It would be interesting to have other readers' opinions on the above.

El-Les.

Leytonstone, N.E.

WAR AND THE ELECTRICAL INDUSTRY.

[AMERICAN VIEWS.]

IN the course of an Editorial on the outbreak of war and "America's Hour of Opportunity," the New York *Electrical World* says:—

"A number of bankers in New York's financial district have expressed almost unanimously the opinion that the outlook for American electrical securities was never better. The effect of the war in Europe, in their opinion, will be extremely favourable to the electrical industries of America. These are not shallow opinions. They are the beliefs of men who are accustomed to back their views with money. Certainly there will be no decrease in the lighting load. There may be some slight temporary decrease in the demands for motor service here and there, but not much, if any, is looked for. On the contrary, a growth in energy consumption in the next few months is confidently expected after conditions readjust themselves, as they surely will. Important as they are, these things are of small moment compared with the tremendous possibilities that the immediate future holds for America, particularly for every branch of the electrical manufacturing industry in this country. Such an opportunity as now presents itself has never arisen before, and is not likely to do so again for generations. Now of all times is the occasion for the United States to become supreme in the markets of the Western Hemisphere, and of the rest of the earth that is not at war. For the last quarter of a century Germany has been labouring mightily, and with success, to establish markets for her goods, especially throughout Latin America. Moreover, since our new tariff went into effect, the Germans have been planning a commercial invasion of the United States. With Germany at war with its neighbours on all sides, the threatening conditions have ended. To-day the United States is in the most favourable position in the world—rich, self-supporting and at peace. The Panama Canal will be opened for commerce this month. We have a new banking law that is especially designed to foster our export trade. The temporary reduction in the prices of electrical securities furnishes no cause for alarm. The real values are unimpaired. There is no ground for worry. On the contrary, there is every reason for hope and none at all for fear."

In a second article, on the effect of the conflict on electrical manufacturing, our contemporary says:—

"The great struggle which is now progressing on the other side of the Atlantic has tied up the export trade of the electrical manufacturers of this country. The General Electric Co. exports monthly electrical apparatus and equipment with an approximate value of £200,000. At the present time this company has goods valued between £60,000 and £80,000 somewhere on the seas. The Westinghouse Electric & Manufacturing Co. does only a nominal export business. For the most part its patent rights in Europe have been purchased by local companies. Its South American trade, however, is large and has suffered. At present there are in New York City, 150 cars loaded with freight from the Westinghouse Co., and more follow each day. This freight, consigned to South America, cannot be delivered until some means of passage by water has been provided.

"At the New York office of the Westinghouse Co. it was stated that of the company's subsidiaries in England, France, Italy and Austria, only the British company pays any dividends to the American company. These dividends amount to about £17,000 a year. This, then, in case of an entire shut-down of its European branches is the most the Westinghouse Co. would lose from that cause. The other subsidiaries pay no dividends to this country, and the Russian company is now practically liquidated. Mr. Tripp, the chairman of the company, is now in London, but the New York office has had no advices from him. The General Electric Co. has no subsidiaries on the Continent of Europe, and its only interest abroad lies in its control of the British Thomson-Houston Co. This last company, however, has not been paying dividends, and at times has needed help from the home company. The General

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Electric Co. sells its American products to foreign firms and thus creates a market. Therefore, its only loss in Europe would be in the purchase price of the British Thomson-Houston Co., and in the absence, for the present, of a European market.

"Far more serious than the interest in foreign companies, however, is the export trade. With commerce blocked owing to the fact that Europe owns the merchant marine, it is, at least for the present, impossible to send merchandise out of this country.

"There is one bright spot in the midst of all this threatening disaster. Those countries in whose control the merchant marine now lies are at war—England, Germany, France and Russia. In this age commerce cannot be completely stopped. Thus it would seem that the United States must find some means whereby exports shall be moved.

"Moreover, South America has largely been supplied with electrical equipment by Germany and Austria. There are none left now to supply the South American demand but our own manufacturers. While our companies will probably not increase their gross income from sales, owing to the inaccessibility of capital, nevertheless during hostilities they will supply a much larger percentage of equipment and apparatus. Time alone can tell to what extent they will be able to retain that trade once acquired."

The American *Electrical Review* writes as follows:—"The foreign commerce of European nations participating in the war is likely to be entirely paralysed, and, indeed, seems to have already ceased. . . . The electrical export trade of the United States will necessarily be affected, and, probably, in two ways. Exports to Europe will largely be suspended, but this should be more than made up by the opportunities for disposing of American goods in other parts of the world. Our principal competitors in electrical supplies have been Germany and England, and their trade with other parts of the world must be seriously crippled by the present conditions. There should be an opportunity, then, for American manufacturers to make advances in South America, in the Orient, and in other territory which has previously been supplied by English and German manufacturers. The principal electrical exports of the United States consist of generators, motors, transformers, telephones, wire and cables. But little of this material has gone to Europe or to English and German Colonies, especially the latter. Interruptions to this business should, consequently, not be so serious as might at first seem likely. Even if England or Germany, through decisive naval victories, should be able to maintain its commerce upon the high seas, the uncertainty of delivery would be very influential in directing orders to this country. . . . One of the most serious effects of the war upon the electrical industry in this country is likely to be felt in the lack of capital for new enterprises. The investment of European capital in this country will undoubtedly cease, and, indeed, has already done so."

BRITISH-MADE MAGNETOS FOR BRITISH MOTOR-CARS.

An Appeal to British Motor-Car and Magneto Manufacturers.

In view of the outbreak of the long-dreaded European War, the petrol motor-car industry of Great Britain finds itself in an extremely awkward position. For some years practically every motor-car manufacturer has been using for ignition purposes a magneto, principally of foreign manufacture—and chiefly German at that—with the result that to-day all deliveries from the manufacturers are cut off, the supplies being restricted to the relatively small quantities held in stock by the representatives or agents of the makers in this country.

Our manufacturers of cars "have only got themselves to blame," for even the motor Press has previously drawn attention to the dangerous position. Thus, in December of last year, under the heading, "A Magneto Monopoly," the *Autocar* published an article which to-day has an added interest and significance. The article in question was instituted by the numerous complaints that had been received with regard to the high prices charged for magneto spare parts, and for repairs, and, while dealing with this phase of the matter, our contemporary took the opportunity of drawing attention to the position British motor manufacturers and traders and also motorists, might be in should labour disputes or strikes occur in the principal centre of the magneto industry.

As was then pointed out, "at the present time one town, Stuttgart, has what to all intents and purposes is a monopoly of the magneto manufacture for British cars; that this is so will be recognised when we say that in Stuttgart the Bosch, Eisemann and the Mea magnetos are made. True, these are not the only magnetos to be found on British cars, but they are so overwhelmingly in the majority, that if the statement were made that all British cars had German magnetos, and all German magnetos came from Stuttgart, it would be so nearly the truth that it would not be worth disputing. This is a really dangerous position, because of the possibility of labour disputes and strikes, as such things may well occur when a trade is so centralised as this one appears to be."

Needless to say, the position, now that war has broken out, has become a much more serious one than would be engendered by strikes, and is one that will undoubtedly give rise to much study. While every credit is due to the German magneto manufacturers for the way in which they established their reputations and businesses, there appears to us no valid reason why we should continue to be dependent on foreigners for our ignition apparatus; indeed, we consider it to be far from creditable to the British motor industry as a whole that this should be the case.

It would take too long to inquire into the why and wherefore of the fact that no British firm has hitherto tackled the magneto business in a really big way. Perhaps it is that none have been sufficiently enterprising, and perhaps it is that British motor manufacturers have not given any encouragement to home firms, but have been too prone to follow the lead in using certain makes of magnetos. Whatever has been the cause, the time has now arrived when a change must be made; when motor manufacturers must no longer be dependent on any foreign country for so vital a part of motor-car mechanism as the magneto. The war is demonstrating what has for some years been realised, the great and indispensable part which motor vehicles now play in military operations—in the rapid conveyance of troops, in the hauling of big guns, in transport work generally, in the commissariat department and in ambulance work, and, in view of such condition of things, it has become of national importance that every necessary part of a motor-car's anatomy shall be capable of production in our own country.

While everyone will admit that reliability and accuracy of manufacture must be associated with the products of those who have specialised on magneto manufacture for many years, and who also, having had the advantage of a large and steadily increasing annual production, have been enabled to train up an army of specialised workmen, and, at the same time, to reduce costs of production to a commercial footing, yet we cannot conceive that in these days of advanced electrical engineering knowledge, there should be any serious and insurmountable difficulty in developing some of the existing British magneto manufacturing businesses to such an extent that they will be able to cope with the demand for magnetos from every point of view—reliability, accuracy and price.

It is, therefore, sincerely to be trusted that in making their plans for the 1915 season, British manufacturers of automobiles—cars, both pleasure and industrial, and motor cycles—will fully inquire into the possibilities of fitting British-made magnetos only, and that manufacturers of the latter, on their part, will do their utmost to demonstrate that either individually, or collectively, they are in a position to supply magnetos of the required standard of reliability at the right price, in the desired quantities, and at the right times. In this connection it is satisfactory to learn that a meeting of motor manufacturers has already been held in Coventry in connection with the supply of magnetos for motor-cars and cycles. A representative Committee was appointed to communicate with English electrical firms, with the view of obtaining supplies of magnetos in the future, and all firms desirous of entering into these important branches of the motor trade are requested to apply to the convener of the meeting, Mr. Harry Smith, of the Rover Co., Ltd., Coventry.

Already it is announced that the British Thomson-Houston Co. has commenced the manufacture of magnetos at its works in Ford Street, Coventry, and that Messrs. Thomson-Bennett, Ltd., of Arden Works, Birmingham, who have been making magnetos on a small scale for several years, are now in a position to turn out 300 machines per week, which number will quickly be doubled if they receive the support from British car manufacturers which they claim they have a right to expect.

There is, of course, a possibility that must be remembered, and one to which we have previously drawn attention, and that is, of a return to accumulator ignition, which would render the magneto unnecessary. With the very wide adoption of a lighting dynamo as a standard portion of the anatomy of a chassis, and in conjunction with this, the installation of a battery of accumulators, there is no technical reason why the latter cannot be used for ignition as well as for lighting purposes, the place of the magneto being taken by a coil and distributor, for with the introduction of the lighting dynamo the old trouble experienced with ignition accumulators—that of keeping them fully charged—has entirely disappeared. Although the change from magneto to accumulator ignition has already been made in one or two American cars, there is, however, no marked tendency in that direction, certainly in this country, so that this should not deter magneto manufacturers from taking all the necessary steps to cope with the trade that is now within their reach.—C. J. W.

Resistance of Steel Conductor Rails: British Standard Specification.—The attention now being given to the electrification of railways makes this report (No. 68) on the British Standard Method of Specifying the Resistance of Steel Conductor Rails of special interest at the present time. The question was brought officially to the notice of the Engineering Standards Committee in March, 1913. In the introductory remarks an explanation is given of the reasons for selecting the particular method which has been adopted of defining the standard dimensions in terms of length and weight per yard, rather than in terms of length and sectional area. Useful tables of reduction factors for converting the resistance of a rail of known weight, measured at a given temperature, to its value in terms of the standard, are given, and in an appendix will be found reduction formulæ, so that previous values for the resistance of rails in terms of copper may be readily reduced to values in terms of the recommended standard.

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WAR ITEMS.

"Who's Who in the War" is a little handbook selling at 1s. (one-half of the proceeds going to the Prince of Wales's National Relief Fund), which should be of very considerable service to those who wish intelligently to follow the course of events. Briefly, the compiler sets forth the population, financial position, military and naval strength, religion, foreign trade and certain other important characteristics, of the different countries involved. A collection of political notes forming a diary of events show how the war began, the diplomatic pourparlers that took place between the great powers prior to the outbreak being amply recorded. Military notes compare matters in the year 1870 with the position to-day; military definitions and information concerning the forces engaged, &c., occupy a number of pages, and there are also naval notes, a couple of maps (one of Europe, and the other of the Franco-German frontier), and a good deal of general information. The booklet is edited by Mr. Geo. L. Polsue and published at Gough House, Fleet Street, E.C.

Mr. Hope-Jones informs us that there are practically no German systems of electric clocks in use in this country, so in that branch of business the electrical profession have nothing to make war upon, but can obtain all supplies at home as heretofore. It would have been a very different state of affairs if the war had been declared some years ago. The "War" against German electric clocks began in 1895. England was an easy winner, and it is now generally admitted that in the electrotechnics of electric time service, British science and practice are far ahead of those on the Continent.

We have received the following message from an important electrical company at Ithaca, N.Y., dated August 8th:—"Americans—with but few exceptions, and these are racial—especially in this locality, and that means universally, for we are much alike in such matters, are with the British Government, applauding the dignified manner in which it endured the offences offered against it, and hoping for and predicting complete success for the arms of the Triple Entente to which it is a party. May we add our own good wishes for British success in this uncalled-for conflict of arms—and that right speedily."

The Ediswan Co. inform us that if they could coin a phrase out of the mottoes they have recently seen, it would be "Don't Worry—Work and keep on at it during the alterations to the map of Europe." The staff of employés in the Royal Ediswan lamp manufacturing section is being added to daily and full time worked, owing to increased orders for all makes of Royal Ediswan lamps. The effect of advertising to the trade through the trade papers, the fact that Royal Ediswan drawn-wire and carbon lamps are made in Great Britain by British labour with British capital, has had a very successful and patriotic effect. The company believe that the *All*-British effort, including British capital, is likely to tell satisfactorily upon their business in the near future in a very marked degree. The company have every confidence in the present general situation and in their ability to meet all demands, now and in future, and no effort will be spared to maintain their usual service to the trade. The Ediswan engineering section is able to speak with equal confidence, not only because of the increased activity caused by Admiralty work, but also by the continuation so far of everyday orders, and, in fact, increased orders for many special lines. The firm are paying the wives of the married men serving in the Army half-pay, and will allow the men to take over their old positions upon return.

Owing to the crisis and the resultant sudden and serious advances which are being made generally in raw materials, the Edison & Swan Company notify the trade that the immediate withdrawal of all existing list prices is liable at any moment. Their position as regards stocks of both raw materials and finished goods is such that they are at the moment, and possibly may be for some time to come, able to fulfil all general requirements. In the interests of their regular customers they have had to refuse many offers of extraordinarily large quantities of accessories, which are now in demand owing to the closing down of the German and other Continental markets, and will continue to do so. Though no drastic alterations will be made in prices at the moment, such procedure may become an absolute necessity at any time. They hold large stocks of finished lamps and adequate stocks of raw materials to cope without the slightest hitch with the large increase in the demand for all-British lamps.

Owing to the war the Annual Conference of the Municipal Tramways Association (Inc.), intended to take place at Salford, is not to be held this year. Mr. Holford, the manager of the Corporation tramways, is approaching the management of the various hotels in order to see what can be done respecting rooms already booked. Due notice will be given of the annual general meeting.

The Southend-on-Sea T.C. has received from the British Niclausse Boiler Co., Ltd., a request for the release of part of the retention money (£722 10s., payable on February 11th, 1915), in respect of the boilers, &c., supplied to the electricity works, owing to the company being unable to obtain remittances from France. Subject to the deduction of discount at the current bank rate, it has been decided to pay the company £250.

In response to its circular, the Council of the Institution of Electrical Engineers have received offers of service from some 1,100 members and others. The following is a copy of a circular letter which was posted on August 21st to the engineers of all the electricity supply undertakings in the United Kingdom:—

"National Service.

"Dear Sir,—I am desired to inform you that as the result of a circular sent by the Council to the members of the Institution, the Council have now the names of a large number of electrical engineers who offer their services (subject to various periods of notice) to fill vacancies in connection with the public services, electric power stations, tramways, railways, &c. These names have been classified by means of index cards under various headings, and are at the disposal of your undertaking should any of the men's services be required."

"I am, dear Sir, yours faithfully,

"P. F. Rowell, *Secretary*.

"*August* 19*th*, 1914."

Reports from Leading Neutral Markets.—In connection with the Board of Trade scheme for assisting British manufacturers and traders to take advantage of the opportunity afforded by the war for securing trade formerly in the hands of German and Austrian or Hungarian rivals, cables were dispatched on August 14th to H.M. Trade Commissioners in Canada, South Africa, Australia and New Zealand, and to British Consular officers in South America, China, Japan and Egypt, asking them to report on the financial and commercial conditions in their districts, and as to the likelihood of regular payments being forthcoming for goods supplied. The following is a summary of the replies which have been received to date:—

South Africa.—H.M. Trade Commissioner reports (August 17th) the existence of depression due to drought which was accentuated by the war. The action of H.M. Government regarding insurance against war risks is highly appreciated. The banks are fully prepared to finance reputable merchants as hitherto, and merchants are ready to carry on trade. Indents supplied previously by Germany and Austria will be executed by the United Kingdom and France.

Canada.—H.M. Trade Commissioner reports (August 16th) that according to the information which he has been able to obtain, the present financial position of importers is generally satisfactory. The approximate value of import trade from Germany is £3,000,000. The following is a list of certain goods in which, in his opinion, British firms might extend their trade as the result of existing conditions:—

Brass articles.	Electric apparatus.
Brass tubing.	Enamelled ware.
Boiler tubes.	Glass ware.
Optical instruments.	Lamps.
Carbons.	Rubber.
Copper tubing.	Zinc bars.

Australia.—H.M. Trade Commissioner in Australia reports (August 17th) that the financial position in that market is strong. The Federal Government is prepared to support the banks if necessary, and the execution of Federal, public and State works will be continued. The commercial position appears to be sound, as the banks are adequately supporting merchants. He considers that there is a good opportunity for manufacturers to secure valuable trade. Firms should cable to their agents that they are able to fill orders if they are in a position to give this assurance.

New Zealand.—H.M. Trade Commissioner reports (August 19th) that the present conditions of trade are disturbed, but he anticipates that this is only temporary, and considers prospects to be good, and regular payments likely to be maintained. An increasing demand for British goods may be expected, but prompt overtures should be made so as to anticipate competition from America.

Brazil.—H.M. Consul-General at Rio de Janeiro reports (August 18th) that an opportunity certainly offers for British firms to secure trade now in German hands. Traders should make arrangements for payment in gold, and not in paper currency, since the Government propose to make a large local issue of paper, and in all probability exchange will decline sharply. British firms desiring to transact business should send competent representatives possessing the necessary technical knowledge to study local conditions. H.M. Consul adds that in Rio de Janeiro firms are in a good financial position, and it should not be difficult to secure regular payment, but the utmost caution should be exercised in the choice of customers.

Argentina.—The British Consul-General at Buenos Ayres reports (August 14th) that the preponderating share of the trade is already in the hands of British firms. Banks refuse to give credit, and there is no money to be had. Regularity of payments cannot be relied upon. There is a danger of depreciation in the value of currency.

China.—The British Consul-General at Shanghai reports (August 15th) that Shanghai merchants are fully alive to the situation. The difficulty in getting shipments away is reacting on the import trade, but Chinese merchants are confident that business will shortly be resumed on a small scale. Silk spinning mills, cotton mills and industrial undertakings generally are working.

The Thermal Syndicate, Ltd., ask us to inform the trade, in view of the dislocation of business, owing to the war, and the lack of supplies of glass and porcelain from Germany and Austria, that they are in a position to supply their vitreosil material promptly, as it is entirely made in their works at Neptune Bank, Wallsend-on-Tyne.

Messrs. Leopold Farmer & Sons, of Gresham Street, E.C., inform us that active steps are being taken by English manufacturers to equip themselves to secure increased trade owing to the present position of affairs. Firms in all branches of trade are seeking factories to open up industries in which they have been barred from manufacture through the low prices of foreign competition. Messrs. Farmer have received applications for factories for the manufacture of goods in the electrical and general engineering trades, soft goods, hardware, chemical and allied industries, from well-known firms and syndicates proposing to establish works for both the export and home trades. "The passing of the Patent and

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Designs Act, 1907, resulted in a figure approaching £2,000,000 being expended in land, buildings, plant and machinery, &c., but we can safely say the foregoing results will be eclipsed on the cessation of hostilities by an enormous trade boom setting in for English manufacturers both in old and new markets and a further increase of prosperity to the old country."

From the inception of the drawn-wire process all the wire used in Mazda lamps has been manufactured in Rugby. The wisdom of the British Thomson-Houston Co., Ltd., in this course is more than ever evident in the present crisis—they are, as they have always been, absolutely independent of any other country for the supply of tungsten wire. This fact places them in a certain and safe position, and also assures the advantage to the trade and public of a continuity of supply. The introduction of half-watt lamps was first announced in Great Britain, at Mazda House, on August 26th last year, and ever since that time the British Thomson-Houston Co. have been busily engaged on the manufacture of such lamps, and British-made half-watt lamps are being produced in commercial quantities at Rugby.

Messrs. J. H. Tucker & Co., of Birmingham, have for 20 years been manufacturing nothing but "All British Goods," so that they are, so far, unaffected by the war, and they are "Carrying On" as usual. They have one of the largest works in this country devoted to goods such as they manufacture, and though their name is so well known as makers of "Tumbler Switches," they also manufacture a most comprehensive range of light and power accessories —lampholders, ceiling roses, wall plugs, and similar articles are turned out by their works in very large quantities. They further make a complete range of switchgear—switch and fuseboards, ironclad fuses and switches, distributing boards, house service fuses and similar goods. Their manufacturing policy has been to make themselves "self-contained," and, with the exception of certain raw material, they are practically independent of outside sources of supply.

The Tudor Accumulator Co., Ltd., of Dukinfield Hall, have decided to keep situations open for any of their employés who are called up for service, and, during their absence, to grant half-pay to their dependants.

The Ilford Urban Council has decided to make up the wages of the men who have joined the colours to the amount received while at work. From the electricity and lighting department six men (five of them married), and from the tramway department ten men (four married), have gone.

Another valuable return issued by the Board of Trade Commercial Intelligence Department in connection with the present campaign in the neutral markets, relates to internal combustion and explosion motors, gas turbines, &c. Values are given of exports of these classes from Germany and Austria-Hungary to all destinations. From Germany in 1912 they aggregated £2,826,000, and from Austria £37,000 in 1913. A table shows at a glance the different countries to which these were sent, and information follows respecting the openings that exist in Canada, South Africa, India, Hong Kong, Egypt, Russia, Roumania, Greece, Turkey, Siberia, U.S.A., Japan, and other countries for such manufactures.

Inquiries have been received in the Commercial Intelligence Branch of the Board of Trade from a large number of firms in all parts of the United Kingdom for the names of manufacturers or purchasers of various classes of goods which have been previously obtained from or sold to Germany and Austria-Hungary. Among the articles respecting which inquiries have been received from would-be purchasers are the following :—

Numbering, dating and perforating machines; heat-resisting glasses and globes; glass wool; compressed asbestos fibre jointing; aluminium powder.

Inquiries have been received from manufacturers for purchasers of the following articles :—

Electrical fittings, &c.; electrical hair-dyes; electrical massage vibrators; glazed pressspahn.

Persons interested in any of the above-mentioned articles are invited to write to the director of the Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, London, E.C., with a view to being placed in communication with the inquirers.

The *Daily Express* reports an interview with Mr. Hugo Hirst, chairman and managing director of the General Electric Co., Ltd. Mr. Hirst urged that British manufacturers of every kind, after they fulfilled their duty in supporting the British Army and Navy, should strain every nerve to take Germany's place in the British home markets. "Provided we are willing to work as hard as the Germans did, and to sink capital and secure financial and public support, I think there is little doubt that we can replace a large proportion of German imports here at home. This should be our first concentrated care. Our success at home should afford us an excellent springboard from which to leap into Germany's other markets, and the war has already shown that the world's sympathy is with Great Britain, and not with Germany. 'Russia alone,' added Mr. Hirst, 'should offer us a splendid new foreign field for enterprise for a long time after the war.'"

The directors of the Newcastle Electric Supply Co., Ltd., and the County of Durham Electrical Power Distribution Co., Ltd., in response to applications for subscriptions to the various local and other funds which have been opened in connection with the war have decided to make a first subscription of £300, which will be handed over as soon as they are advised as to how such funds will be administered in the service of the areas in which the companies operate.

An evening newspaper states that Sir Adam Beck, chairman of the Ontario Hydro-Electric Commission, has presented his stable of hunters, which remained in England after the Horse Show, to the War Office. The animals are 11 in number, and are worth fully £500 each.

The Schniewindt Electric Co., of Birmingham, has been taken over by the Cressall Electric Co., and we are asked to state that there are no German interests whatever in the new company. The Cressall Co. are carrying on business as usual, and are in a position to execute all orders for resistance nets, &c., promptly. No advances in prices have yet been made, nor will they be unless rise in raw material prices compels.

Mr. William H. Taylor, patents specialist, of 3, Brown Street, Market Street, Manchester, learns from his Paris agent that by a decree given on the 16th inst. the French Government, with commendable thoughtfulness for inventors, will allow applications for patents to be made without payment of the usual application fee of 100 fr. Such payment is only to be made after the war and on a date to be subsequently fixed. The decree applies to British applicants and presumably to all others except subjects of those countries at war with France.

The Board of Trade has made rules under the Patents, Designs and Trade Marks (Temporary Rules) Act, 1914, regulating the procedure for the avoidance or suspension of any patent or licence granted to, or trade mark, the proprietor of which is a subject of any State at war with his Majesty. Where an application is made to the Board for this purpose it must be satisfied that the applicant intends to manufacture the article concerned or carry on the patented process, and also that it is in the public interest that this should be done. The rules provide also for the avoidance or suspension of any application for a patent or trade mark by the subject of an enemy State.

Copies of these rules may be obtained from the Superintendent of the Sale Branch, Patent Office, 25, Southampton Buildings, W.C.

A correspondent writing to the *Times* on the patents question, says :—

"What about those of us who hold patents in Germany? If we appropriate German patents here in Britain, we must expect similar treatment later with our patents in Germany, the granting of which is not only costly, but very difficult to obtain. Would it not be better for the Government to take over the German patents in this country *en bloc* and distribute them out to responsible British manufacturers in this country holding German patents?"

The Edison & Swan Co., Ltd., are supplying to H.M.B.C. *Tiger* a quantity of Admiralty pattern quartzalite radiators. The order has been placed through their Glasgow branch, as the ship is being built by Messrs. John Brown & Co.'s yard, at Clydebank.

Messrs. F. Wiggins & Sons, of 102, 103 and 104, Minories (City), London, ask us to draw the attention of the electrical trade to the following facts :—

"1. We have the largest stock of mica in the world here in our own warehouses in London.

"2. Our prices have not advanced owing to the war except for a few sizes for which there has been a heavy demand.

"3. Shipments of mica to this country are practically all stopped at present, mainly for financial reasons. This will probably continue for some time; nevertheless we believe our stock to be large enough to keep the British electrical industry supplied with mica until further supplies come in, without prices rising appreciably.

"4. We are an all-British firm. Our partners, managers and workpeople are all British, and since we were established in 1840 we have never had anyone but Britishers by birth connected in any way with our firm.

"5. Our business motto is 'A Square Deal.'"

The Government has issued the following explanation of its proclamation against trading with the enemy :—

1. For the purpose of deciding what transactions with foreign traders are permitted, the important thing is to consider where the foreign trader resides and carries on business, and not the nationality of the foreign trader.

2. Consequently, there is, as a rule, no objection to British firms trading with German or Austrian firms established in neutral or British territory. What is prohibited is trade with any firms established in hostile territory.

3. If a firm with headquarters in hostile territory has a branch in neutral or British territory, trade with the branch is (apart from prohibitions in special cases) permissible, as long as the trade is *bona fide* with the branch, and no transaction with the head office is involved.

4. Commercial contracts entered into before war broke out with firms established in hostile territory cannot be performed during the war, and payments under them ought not to be made to such firms during the war. Where, however, nothing remains to be done save to pay for goods already delivered or for services already rendered, there is no objection to making the payment. Whether contracts entered into before war are suspended or terminated is a question of law, which may depend on circumstances, and in cases of doubt British firms must consult their own legal advisers.

This explanation is issued in order to promote confidence and certainty in British commercial transactions, but it must be understood that, in case of need, the Government will still be free to impose stricter regulations or special prohibitions in the national interest.

A Newcastle-on-Tyne paper (*North Mail*) says :—"The manufacture of electrical gear of all descriptions is a rapidly growing North-country industry, and according to a Tyneside authority, Northern firms should do well at the expense of Germany, which had competed vigorously and determinedly in all parts of the world. During recent years she has made a tremendous bid for the electrical trade in this country and abroad. Manufacturers, merely to obtain a footing, readily sacrificed profits—even sold at a loss, and employed all kinds of "dodges" to oust the Britisher. Naturally, this country was bound to suffer, but the blades of war have sliced Germany's trade strings."

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Reuter's correspondent in Paris says:—"A number of French firms are anxious to know whether British manufacturers of tools, machine parts, and ironware can supply the goods which can replace similar articles exported from Germany to France. The inquiry seems to have special interest for Sheffield, Birmingham, and Coventry. The British Chamber of Commerce is prepared to assist British manufacturers in getting into touch with French firms."

The views of "a prominent City man who has made a special study of our trade relations throughout the world," have been given in an interview to the Press Association. He said that the idea of seeking information through British Consuls and trade commissioners as to the business done between the Colonies and neutral countries and Germany and Austria and of exhibiting samples for the inspection of manufacturers and traders in the United Kingdom was an eminently practicable one. He expressed the opinion, however, that any accession of trade could only come very gradually. When the war broke out British manufacturers generally were very full up with orders, and any extension of business would probably necessitate the installation of special machinery for the production of certain goods. "Of course," he added, "there is a limited value to what the Consuls and trade representatives may report. The people who really know the position of things are the firms who have been unsuccessful in competing with the Germans and Austrians. They know why they have been unsuccessful, and what is actually required, and they are hardly likely to publish this information to the entire world. Much of the trade which Germany has hitherto been doing she is welcome to retain, because it has been done with countries and firms either bankrupt or on the verge of bankruptcy."

A Manchester correspondent, writing on "Lancashire and the War" in the *Financial Times*, states that vigorous efforts are being made by British manufacturers in the North, particularly in the electrical and chemical industries, and many sections of the cotton trade. "The British Westinghouse Electrical and Manufacturing Co. has, since the outbreak of the war, received important orders from Norway and elsewhere which, it is affirmed, would otherwise have gone to Germany. Similar reports come from other important electrical, general engineering and textile machinery concerns in the Greater Manchester district, some of which are now preparing to open out new departments. Most engineering works would already be very busy but for financial questions—mainly the existence of the moratorium, and the absence of normal facilities for bill discounting."

"A Rejected One" writes:—"It is time that everyone recognised the facts as to the German menace of the last quarter of a century more particularly, or say, rather the last 30 years. It has been not merely a military and naval menace, but an industrial and an immoral menace. I have had special means for knowing something of the internal arrangements of the means by which Germany has fostered her trade in this country, and it is for these reasons that I have become so bitter an opponent of municipal trading and of municipal picnics upon the Continent in general, and to Germany in particular. My observations convinced me that the electrical orders which went to Germany, went there as a result of improper methods. When I have read of the impossibility of obtaining what was wanted at home, and that it was compulsory to go to Germany, I have felt convinced of the real reasons. With Germany already pressing on the French defence, is it not time that the 500,000 men wanted by Kitchener should be forthcoming? Instead, they are busy with cricket or 'lolling with a dolly' on the sand."

Mr. D. G. E. Barrie, of Clapham Junction, writes to us as follows:—"The Unpatriotic English Manufacturer. The English manufacturers for years past have complained about the unfair competition set up by German manufacturers, and now their chance has come to collar the trade hitherto held by the Germans, they are, instead of trying to encourage it, simply handicapping it. Instead of standing by their customers in the time of need, they are pressing for payment of accounts and refusing to supply customers on books except for cash; the result is that a lot of firms who could have stood the racket have had to close down, thus throwing a large number of hands out of employment."

As the Swiss Government has mobilised, the Bureau International de l'Union Télégraphique and Convention Radiotélégraphique Internationale notify their inability to cope with the work to be performed as so many of their employés are serving with the army. It has been consequently necessary to cease the publication of the *Journal Télégraphique*, and the preparation of the nomenclature of radiotelegraph stations, as well as the preparation of the map showing such stations and shipping routes. Delay in dealing with communications from Administrations will also necessarily result.

A further statement issued by the Board of Trade deals in full detail with German and Austro-Hungarian exports of industrial and agricultural implements and tools, and also the exports of similar manufactures from the United Kingdom. Notes are given from which an idea may be obtained regarding the prospects for doing additional British business in various specified markets. This return, like the others of the series, will doubtless be called for by many of our manufacturers.

A Historic American Vehicle.—A three-wheeled electric car "of the vintage of 1893" has recently been presented to the American Electric Vehicle Association of New York, and will be preserved as a relic. Its builder is now unknown, and there is little but its antiquity to recommend the quaint little vehicle

LEGAL.

An Electrical Contract.

The *New Zealand Times* contains an account of a case adjudicated upon by his Honour the Chief Justice (Sir Robert Stout) in the Supreme Court, Wellington, in which Messrs. Turnbull & Jones, Ltd., proceeded against the Taihape Borough Council, seeking a declaration of the Court that the defendant Corporation was bound, by the orders of its engineer, to alter works under a contract entered into between the defendant and the plaintiff.

The contract was for the construction of a hydro-electric lighting plant, and in the general conditions there was the following clause:—

"If any alteration shall hereinafter be made by order of the Borough Council by varying the plans or specifications, or otherwise, such alterations shall not vitiate the contract in anywise, but any alteration in the works ordered by the engineer in writing shall be executed by the contractor, and the value thereof, whether additions to or deductions from the works included in the contract, shall be ascertained by the engineer, without reference to any person whatever, and the amount thereof shall be added to, or deducted from, the amount of the contract, as the case may be."

After the contract had been entered into, the plaintiffs' engineer visited the proposed site of the works, and found that alterations would have to be made in the mode of constructing the works. Most of the suggested alterations were approved by the Council's engineer, who wrote ordering Messrs. Turnbull & Jones to make them, including a change of turbine from double to single discharge. The Council, however, objected to the alteration of the specified turbine. Before the plaintiffs received notice of the objection they had ordered the single discharge turbine from England. It was agreed between the parties that if the plaintiffs had to pay any damages for cancelling the order, the defendants would leave it to an arbitrator to state what sum the defendants should pay, provided that the Court determined whether the engineer had power to change the double discharge turbine to a single discharge turbine.

According to the report before us, his Honour remarked that this was not a case in which the engineer had by an order increased the cost of the works. On the contrary, the cost would have been lessened by some £500 if the engineer's alterations had been carried out. The class of cases, therefore, in which the engineer or architect had purported to increase the price or cost of works did not apply. After considering the legal aspects of this and relevant cases, his Honour said he was of opinion that the plaintiff was entitled to the direction asked for, and that the engineer had power to change the one turbine for the other.

Judgment was given accordingly. Costs would be on the scale to be fixed by the quantum of damage awarded, and might be reserved until this was settled, or until the further order of the Court.

Charge against an Electrician.

According to the Birmingham *Daily Post*, George Kertland, a young electrician, belonging to Shepherd's Bush, was charged at Wimbledon on 19th inst. with being concerned with two other men in breaking into the Foster Engineering Co.'s works at Wimbledon on the previous Sunday night and stealing carbons and other material valued at about £2,000. It was stated that he arranged with a London firm of carriers to remove the goods in motor-cars from the works shortly after midnight on Sunday. Five hours were taken by him and two other men in packing them. They weighed about 13 tons, and were removed to a place at Hayes, Middlesex, where the police found most of them. The rest were stopped in transit on the Great Western Railway.

A detective-sergeant said that when he arrested the accused Kertland stated: "I have a complete answer to the charge. These carbons are the property of an alien enemy, and the Government want carbons, and we have the authority of the Treasury."

He was remanded in custody.

U.S. Army Wireless Outfit.—A portable wireless outfit, which can be set up in 12 minutes and has a radius of operation up to 800 miles, has recently been adopted by the U.S. Army Signal Corps. It includes a motor-wagon, with a 30-H.P. engine, which is geared to a 110-volt generator, current being stepped up to 22,000 volts pressure for the wireless equipment. The antennæ are of the umbrella type, attached to an 85-ft. mast, which is built up in nine sections by block and tackle, and is transported in compartments of the truck. The counterpoise or artificial ground consists of heavy insulated wires radiating from a common centre, to which is attached the ground wire of the set.—*Elec. World.*

Faraday House Electrical Engineering College.—In view of the large withdrawal of engineering students from Continental colleges and works on account of the war, the Governors of Faraday House are willing to offer special arrangements to those who wish to join the College. They are prepared to take into consideration, as far as possible, the time already spent abroad, and to shorten proportionately the four years' course ordinarily required for the diploma. Students would complete their practical training in large engineering works and power stations in the United Kingdom.

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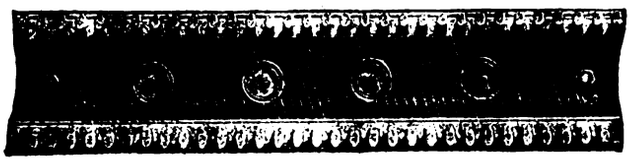
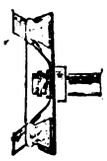
NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Credenda Electric Fires.

The Credenda Conduits Co., Ltd., of Chester Street, Aston, have brought out a range of electric fires, for which Messrs. Baxter & Caunter, Ltd., are the London agents. The fires are fitted with a new bar unit which is being patented, consisting of a metal frame carrying eight dove-tail sections of steatite; the latter have





Figs. 1 and 2.—Credenda Heating Element.

a number of projections on which is wound the nickel-chrome heating wire in zig-zag. Holes in the metal channel allow air to circulate through the hot-wire grid, cooling the metal frame and preventing overheating of the wire, which works in free air. As the sections of steatite are of small dimensions, breakages are minimised. Each bar unit has a plug contact at each end, so that bars for different voltages can easily be inserted, and the whole

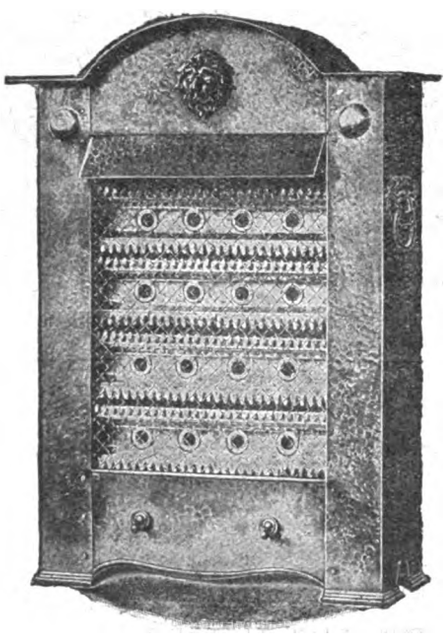


Fig. 3.—Electric Fire, 2,000-3,000 watts.

frame which carries the bars can readily be removed with the switches and wiring from the outer case, after taking off the bottom and unscrewing the switch rings. The bars are interchangeable, and as they are coupled in parallel, the removal of one does not affect the others. Owing to the width of the elements, less bars are required to make up a given area of heating surface, and longer lengths of heavier gauge wire can be used without spiral winding, which has a tendency to local heating.

Figs. 1 and 2 show one of the bar units, and fig. 3 one of the many patterns of fire in which the bars are used.

Heating and cooking apparatus are also made by the company.

The "Jumper" Control Gear.

The starting and stopping of hydraulic pumps automatically is usually done by the accumulator actuating a trip switch or pilot valve by tappet gear, and in the case of air compressors, by the variation in pressure in the receiver.

From a mechanical point of view, this should be done gradually, and from an electrical point of view, with as little sparking and excess of current as possible.

As electric motors, particularly of the A.C. type, start up and stop much too quickly for ideal pumping conditions, the pumps should preferably be unloaded prior to these operations, in which case there is less current to deal with; furthermore, the motion imparted to the controller should be slow when on the contacts and relatively quick when passing from contact to contact.

The "Jumper" control gear, which is here described, is made by the Leeds Engineering and Hydraulic Co., Ltd., Rodley, near Leeds.

Fig. 6 shows a section of the gear proper, which consists of a hydraulic cylinder A actuated by a pilot valve B and accumulator striking gear C, C (shown on fig. 5), a cataract D, a sentinel valve E for actuating the unloading valve F (shown on fig. 5), the speed of the unloading valve being governed by the needle valve G, a

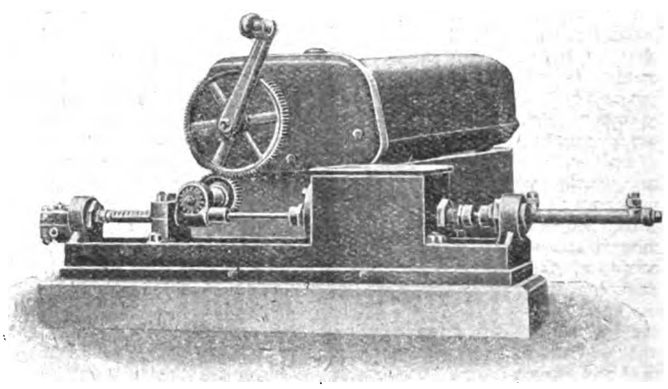


Fig. 4.—Controller with "Jumper" Gear.

rack and pinion and gearing or pitch chain being employed for connecting the gear to the electric controller H.

When the gear is in full "on" position, and not until then, it actuates the sentinel valve, which closes and keeps closed the by-pass valve which loads the pump; in like manner, when the accumulator has reached its highest position and tipped over the pilot valve, the main gear moves it to the "off" position; in

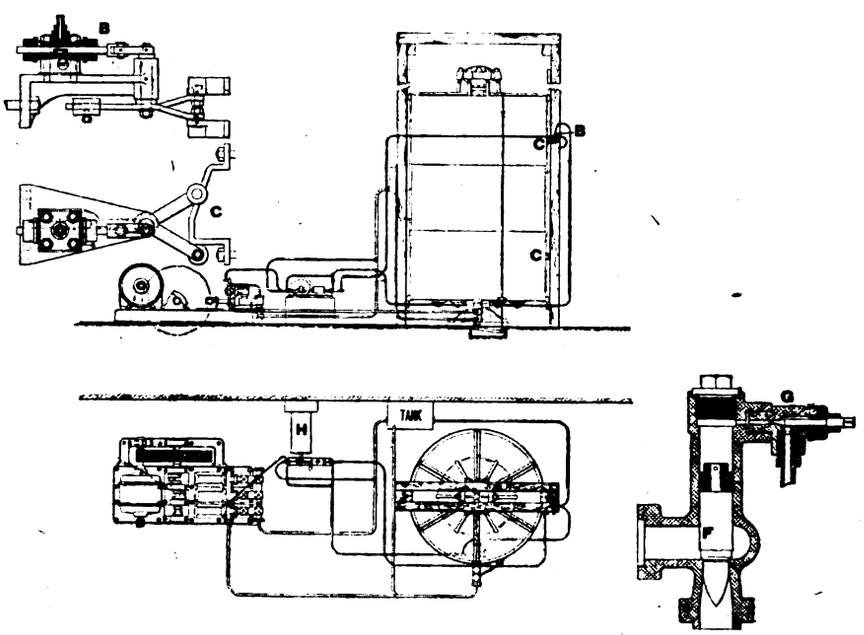


Fig. 5.—General Arrangement of "Jumper" Control, also Valve Details.

doing this, it first unloads the pump by opening the by-pass valve.

The "Jumper" gear can be made to actuate any type of electric controller, but the controller generally preferred is the tramway type, because the contacts are usually large, easily get-at-able and cheaply renewed.

In order to reduce the wear and tear of the contacts, it is desirable to impart a "jumping action" to the controller drum—hence the name. This is effected by inserting a rod M inside the cataract D on which there are a series of alternately raised and recessed parts corresponding with the number of contacts in the controller. The raised parts fit the hole in the cataract piston N.

When the piston comes to a raised part, it passes slowly over it, and when it comes to the recess it jumps forward, and so on. The time taken to pass over each raised part may be varied in either direction by the needle valves, K, K, while the cataract cylinder is kept solid by suction valves L, L.

The cataract cylinder is submerged in the fluid, which is entirely enclosed in order that it may keep clean and require renewing infrequently.

During such periods the pump can be automatically loaded and unloaded by opening and closing valves which connect the accumulator pilot valve with the by-pass valve and disconnect the gear, in which case the pump is started up unloaded, by hand, by

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withdrawing the catch pin in the controller handle, which engages with the stop of the gear wheel. It will be noted that the by-pass valve F is made acorn shaped so that it shall open and close gradually; a non-return valve must be placed between the by-pass valve and accumulator.

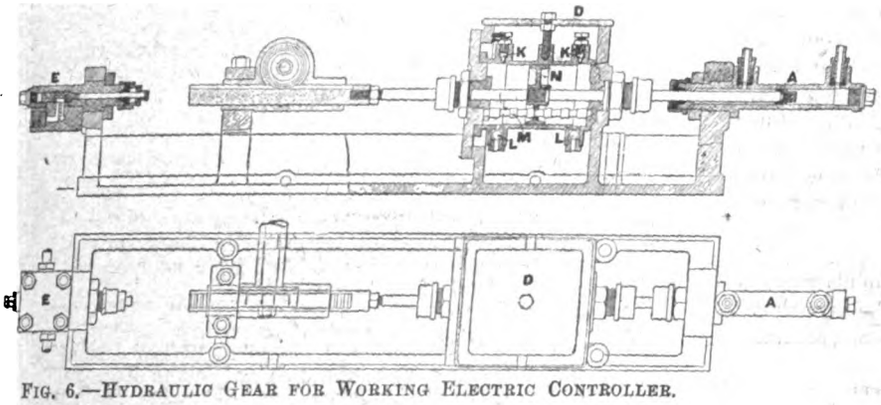

Fig. 6.—Hydraulic Gear for Working Electric Controller.

Electric Fittings.

Messrs. J. & W. B. Smith, of 15-23, Farringdon Road, London, E.C., who have had a lengthy experience in the manufacture of fittings and accessories for lighting purposes, are engaged upon a large development of their electrical business. They have just issued for the coming season an excellent catalogue of 140 pages, in which these are set out in detail; and at their showrooms, as we have seen for ourselves during the last few days, they have on exhibition a representative collection of practically all the lines included in this publication, as well as a number of novelties to which we hope to make reference in due course. The manufactures are practically British-made throughout; it is only in the case of one or two exceptions, such as certain special lines of glassware which have hitherto been peculiar to the Continent, that this is not the case. Large stocks are held in readiness for immediate delivery—a point of even more than usual importance in view of the present crisis, which is making increased demands on firms dealing in lighting supplies. Contractors and trade purchasers are invited to make full use of the showrooms for their own and their clients' edification and instruction. We noted on the occasion of our visit the very clear marking of fittings with catalogue prices. The catalogue starts off with a variety of lamp-shades in plain and fancy glass, beads, silk and cardboard. Some attractive examples of china portable table standards, statuettes, brackets, pendants, hall and other lanterns, ceiling lights, adjustable pendants, candle fittings, and a full collection of electroliers, follow. Semi-direct lighting fittings form a special feature, quite a number of different and pleasing designs being shown fitted with "Pearlite," pearl onyx and "Radiac" dishes. We select a couple of these examples for illustration, fig 7 showing a chain-suspension polished-brass fitting, with pearl onyx dishes of 12 and 14 inches diameter; and fig. 8 representing a Georgian antique brass-finished fitting with 14 in. diameter band, and "Pearlite" dish. Other manufactures in the catalogue include Holophane bowl reflector fittings and glassware, church fittings, "Glasmi" luminous electric radiators, "Holborn" electric fires, electric heating and cooking apparatus, and a variety of tumbler and other switches, bells, "Glasmi" conduits and fittings, illuminated signs, electric fans, weatherproof outside lanterns, and so forth.

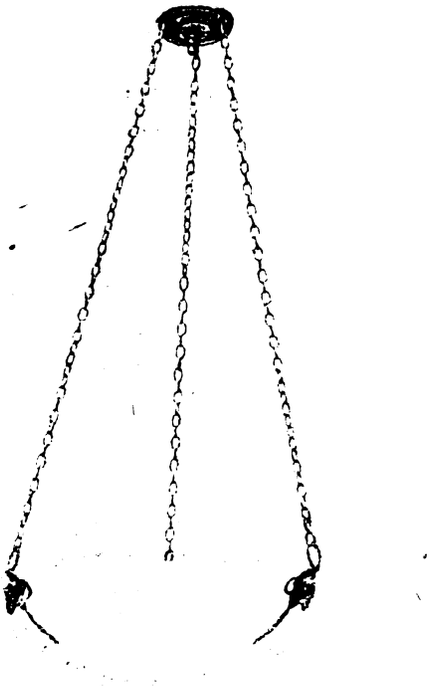

Fig. 7.—Chain-Suspension Semi-Direct Fitting.

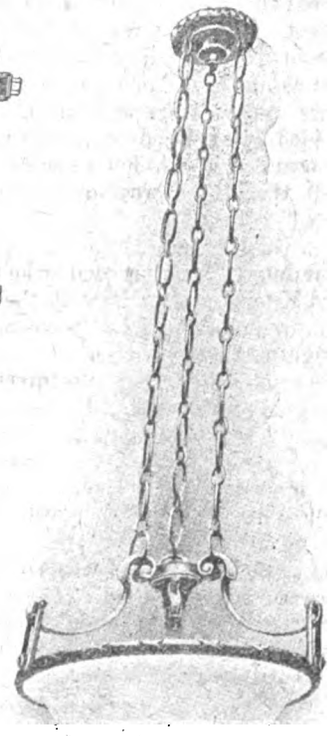

Fig. 8.—Georgian Semi-Direct Fitting.

Totally-Enclosed Circuit-Breakers.

In industrial work it is desirable that circuit-breakers and other electrical gear shall, wherever possible, be totally enclosed. The General Electric Co., Ltd., of Witton, Birmingham, have recently introduced a new design which is shown in the accompanying illustrations. The circuit-breaker is fixed in a strong cast-iron case intended for mounting on a wall or angle-iron framework. The lid is hinged and is interlocked with the switch by means of the G.E.C. patent interlock. The important feature about this circuit-breaker is the fact that the breaker can be opened and closed with the same handle—a great improvement over the usual method of operating, as no special lever for tripping is necessary.

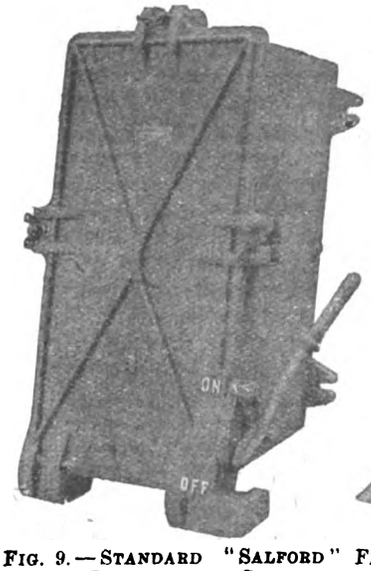

Fig. 9.—Standard "Salford" Circuit-Breaker in Cast-Iron Case.

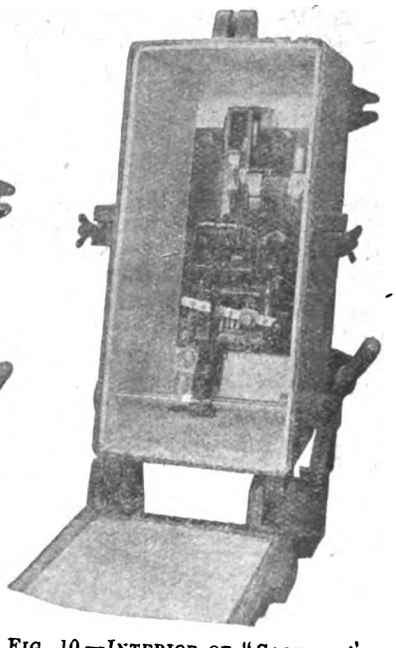

Fig. 10.—Interior of "Salford" Circuit-Breaker.

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THE PRINCE'S RELIEF FUND.

Many electrical firms and undertakings have adopted a policy of generous treatment of the members of their staff who have gone to the front and their dependants left at home, giving them also an assurance of an open door and a proud welcome when they return from the battlefield. Much distress will be avoided by everybody doing his part—everybody sweeping his own doorstep. For some firms, added to the already present though we trust quite temporary dislocation of business, this is no light burden to carry, but we are sure it will be carried, and that cheerfully, wherever possible. It is our duty to work hard and make big sacrifices in order that Lord Kitchener may have all the men that he asks for. To many who long to join the colours, assurances of such a kind might settle the matter.

We are equally confident that manufacturers, professional men, and others engaged in electrical pursuits will contribute liberally to the Prince of Wales's Relief Fund. The response has been magnificent thus far, showing that where national spirit is properly aroused, the well-springs of charity may still be relied upon. The needs will be such as we have never known before, and the resources available to meet those needs must be worthy of the nation and Empire in whose defence they are incurred. The interests of the Fund have, doubtless, already come under the notice of most of our readers, but we may be allowed to add our own earnest appeal to all to support this noble and beneficent effort on the part of the Prince, and subscribe as heavily as their other claims will permit them to do. A coupon for their convenience is given in our advertisement pages.

TELEGRAPHS AND TELEPHONES IN CHINA.

Below we print extracts from an extremely interesting and exhaustive report on proposed telegraph and telephone construction work in China, by Mr. George E. Anderson, the American Consul at Hong Kong. A good deal of the extensive work proposed has been held up owing to the political condition of the country, but the writer of the report is of the opinion that in due course when the position becomes more settled these extensions will be carried out in their entirety. It is interesting to note that the official programme was drawn up with the intention that the materials for the work should be manufactured as much as possible in China, but it is extremely doubtful whether this intention will be realised to anything like its full extent. We are afraid that our firms, not only electrical, have been rather slow to realise the immense opportunities which will arise for construction work in China when political affairs are settled, and it is therefore gratifying that the Board of Trade should have so speedily carried out its intention of sending a special Commissioner to China to study the conditions and prospects of British trade in that important market. The Commissioner, Mr. T. M. Ainscough, is now prosecuting his enquiries in China, and we shall look with confidence for some valuable information and suggestions when he returns.

There is some uncertainty as to the immediate future of telephonic and telegraphic development in China, especially concerning telephones in and between cities, which is a matter of finance. Reporting on this subject recently the American Consul at Hong Kong points out that the country's telegraph system is owned by the Chinese Government and has been operated with considerable success for several years both in domestic and foreign services. Immediately after the revolution an expansion policy was determined upon by the Government telegraph administration comprising a supplementary telephone service to be owned and operated by the Government and telephone extensions in various Chinese cities. The telegraph administration borrowed £500,000 from the Eastern Extension and Great Northern Telegraph Co. (the cable company with which it is most intimately connected in foreign business) to extend its telegraph lines and to establish certain telephone lines. Interest and payments were to be met out of current earnings of the administration on its foreign business.

The telegraph extension was in keeping with the steady growth of the system. The first lines in China were between Shanghai and Tientsin and between Shanghai and Woosung, the latter being a private enterprise. In 1884, the Peking-Tientsin line was taken over by the Government; a line was run up the Yangtze Valley from Shanghai and through communication was established between Canton and the North. Since that time the system has been steadily extended to the Russian frontier at Hunchun, Helampo and Kiakhta; to the Japanese frontier at Wiju; to the Burma frontier at Bhamo; to the Tongking frontier at Mankai and Laokai, and as far as the Tibetan frontier at Batang. There are now 36,339 miles of land lines and 1,000 miles of submarine cable. In 1913 there were in use about 1,300 Morse instruments and something less than 50 Wheatstone instruments; there were 561 telegraph stations, an operating staff of 1,900 natives and 6 foreigners and a total of 7,522 employés.

The principal lines are: The Shanghai-Tientsin, 1,025 miles, constructed in 1882; the Shanghai-Canton line, 1,820 miles, 1882; the Hankow-Luchow line, 1,047 miles, 1886; the Sianfu-Peking line, 964 miles, 1890; the Peking-Kiakhta line, 1,061 miles, 1897; the Shanghai-Hankow line, 873 miles, 1884; the Hankow-Peking line, 974 miles, 1910; and the Kiukiang-Canton line, 988 miles, 1884. The capital expended upon these various lines is about £560,000. The charge for service is about 2d. per word for messages in a foreign language in the same Province; about 4½d. per word for messages to all other places in China, and about 1½d. for Press messages throughout China. For Chinese messages, which are usually transmitted by sending numbers corresponding to words in a sort of telegraphic dictionary or code book, the charges are two-thirds those for foreign messages, the Chinese Press rate being about ¾d. per word. These charges are for all words, including address and signature. The rates, therefore, are high.

While the construction programme provided for in the loan agreement has been interfered with considerably by disorders and disorganization attending the revolution, most of the extensions planned in the elaborate programme outlined by the Government are being made. The extensions made in the past two years include the Hunkiang and Yungchow lines in Hunan Province; the Chowchia-kou and the Hanchow lines in Honan Province; the Anhui Province lines in Anhui; and in Kwangtung, the Kaochow-Pi-ching lines. Extension of the northern and southern telegraph circuits in Shensi and Shansi Provinces has been in progress, and some extensions have been made in Kwangtung and Kwangsi Provinces and in lines between Fukien and Kiangsi Provinces. Recently the Eastern Extension Co. completed a new telegraph line from Kowloon, a part of Hong Kong, to the Chinese frontier along the Kowloon-Canton railway, and the Chinese are now completing the line to Canton. When completed, this will be the third through line between Hong Kong and Canton.

The official programme in connection with the loan agreement provides that in 1914 telegraph lines will be extended from Hsingi in Kweichow to Kwangnan in Yunnan, and from Chengtu, the capital of Szechwan Province, to points in Kansu Province. In 1915 extensions will be made to the lines between Puerh and Hsunning in Yunnan, and to the lines between Chingyuan in Kwangsi and Kueiyang in Kweichow. A survey will be made for a line between Urga and Kobdo, Mongolia, and lines in both inner and outer Tibet will be extended. In 1916 telegraph lines in inner and outer Mongolia will be extended. Plans will be made for constructing telegraph lines from Paotien-Chen in Ninghsia, from Kansa to Chinghai and inner Tibet, and from Ili to Kuche. The telegraph lines in the northern provinces will be reconstructed and general improvement of all the electric lighting plants and telephones in the Empire will be undertaken.

Just how much of this programme will actually be realised is difficult to foresee. Much of that planned for the past three years has been accomplished more on paper than otherwise and there has been complaint that much of the disorganisation and confusion attendant upon the change in Governments has been especially noticeable in the office of the Board of Communications, in which much of the administration of such extension and other work centres. Much has been done, however, and since the work being done and proposed is largely under foreign supervision and control it is likely that, in general, plans for the general improvement of the service will be successfully carried out in course of time.

A great deal of the official programme has had regard for the manufacture of telegraph and telephone, as well as electric light and power, materials in China. Representatives of the Government have been sent abroad to study foreign establishments manufacturing such materials, and in the official programme it has been planned that new depôts for the manufacture of such goods shall be established during the current year, while in 1915 the work is to be extended to include all materials used in wireless telegraphy. However, there are indications that financial considerations will interfere materially with this programme for the present.

The use of the telephone in China is much more limited than the telegraph, though the Chinese take to the telephone with extraordinary readiness. Modern inter-urban communication by telephone is almost unknown in China, the only exceptions being the line between Pekin and Tientsin and several small ones used in connection with the dispatch of

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railway trains. Local telephone exchange systems are found only in Peking, Tientsin, Shanghai and Canton. They are Government owned and are operated as a part of the telegraph system. The number of subscribers is not available, but the exchanges are small.

As a part of its policy of extension the Chinese Government is increasing the use of the telephone as an adjunct to the main telegraph system, the telephone being used to forward telegraph messages from the ends of telegraph lines to interior points not yet reached. In the past two years considerable extensions have been made to the systems in Chekiang and Kiangsu Provinces, in extending the local service from Shanghai and in Cupel, Yunnan, Shensi, Hunan and Shantung Provinces. The programme for the current year provides for extensions of the systems in Szechuan, Yunnan, Kweichow, and Kwangsi Provinces and in the next two years it is planned to extend these small telephone systems into Kweichow, Yunnan, Szechuan and Kansu Provinces and to include Tibet and the New Dominion if possible. Much of this programme, however, is at present uncertain in view of the political condition of the country and of the political considerations some of the proposed extensions will involve. Considerable actual improvement has, however, been made in many parts of the country including points near Hong Kong, and there is no doubt that the general work will be undertaken as soon as financial and other considerations make it possible.

The United States has had little or no part in the construction or equipment of either the telegraph or telephone systems of China. The telegraph systems were introduced in the first place largely through the efforts of Danish interests, and nearly all of the extension work has been done by Danes, Swedes, Russians, or other North-European people. Naturally North-European instruments and materials have been preferred. In the way of telephone equipment, American instruments and materials are generally too high in price for the service demanded. American expert service is too high-priced to be used in such work, as a usual thing, and this has operated to advance the interests of manufacturers of other nations. So far as local exchanges are concerned, the question of finance has entered in a controlling way and foreign instruments have been introduced in the new Canton exchange, for example, because the foreign concern selling them was in a position to finance the enterprise. A considerable proportion of Chinese equipment is being used, the product of Government concerns in North China.

It is uncertain exactly what course development of telephone systems in the cities of China will take—that is, whether they will come by private initiative and investment or solely through Government operation and control. At present, the Government seems disposed to control such services directly and to own and operate them so far as may be possible. While the Chinese take to the telephone readily and gladly, it is difficult to obtain enough subscribers in a Chinese city to support a system, and it is a long struggle to make a system pay financially without Government support or without connection with some other enterprise like the telegraph system. Nevertheless, the extension of the use of telephones in all parts of China will doubtless be great, and in some cases rapid, as soon as more settled conditions obtain.

The plans of the Chinese Government also include establishing a comprehensive system of wireless telegraph stations. Stations of various degrees of power have already been established at various points in the north, along the coast, and in the south, particularly at Peking, Tientsin, Hankow, Shanghai, Canton, and Hoihow. In Canton the main station has been made the centre of a series of 12 sub-stations in Kwangtung Province, and a school for the instruction of operatives has been established at Canton. In western China various stations have been established under the Board of War. Plans for much more comprehensive and powerful stations along the coast, including Peking, Hankow, Shanghai, Swatow, and Canton, have been made and a contract for their erection has been initiated, but pending the raising of the necessary funds the enterprise is temporarily held in abeyance. The proposed system, however, will have a radius of 1,500 miles and will include stations at Kalgan, near the Siberian border, and on the Pratas Island shoals, about 600 miles south of Hong Kong, where a station is urgently needed for meteorological purposes and the protection of shipping.

BRITISH-MADE CARBONS IN WAR-TIME.

The following communication has reached us too late for inclusion among our "Correspondence." The matter is one of supreme importance at the present moment. The General Electric Co., Ltd., is to be congratulated upon the fact that every need of the Government for carbons for war and other purposes can be met within these islands. We need have no fears in that direction. Our readers will remember the speeches of the late Mr. G. Byng in the early days of the Witton carbon works, in which he laid stress upon the national aspect of the company's carbon-making operations. Mr. H. Hirst likewise has shown an equally commendable foresight in regard to the same matter. Now that the catastrophe of Continental war is in progress, and we are in the main dependent upon what we can do for ourselves, the value of the General Electric Co.'s efforts, conducted at a great loss to themselves, is obvious to everybody. The demands of the Government are imperative, and of course the nation has first call upon us all. Horses, motor-cars and other necessities are commandeered, and we resign ourselves to the inconvenience consequent thereupon. The limited output of carbons will probably likewise entail upon many of us in the electrical world an inconvenience which will be very real, but we shall, so long as the war lasts, have to resign ourselves to that also. In this, as in other matters, we shall find it necessary to accommodate ourselves to the situation. In some directions it may be compulsory to use other means for effecting our electrical illumination. Having watched the position for some years, more or less closely, we would urge upon the trade the wisdom of meeting the difficulty with those infinite resources of which it is possessed. After the Government requirements have been met, the available balance of British-made carbons will be dealt with as fairly and equitably as possible, and though, as we say, there may be inconvenience and hardship, the difficulties will, we are sure, be fully appreciated and understood.

Arc Lamp Carbons.

As it is impossible for us to explain the position in the arc lamp carbon industry individually to all inquirers and users, we should be glad of the hospitality of your columns for this purpose.

Our carbon works is the only factory in Great Britain, and the enormous preponderance, approximately nine-tenths, of the carbons used in this country have been imported from abroad from factories in Germany, Austria and France, which for some time to come cannot send supplies. A very small percentage of the carbons imported came from small Swiss and Spanish works, who can do little if anything to relieve the situation. A factory exists in the United States, but will be called upon to make up for the large American demand hitherto supplied by Germany. In addition, it must be remembered that the British Dominions have been large buyers of German-made carbons.

Under the now prevailing circumstances we have not been surprised during the past three weeks to receive enormous demands for carbons for both immediate and forward delivery. In less than a week we could have sold our output a year ahead. A few of these inquiries came from our old customers. The majority from the large users, such as railway companies and municipalities, who have consistently refused us their support in the past, on account of the cheaper prices of German and Austrian carbons.

Our endeavours to educate users to the necessity of supporting the only English works with only a small portion of their requirements have been constant for 12 years, but without practical results.

When our works were started 12 years ago the prices ruling for carbons were about double those recently prevalent in this country. The starting of our works was met by a persistent policy of price-cutting on the part of our competitors, which at once made the factory unremunerative. In spite of this we have kept our works running, because we recognised the possible disaster if this country had not at least one source of home supply. This policy has involved our company in a loss amounting to over £70,000, which has naturally not encouraged us to increase the factory to a size capable of supplying a reasonable share of the English demand.

We are, therefore, now faced with a demand some 10 times as great as we can satisfy. After serious consideration, we have decided to act upon the following principles:—

1. In the first place, we shall, of course, supply all naval and military demands.

2. We have raised prices, not merely to a remunerative level, but sufficiently to prevent buying by those who are not in absolute need. In this connection we realise that it is possible for many of the largest users to replace temporarily their arc lamps by other forms of lighting such as metal-filament lamps, and those who are in this position should be encouraged to do so.

3. We shall dispose of our present stock of carbons of all kinds according to the above principles, but as far as manufacture is concerned, we shall adhere to the programme described below.

4. We propose to limit our manufacture to as few types and sizes as possible in order to obtain the maximum output from our existing works.

We would point out in this connection that by reducing the number of sizes we make, our output can be very materially increased, as the machinery can be utilised to the best advantage.

In deciding what sizes we shall make we have been principally guided by the consideration of what types of arc lamps can best be replaced by other forms of illuminants, and, so far as possible, we are therefore confining our manufacture principally to those types of arc lamps, which, in our opinion, cannot easily be replaced.

We propose, therefore, in the first place to make carbons for Magazine flame lamps, as there are many thousands of such lamps

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in use of two or three well-known makes using the same sizes of carbons. Subject, of course, to possible Government requirements, our output of these Magazine carbons should be sufficient to meet all demands. These carbons are 9 mm., 8 mm. and 7 mm. in diameter in 15-in. and 12-in. lengths. Similar carbons with the addition of 10 mm. diameter—if provided with metal cores—can be used in these lengths in practically all converging carbon flame lamps.

Secondly, we shall manufacture a certain quantitly of 11 mm. and 13 mm. enclosed lamp carbons in 12-in. and 10-in. lengths, as enclosed lamps are used for certain purposes for which other sources of lighting are not suitable.

Thirdly, we propose to make a certain quantity of carbons for projection work for cinematograph and similar purposes, where the quantities are comparatively small, and where also any other source of light is inadmissible. The stoppage of these supplies would paralyse the whole trade, and cause very great distress.

As we realise that the amount of open-type carbons, which we could by any means produce, would be a mere drop in the ocean, we shall discontinue for the time being the manufacture of these entirely.

We are confident that in taking this course we are acting in the best interest of carbon users and the public generally, and hope our policy will meet with general support. Individuals will realise that where it is absolutely impossible to satisfy all, we are taking a course which enables us to satisfy the greatest number in our power.—Yours faithfully,

THE GENERAL ELECTRIC CO., LTD.
K. ALWOOD, *Secretary*.

London, E.C., *August 26th*, 1914.

BUSINESS NOTES.

Book Notices.—"British Standard Method of Specifying Resistance of Steel Conductor Rails." London: Crosby Lockwood & Son. Price 10s. 6d. net.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIII, No. 8. August. New York: The Institute. Price $1.

"Calendar of the Royal Technical College, Glasgow, 1914-1915." Glasgow: The College.

Annual Outing.—The first annual outing of the ALPHA MANUFACTURING CO., of Balham, was held on Saturday, 22nd inst., when the men, numbering 28, went to Brighton for the day. Dinner was served at The Pavilion Creameries, Mr. G. F. Beare presiding. Mr. Fletcher, secretary for the outing, on behalf of the men, thanked the firm for keeping the whole of the staff on during the present crisis.

Bankruptcy Proceedings.—GRANVILLE BURGESS, electrical engineer, 27, Museum Chambers, Bury Street, W.C.—A sitting of the London Bankruptcy Court was held on Tuesday before Mr. Registrar Hope, for the public examination of this debtor, who failed in July, with liabilities £463 and assets valued at £88. Replying to Mr. E. Leadham Hough, Senior Official Receiver, the debtor stated that, having previously been employed in the trade, he, in February, 1913, commenced business as above, and carried on the same until the receiving order was made against him on July 7th at the instance of creditors. Witness attributed his insolvency to loss in carrying on business owing mainly to the recent long-continued building strike. This was his first failure. The examination was concluded.

F. T. JOHNSON (F. JOHNSON), electrical engineer, Cambridge. Trustee (Mr. H. N. Cox, 5, Petty Cury, Cambridge) released June 19th.

Catalogues and Lists.—EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD, Ponder's End.—Two wall showcards, one denoting that Ediswan drawn-wire lamps "stand alone," and the other emphasising that Ediswan fans are "All-British." The company announce that owing to the large increase in trade in radiator lamps last season they anticipate an even larger increase during the coming months, and have decreased their prices accordingly. All voltages will drop in price to one standard.

MR. C. H. BLUME, White Building, Sheffield.—Price leaflet relating to "Megomac" and "Insulac" insulating varnishes. These varnishes are manufactured at Mitcham, Surrey, where large stocks are held.

MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—Illustrated leaflet giving brief particulars and prices of watertight switches with turn movement, a new pattern of which, in brass, has been introduced for marine installations, &c.; brass and lead bushes required by engineers who object to tube-end bushes made of wood or moulded insulation material; and chain-pull switch boxes for use in conjunction with Simplex watertight fittings.

MESSRS. BELLING & CO., Edmonton, London, N.E.—Illustrated list giving reduced prices, which came into force last Monday, of Belling's electric boiling rings, grillers, combined griller-ovens and electric fires, all of which, of course, are British made.

MESSRS. CUTTING BROS., LTD., Park Works, Stamford.—Card giving tabulated prices and specification of enclosed ventilated electric motors, ranging from ½ to 80 H.P.

Trade Announcements.—The Dey Time Registers, Ltd., of Queen Victoria Street, E.C., have amalgamated with the International Time Recording Co., Ltd., of City Road, E.C., and both firms will give up their present premises. The combined businesses will be known as the INTERNATIONAL TIME RECORDING CO., LTD., and will occupy the entire five-storey building, 30/32, Farringdon Road, E.C. Their range of all kinds of time recorders for time-keeping and job-costing is very complete.

MR. J. MARTIN BLAIR, 53, New Broad Street, E.C., has been appointed the London representative of an English firm of ebonite and vulcanite manufacturers, and invites inquiries for rod, sheet and tube, also battery boxes, telephone fittings and turned and moulded goods. Mr. Blair also represents the Record Engineering Co., Ltd., Manchester, for petrol, paraffin and gas engines, and Messrs. Broom & Wade, Ltd., High Wycombe, for air compressors and hoists.

Liquidation.—THE EUREKA CLOCK CO., LTD.—This company is winding up voluntarily, with Mr. A. E. Tilley, of 8, Staple Inn, London, W.C., as liquidator.

LIGHTING and POWER NOTES.

Aberdovey.—PROPOSED E.L.—The U.D.C. has been recommended to invite competitive schemes for the best means of lighting the town by electricity, generated by water or other power.

Atherton.—L.G.B. INQUIRY.—An inquiry was held here last Friday into an application by the D.C. for permission to borrow £2,100 for the purposes of the electricity undertaking.

Australia.—The Newcastle (N.S.W.) Council during 1913 decided to largely extend its undertaking, but apparently some delay is taking place. A new station site was under discussion, providing for a first unit of 2,000 KW.; the Council has, however, decided to hold this in abeyance, but intends providing a 500-KW. set to meet the winter demand of 1915, and tenders are now about to be called for this plant complete with surface condenser, boilers and other essentials to render it a complete unit. The question of a general extension into the district is, for the time being, also held in abeyance. The principal difficulty, according to Press reports, appears to be that the Council's borrowing capacity is not in proportion to the development of the city, and the Government is to be approached upon the general question of increased powers. The business of electricity supply is steadily developing, and many people appear to be changing over from gas to electric light, while modern buildings are all being equipped for electric lighting, heating and power. The power load in this district should, in the future, be very great, as the new steel works will be in operation early in 1915, and this, it is expected, will encourage the manufacture by the smaller men of many special lines.

Bacup.—STREET LIGHTING.—The T.C. has approached Rawtenstall with a proposal to light Newchurch Road and Market Street by electricity in a similar manner to the Rawtenstall streets.

Bolton.—PROPOSED LOAN.—The Finance Committee has decided to make application to the L.G.B. for sanction to borrow £17,000 for electric cables.

Canada.—A Consular report, quoted by the American *Electrical Engineering*, refers to the Ontario Hydro-electric Power Commission. In addition to the expenditure already made of $5,915,725, the Commission is authorized, says the report, to spend $5,000,000 during the current year in extending the supply of electricity at cost to municipalities for power and lighting. In addition to the 45 municipalities served last year, more than 100 others have asked for estimates for installing plants for the distribution of electric power which will be obtained from the Niagara Falls and other places. By the end of last year 45 municipalities had installed distributing plants at a total cost of $8,469,197 (of which Toronto expended $3,919,810); the total revenue derived therefrom was $2,605,006, and the net surplus $390,012. The municipalities retain part of the revenue as working capital. A compilation of the private electrical corporations in Ontario has been made by the Canadian Electrical Association, which is a branch of the National Electrical Association of the United States. It has been found that the number of plants is 157, and the total capitalisation approximately $108,500,000, which includes the hydro-electric power plants at Niagara Falls. Estimates of cost were made for only a few plants having a capitalisation of something more than $1,000,000. Besides the works of the 157 companies, there are some hydro-electric and other electric power and lighting plants owned by municipalities.

Chile.—Plans and specifications submitted by Don Francisco Soto for the erection of an electric generating station to supply the town of Cartagena with electric light have been approved.—*Board of Trade Journal.*

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Chobham.—Proposed E.L.—The P.C. has informed the Chertsey R.D.C. that a supply of electricity for the parish is desirable if obtainable at a reasonable price, and failing the Ascot Gas and Electricity Co. giving a supply at an early date, permission be given for the Woking Electric Supply Co. to extend its mains to Chobham. At a meeting of the R.D.C. on August 18th it was stated that the Ascot Co. had intimated that it intended exercising its powers, and that it would not permit the Woking Co. to give the supply. It was decided to forward the views of the P.C. to the Ascot Co.

Continental Notes.—Norway.—The owners of the electrical power plant at the Solberg Waterfalls to the north of Kristiania, have recently placed an order with the A.E.G. for six 6,250-kw. transformers, oil insulated and cooled by means of compressed air. They will be employed in connection with the transmission of 20,000 kw. to a sub-station at Kristiania; the primary voltage will be about 60,000.

The Skienfjord Municipal Power Co. is obtaining similar transformers, with a total capacity of 42,000 kw., and the Norwegian Hydro Co., transformers with a capacity of 10,000 kw., to be installed at Rjukan II.

Russia.—The Commission appointed in 1909 to inquire into the water-power resources of Russia has occupied itself with the classification of the watercourses available for railway working. Up to the present only rivers have engaged attention, the Dniester being calculated to yield 15,000 kw.; the Niemen, 30,000 kw.; and the big waterfalls on the Szuna 120,000 kw. at most, and 12,000 kw. at least, flow. The cost of construction of the Birschtany power station on the Niemen, of a capacity of 15,000 kw., is estimated at 4,000,000 roubles. The cost of the three power stations at falls on the Szuna, of 20,000 kw. capacity each, is put at 3,000,000 roubles. The output may, however, be raised by the building of a storage dam.

Austria.—Among municipal undertakings in Austria, those for the generation of electricity are most numerous and consequently most important. According to statistics gathered by the Elektro-Technische Verein, of Vienna, there were in January, 1913, throughout Austria 886 electrical concerns working or under construction. Of these, 345, or 39 per cent., were owned by municipal or communal authorities. Similar statistics compiled for Switzerland, give a proportion of 296, or 38·5 per cent., of municipal undertakings in an aggregate of concerns supplying current to third parties of 766. These figures relate to the year 1911.

Donoghadee.—Prov. Order Extended.—The B. of T. has deferred the revocation of the U.D.C.'s E.L. order of 1911 for a further period.

Dublin.—Street Lighting and the War.—The Electricity Supply Committee has decided to curtail the lighting hours. From Monday last, and until further notice, each alternate arc lamp in the streets will be extinguished at 11.30 p.m. This measure, it is stated, is rendered necessary as the result of the limited stock of carbons.

Heeleyfield.—Public Lighting.—The ratepayers have adopted a scheme of public lighting by electricity for the district, including the village of Castleside.

Helsby.—Loan Sanction.—The L.G.B. has sanctioned a loan of £405 for the installation of electric power at the waterworks.

Greenock.—Year's Working.—There was a surplus of £3,463 on the past year's working of the Corporation electricity department, against an estimated surplus of £1,273.

India.—From our contemporary, *Indian Industries and Power*, we gather that preparations for demonstrating the rival advantages of high-pressure gas and electric lighting in the Bombay streets have reached an advanced stage; both illuminants have their partisans in the city. The Simplex Mill, containing 30,000 spindles and 800 looms, which has been converted to electric driving in connection with the Tata hydro-electric supply, was started with a temporary supply from the Electric Supply and Tramway Co.

According to the *Englishman*, nearly the whole of the machinery on the Kolar Goldfields is now worked by steam, owing to the shortage of electric power from the Cauvery power plant.

Irlam.—Proposed E.L.—The U.D.C. has decided to engage an expert to report upon the suitability of the district for electric supply, and to advise the Council as to the promotion of a prov. order for E.L. The Lancashire E.P. Co. has already intimated its intention to apply for an order.

Kingston-on-Thames.—L.G.B. Inquiry.—An inquiry was held on August 20th into the application of the T.C. for a loan of £8,500 for two extra-high-pressure cables, and the erection of a transformer sub-station. There was no opposition.

Liverpool.—Proposed Loan for Mains.—The E.L. Sub-Committee has recommended the T.C. to apply to the L.G.B. for sanction to a loan of £40,000 for new mains.

Mexico.—The *Electrical World* states that owing to the more settled conditions at the mines, the Mexican Northern Power Co.'s 50,000-H.P. hydro-electric plant at Santa Rosalia will now be pushed to completion. Work on the plant was suspended last October, when the hydro-electric plant had been installed and the transmissions nearly completed; in the interval the floods have filled the reservoir, forming a lake 30 miles long and several miles broad.

Middleton.—L.G.B. Inquiry.—Mr. H. R. Hooper has held a L.G.B. inquiry into the application of the T.C. for sanction to borrow £7,610 for extensions at the electricity works.

Rawtenstall.—Plant Extensions. — The electrical engineer (Mr. Stewart) having submitted details of the cost (about £9,000) of the proposed extension of the boiler house at the electricity works and of the new plant required, the Finance Committee has arranged for the provision of £3,500, and that the remainder be taken out of the renewals and reserve fund.

South Shields.—Annual Report.—Mr. Harry Ellis, the borough electrical engineer, records a surplus of £3,522, compared with £3,163 in the previous year, and this amount has been transferred to the reserve fund. In making comparison with the previous year, it should be remembered that £1,081 has been spent out of revenue on connecting new consumers' meters, showroom equipment, &c. The revenue amounted to £33,775, as against £30,341, an increase of £3,433, equivalent to 11·3 per cent. The total costs amounted to £16,821, against £14,895, an increase of £1,926 as compared with the preceding year. The principal item in the expenditure account was for fuel, which cost £996 more, due to increased output and price of coal. The best indication of the business done is the fact that domestic heating and power units increased from 40,584 to 68,443, or 68 per cent., and private lighting increased from 974,285 to 1,063,591, or 9 per cent. The total power connections increased from 4,030 H.P. to 4,461 H.P., an increase of 10 per cent. The supply for traction also showed an increase from £5,924 to £6,952. The gross profit was equivalent to 9·7 per cent. The total number of units sold was 4,569,798. The engineer states that the high C.P. half-watt lamp had enabled them to obtain many consumers for outside shop lighting who were previously apparently satisfied to be without that class of lighting altogether. Although he welcomed the high C.P. half-watt lamp, he should not welcome to the same extent a similar low C.P. lamp, as such a lamp was not needed to enable them to compete for inside lighting, and it would have a serious effect on their revenue. It was more than probable that such a lamp would come, and it was partly on that account that he advised them to do all they could in the way of increasing their business in the direction of power supply and the supply for heating, cooking, and other domestic purposes. To do this they should have powers to hire and sell electrical apparatus, and to carry out wiring work. He recommended them to develop the commercial side of the undertaking as far as lay in their power.

United States.—A permit has been issued for the erection of a power house for the Philadelphia Electrical Co., at Philadelphia, to cost $1,000,000. The building will be equipped with two turbo-generators, one of 30,000 kw. and the other of 35,000 kw. The plant, when completed, will furnish electricity to operate the Pennsylvania Railroad lines from Broad Street Station to Paoli.

Uruguay.—The directors of the Government electricity works have issued their report for the years 1911-12 and 1912-13. The report only deals with the works at Monte Video. For the year ended June 30th, 1912, there was a gross profit of $725,451 gold, and after providing for service on bonds and payment of the amount due to the municipality, there was a net balance of $545,499. For the year ended June 30th, 1913, the gross profit amounted to $934,794; service on bonds to $83,339; the municipality received $250,000, and $35,145 was placed to reserve, leaving a net profit of $516,309. At the end of June, 1913, the total number of lamps in service was:—Incandescent, 331,342; arc, 2,273; various, 3,955; and there were 2,758 motors, with a total of 12,508 H.P. The total revenue was $1,409,423, and the total output was 23,200,228 kw.-hours, as compared with 16,281,410 in 1911-12. The gross revenue for 1911-12 was $1,101,367, and for 1912-13 $1,409,423. Two new Babcock & Wilcox boilers, equal to the eight already existing, have been installed. They are of the marine type, with 400 sq. m. heating surface and a normal production of 900 kg. of steam per hour. The economisers were supplied by Messrs. E. Green & Sons. The boiler house is now able to supply steam for a total load of 9,000 to 10,000 kw., but as the load will soon pass this amount the boiler house is being enlarged. During the year two turbo-generators of 4,000 kw. have been acquired from the A.E.G. These new machines increase the capacity of the station from 6,800 to 16,800 kw., which will be sufficient to meet all demands up to the winter of 1915, when a new group of 8,000 to 10,000 kw. will be installed. The total length of underground mains in June, 1913, was 464,105 metres. Overhead feeders had a length of 84,294 metres and overhead distribution lines amounted to 600,200 metres. During the year ended June, 1912, the consumption of coal per kw.-hour produced was 1·1637 kg., and for the month of June, 1913, 0·97 kg.—*Review of the River Plate.*

TRAMWAY and RAILWAY NOTES.

Aberdeen.—P.A.Y.E. Cars.—At a meeting of the Corporation the Tramways Committee's recommendation to purchase six new P.A.Y.E. cars, at a cost of £4,284, was sent back for further consideration. Bailie Fiddes said that, as far as convenience was concerned, he was convinced that the P.A.Y.E. system was an absolute failure. Another member said he could not see

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why anybody paid more than ½d. in the P.A.Y.E. cars, and that it must only be an excess of conscientiousness, because nobody was obliged to do it.

Australia.—According to the Australian papers, the electrification of the first Melbourne suburban railway line, from Broad Meadows to Sandringham, will not be completed until about November, 1915, which is about six months later than was anticipated. This delay is chiefly attributed to the fact that the tenders for the switchgear, which is of a very complicated design, were not satisfactory, and fresh tenders were invited. The department has been proceeding with the track circuiting of the line on the direct-current system, and it is essential that alternating-current track circuiting be substituted before any stock is used. The site of the power station has also had to be altered.

Blackpool.—War Effects.—The monthly report of the manager (Mr. C. Furness) just issued shows that the tramway receipts were £14,247, against £16,983 in the corresponding period last year—a decrease of £2,736. The passengers carried were 2,000,611, against 2,269,394, and the takings per car-mile decreased from 2s. 6¾d. to 2s. 3¾d. The returns for the year are, however, still ahead of last year to the extent of £1,256. In the electricity department the returns were very satisfactory, the output being very much in advance of last year, while there were 170 new consumers, compared with 126 up to the corresponding date last year.

Continental Notes.—Belgium.—According to the daily papers, the Germans in occupation of Brussels each night seized the takings of the tramways undertaking, and the company retaliated by carrying passengers free of charge.

Germany.—The Saxon State Railways have made some successful experiments with a new system of electric traction, suitable for lines with small and infrequent traffic, where a steam locomotive is too costly and an accumulator battery motor is not applicable. The system consists of a combination of a Diesel engine with a dynamo. A six-cylinder Diesel motor was used, working with the cheapest oil, coupled to the dynamo, as a direct drive by the Diesel motor was not found feasible, owing to the high speed of the motor. The dynamo allows a speed of 70 km. per hour with a trailer attached and a passenger load of 80, besides supplying the electric lighting and working the vacuum brakes. A driver and two conductors is all the staff found requisite.

Rawmarsh.—Proposed New Tramways.—The U.D.C. has appointed a deputation to meet the Mexborough and Swinton Tramways Co. with a view to ascertaining whether the company would be willing to provide a double tramway track in High Street, while the proposed improvement was being carried out.

Rochdale.—Loan Sanction.—The Town Clerk has received a notification from the B. of T. that an application for a loan of £17,000 for the erection of a new tramcar shed and workshop at Mellor Street has been sanctioned.

Stirling.—Proposed Tramway Purchase.—The secretary of the Tramways Co. has informed the Town Council that the company is prepared to dispose of its undertaking for £15,000. The T.C. proposes to take over the tramways and electrify them.

United States.—Owing to labour troubles, the electrification of the Chicago, Milwaukee and St. Paul Railway has been indefinitely postponed.

TELEGRAPH and TELEPHONE NOTES.

Canada.—The Government telephone and telegraph system in and around Kamloops (B.C.) is, it is understood, to be reconstructed and extended, at an estimated cost of about $110,000.

Canadian Marconi Stations.—The Government is erecting a new wireless station at Cape Race which will practically double the present radius of that station and render Cape Race the first point of land communication for all vessels sailing from or to North Atlantic ports. The new equipment will have a radius of at least 500 miles, instead of the present normal one of about 250. Even with the comparatively limited radius of the present station, news of the majority of the Atlantic mishaps is now picked up by the Government operators at Cape Race. The new towers will be ready for operation during the present month.—*Financier.*

Chinese Telephones.—The use of the telephone has not developed to any extent in China; long-distance lines, apart from the Pekin-Tientsin line and some railway lines, are non-existent. Local networks exist in Pekin, Tientsin, Shanghai and Canton, which are controlled by the State and associated with the telegraphs. The Chinese Government is understood to favour a great extension of telephone facilities, especially where there is no telegraph, and a number of installations are to be carried out during the next two years.—*Deutsche Verkehr Zeitung.*

Japan.—A wireless telephonic transmission and receiving station is to be established by the Japanese Government at the entrance to Ise Bay, Shiba Province.

New York-Panama Cable.—To provide for the large increase in business which it is expected will follow the opening of the Panama Canal, a $1,500,000 cable is to be laid from New York to Colon, by way of Guantanamo, before the end of the year. Later it may be extended to Brazil. The cable, which is being constructed in England for the Central and South American Telegraph Co., will be much larger than the present cable. The c.s. *Colonia* will leave England in November with the cable, for New York.—*Am. Electrical Review.*

Spain.—The Civil Governor of Barcelona announces that several wireless installations have been dismantled, and only a few of the ships in the port are able to receive messages by radio-telegraphy.—*Standard.*

Sweden.—The B. of T. announces that an order has been issued by the Government of Sweden prohibiting the use of wireless telegraphy on the vessels of belligerent Powers within the radius of Swedish harbour areas.

United States.—The Ohio Public Utilities Commission has approved of the consolidation of 15 of the leading telephone companies in Ohio, and the Ohio State Telephone Co. has been incorporated in accordance therewith. The capital liabilities of the 15 companies are $35,568,000, which will be reduced by $5,396,600 by the consolidation, and $2,850,000 is to be spent on improvements. The new company will control over 250,000 miles of line and 64 exchanges.—*Electrical World.*

It is reported that the U.S. Government has notified the German owner of the Tuckerton wireless station that the licence granted for three weeks' experimental work has expired and that operation must cease. The Tuckerton station has a tower 820 ft. high, and could communicate direct with Berlin.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—September 9th. Electrical goods, for the Powell Duffryn Steam Coal Co., Ltd. Stores Manager.

Australia.—Sydney.—September 14th. Municipal Council. 22,500 yards of 33,000-volt, three-core, paper-insulated, lead-covered cable. Deposit £200. Specification, 10s. 6d., from the City Electrical Engineer; a copy may be seen at the B. of T. Commercial Intelligence Dept., London.

September 30th. Telephone instruments and parts for Postmaster-General. See "Official Notices" August 21st.

October 7th. Telegraph instruments, measuring instruments, incandescent electric lamps, switchboard parts, for the Postmaster-General. See "Official Notices" to-day.

Adelaide.—Sept. 9th and 23rd. Telephone material, microphones, protectors, &c., switchboards, bells and cells, for the Postmaster-General. See "Official Notices" July 31st and August 7th.

September 2nd. 6½ tons bare hard-drawn copper cable, for the City Council. See "Official Notices" August 21st.

September 23rd. 102 electric motors, starters, switchboards and wiring for installing electrical drive at Messrs. Sands & McDougall, printers. Mr. M. C. Coates, consulting engineer.—*Tenders.*

Melbourne.—Victorian Railways Department. October 7th. Motors and switchgear, and motor-driven air compressors for the Ballarat and Bendigo workshops.

October 14th. Victorian Railways Commissioners. (1) Low-tension switchgear and instruments, (2) 12,540 yards of low-tension cable, (3) fuse distribution boxes and fuses, and (4) best quality Yorkshire iron forged billets. Specifications, &c., may be seen by United Kingdom manufacturers at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*B. of T. Journal.*

Perth.—September 9th. Coin attachments, for Postmaster-General. See "Official Notices" August 14th

Batley.—Electricity Committee. 500 tons of pea nuts or beans and 1,500 tons of best slack coal, for the electricity works. Mr. J. H. Craik, Town Clerk, Town Hall, Batley.

Birmingham.—September 7th. Coal (173,000 tons) for the Corporation Electric Supply Dept. Mr. R. A. Chattock, City Electrical Engineer and Manager, 14, Dale End.

Clayton (Bradford).—September 7th. Electric lighting installation, for the Guardians of North Bierley Union. Specifications from Messrs. J. Harper Bakes & Sons, Calverley Chambers, Leeds.

Dundee.—August 31st. Corporation. Rotary converters, switchgear. See "Official Notices" August 21st.

Huddersfield.—September 9th. West Riding Asylums Board. Electric lighting, telephones, bells, &c., at the new chronic blocks, Storthes Hall Asylum, Kirkburton, near Huddersfield. Particulars from Mr. W. E. H. Burton, Engineer to the Board, West Riding Asylum, Wakefield.

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London. — L.C.C. — September 8th. Cables, H.T. and L.T., and laying stoneware ducts (tramways). See "Official Notices" August 7th.

September 8th. Reconstruction of motor-generators in the tramway southern sub-stations. See "Official Notices" Aug. 14th

September 22nd. Induced-draught fans, motors, spare parts and dampers, also alteration of flues and moving of dampers at the generating station, Greenwich. See "Official Notices" to-day.

ST. PANCRAS.—September 21st. Electric lift for heavy vehicles, for the B.C. See "Official Notices" to-day.

Manchester.—September 15th. Supply and erection of steel storage shelving in the Stores Dept., Hyde Road car depôt, Manchester. Mr. J. M. McElroy, General Manager, Corporation Tramways, 55, Piccadilly, Manchester.

Middlesbrough.—September 12th. Corporation. Three electric motor-driven sewage pumps, priming pumps, metering arrangement, pipework, overhead travelling crane. See "Official Notices" August 14th.

New Zealand.—September 30th. Traction battery for the Dunedin City Council. Specifications from the Borough Electrical Engineer.—*N.Z. Shipping and Commerce.*

Spain.—October 19th. Concession for the construction and working of an electric tramway in the town of San Sebastian. An option on this concession is held by the "Compania del Tranvia de San Sebastian." Tenders to the "Direccion General de Obras Publicas, Ministerio de Fomento," Madrid, accompanied by a deposit of 4,006 pesetas (about £148), which is to be paid into the "Caja General de Depositos."—*B. of T. Journal.*

Torpoint.—September 3rd. Electric light brackets and fittings for public lighting, for the U.D.C. Messrs. Rolands and Beaumont, engineers, Torpoint.

Warrington.—September 11th. Education Committee. Wiring, &c., at the Evelyn Street Council School. Mr. J. Moore Murray, Secretary and Director, Education Office, Sankey Street, Warrington.

September 15th. 12 months' supply of earthenware conduits, for Tramways Committee. See "Official Notices" to-day.

Whitby.—September 30th. U.D.C. Construction of cliff tramway or lift. Particulars from the Clerk to the Council.

Wolverhampton.—September 8th. Construction of tramway permanent-way, Bilston Road, for the T.C. Mr. George Green, Borough Engineer (returnable deposit of £1 1s.).

CLOSED.

Australia.—The N.S.W. Public Works Department has accepted the tender of Messrs. Noyes Bros. (Sydney), Ltd., at £1,290 10s., for lead-covered cables and accessories at the new abbatoirs.—*Aus. Mining Standard.*

London.—L.C.C.—The Council has again placed with Messrs. Siemens Bros. Dynamo Works, Ltd., its contract for the supply of 125,000 tantalum traction lamps. Tantalum lamps have been used for the past two years on practically the whole of the L.C.C. tramcars.

OFFICE OF WORKS.—Messrs. Siemens Bros. Dynamo Works, Ltd., have received a contract for a 12 months' supply of Wotan drawn-wire tungsten lamps for H.M. Office of Works.

Morecambe.—The E.L. Committee has accepted the tender of Messrs. Terry, Greaves & Co. for the supply of coal to the electricity works.

Scarborough.—The Board of Guardians has accepted the tender of the Brightside Engineering Co., at £4,841, and that of Messrs. Jaram, amounting to £1,123, for the heating and lighting alterations to be carried out at the workhouse.

Southend-on-Sea.—The T.C. has accepted the tender of the Oliver Arc Lamp, Ltd., for ten 10-amp. 400-C.P. arc lamps to replace those on the Leas.

FORTHCOMING EVENTS.

Association of Mining Electrical Engineers (North of England Branch).—Saturday, September 5th. Visit to Felling Colliery and Garden Party at Wardley Hall.

Salford Technical and Engineering Association.—Saturday, September 5th. At 7 p.m. At Royal Technical Institute, Peel Park. Paper on "Centrifugal Pumps for Salvage, Sewage and Gravel," by A. W. Taylor.

NOTES.

Miners' Demand for Electric Lamps.—The miners employed at the Glapwell Pit belonging to the Sheepbridge Coal and Iron Co., Ltd., are demanding that electric safety lamps shall be introduced. At the meeting of the Council of the Derbyshire Miners' Association, at Chesterfield, on Saturday, it was stated that another type of lamp had been tried, but it was not satisfactory. The Council gave the men permission to ballot on the question of handing in their notices unless the matter is satisfactorily settled.

Appointments Vacant.—Electrical engineer, age 25-30 (Rs. 500 per mensem), for South Indian Railway; switchboard attendant (30s.) for Portsmouth Corporation; commercial assistant for Bermondsey electricity department (£140 + commission); electrical engineer, under 45 (£500) for Swansea Corporation. Particulars are given in our advertisement pages.

Educational Notes.—GOLDSMITH'S COLLEGE, UNIVERSITY OF LONDON.—The new session of the engineering department commences September 21st. Particulars are given in our advertisement pages to-day.

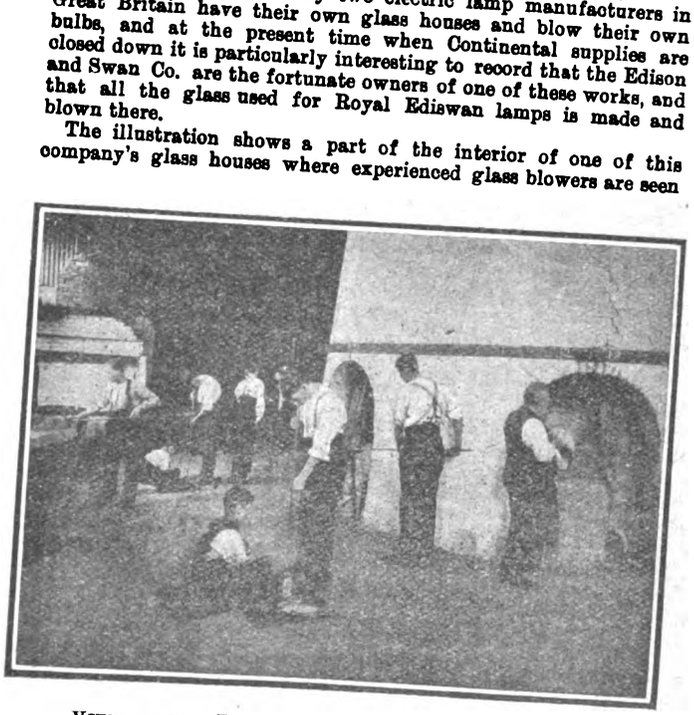
SOUTH-WESTERN POLYTECHNIC INSTITUTE, CHELSEA.—Electrical engineering courses commence September 28th. Particulars are given in our advertisement pages to-day.

Cables in War Time.—As the result of inquiries made on Wednesday as to what submarine telegraph cables were interrupted on that day, we received the following reports:—

Commercial Cable Co.	All intact.
Cuba Submarine Tele. Co. ...	"
Direct Spanish Tele. Co. ...	"
Direct U.S. Cable Co.	"
Direct W. India Cable Co. ...	"
Eastern Extension, Aust. and China Tele. Co.	No information.
Eastern Tele. Co.	" "
G.N. Tele. Co.	No information given.
Indo-European Tele. Co. ...	Interrupted July 31st; this was notified in the papers; interrupted at present.
P.Q.	All working except the Bundaberg (Aus.) cable, but this is probably only a temporary interruption.
S. American Cable Co.	All intact.
Western Union	" "

Ediswan Glass Works.—It has recently been pointed out in the Press that only two electric lamp manufacturers in Great Britain have their own glass houses and blow their own bulbs, and at the present time when Continental supplies are closed down it is particularly interesting to record that the Edison and Swan Co. are the fortunate owners of one of these works, and that all the glass used for Royal Ediswan lamps is made and blown there.

The illustration shows a part of the interior of one of this company's glass houses where experienced glass blowers are seen at work. One of the operatives can be seen at the furnace gathering "metal," and two other operatives are seen blowing and finishing the bulbs off in the mould. This class of work is skilled and requires a great deal of experience and careful handling.



VIEW IN THE EDISON & SWAN CO.'S GLASS WORKS.

The glass houses are kept continuously running; the operatives work in three eight-hour shifts, thus making up night and day.

Considerable extensions to the existing Ediswan glass houses are being made to meet the anticipated increased business which is even now being negotiated on every hand for all-British lamps.

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Institution and Lecture Notes.—At the Congress of the South African Association for the Advancement of Science, held at Kimberley, Mr. W. Elsdon-Dew gave a series of statistics relating to the use of electricity on the Witwatersrand. In introducing the subject, Mr. Elsdon-Dew predicted that with the electrification of the railways there would follow the supply of cheap power for the use of the farmer, for ploughing, irrigation, &c. He also mentioned that the load factor on the Witwatersrand mines was generally between 70 and 80 per cent., and that about 2½ million tons of compressed air was supplied to them.

Inquiries.—A correspondent asks :—"Can you advise us where we can obtain permanent magnets in quantities from a neutral and friendly country?"

Another correspondent writes :—"Would you kindly let us know where we could best get made an electrolyte apparatus for experiments in bleaching with H_2O_2, Fischers' German patent, 8582/13? We are patriotic, and wish to try this. German makers are now out of it."

A correspondent asks for the names of makers of enamelled wire.

Another writer wants the name of some British firms that manufacture jointed or hinged brass lubricating rings. He says that he is looking out for actual British manufacturers and not factors, who generally represent Continental firms.

What Constitutes a British Firm?—The following letter from a member of a well-known firm of consulting engineers reaches us just as we are going to press :—"A good many people have been talking, and I have personally been approached by representatives of firms asking us to stop giving orders to Siemens—because apparently the share register shows that some 90 per cent. of the capital is held in Germany! I may be unjust, but it seems to me to be a mean and dirty suggestion. No firm has done so much during the past 50 years for electrical trade in England and her Colonies as the Siemens have.

"Sir William Siemens was a pioneer in this country; he was everywhere highly honoured, and his support of technical education was considerable. Think of the Siemens Laboratory at King's College also. Alexander Siemens is a universal favourite, and he has been a trusted member of the Institution for many years. Few could have done more than he has for us all, and especially for the engineering trades.

"If Siemens were barred, some thousands of workmen and their families, and many good engineers, would be thrown out of work. All because a few busybodies are afraid that the capital of Wilhelm and Carl von Siemens, and others of the family, might earn a dividend this year!

"If you like you can publish this verbatim, but in any case I wish you could see your way to curb the malicious tongues."

Bradford Electrical Exhibition.—Owing to the war this Exhibition, which was to have been opened on October 6th, has been postponed. A new date will be announced shortly.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Todmorden Council has unanimously agreed to increase, by £25 per annum, the salary of the borough electrical engineer, MR. JOSEPH BOYCE.

MR. A. H. BLAGDEN was to leave England on Saturday last for the Shanghai municipal electricity department.

General.—MR. R. H. SPERLING, on the occasion of his retiring from the post of general manager of the British Columbia Electric Railway Co., Ltd., was presented by the office staff and employés with a solid gold cigar box and a large framed group containing individual photographs of nearly every employé on the North Shore. Mrs. Sperling was the recipient of a five-stone diamond ring enclosed in a gold casket. The presentations were made on Saturday, August 1st, at the Vancouver offices of the company, in the presence of about 400 members of the staff and their families. Every section of the company's field was represented, from Victoria to Chilliwack. Mr. F. S. Barnard made the presentation, and Mr. Sperling, in responding, asked for the same hearty support to be given to his successor, Mr. George Kidd, who had been successful in his previous fields of activity in company work both in London and British Columbia. A farewell banquet was given to Mr. Sperling at the Hotel Vancouver. It was attended by 50 of the leading spirits in the company, and in the course of his reply to the toast of the evening, Mr. Sperling said that it was with deep regret that he was leaving British Columbia, but he felt that in London he might be able, understanding the conditions now prevailing throughout the company's field, to so advise, that the best interests of the company might be served by the action of the London board. From time to time he hoped to return and personally inspect the operations of the company.

MR. A. W. HARRIS, late chief superintendent of telegraphs at Bristol, on leaving to become postmaster at Dover, has been presented by the combined staffs and the telephone department with a silver tea service and silver cigar case.

At Sacriston (Co. Durham), on August 19th, the marriage took place of MR. JOHN PEARSON, chief electrician to the Sacriston Collieries, and Miss J. D. Green, daughter of Mr. Thos. Green, late under-manager of the collieries.

At St. Barnabas' Church, Linthorpe, Middlesbrough, on August 19th, the marriage took place of MR. BARTHOLOMEW SNOWBALL, B.Sc., A.M.I.E.E., of Newcastle-on-Tyne, and Miss Daisy Williams, only child of the late Mr. Thos. Williams, of Cotes Hall, Eccleshall (Staffs.).

The daily Press states that on the retirement of MR. E. CRABB, C.B., second secretary of the Post Office, the Postmaster-General has appointed COL. A. M. OGILVIE, C.B., now third secretary of the Post Office and Director of Army Signals (Home Defence), and MR. H. S. CAREY, C.B., now senior assistant secretary, to be joint second secretaries of the Post Office.

MR. T. H. DENNIS, A.M.I.E.E., is now at home on long leave from Singapore.

On Saturday, 22nd inst., MR. T. C. HODGSON, chief electrician with the Frodingham Iron and Steel Co., who has resigned his position after six years' service, was entertained to a smoking concert at the Queen's Hotel, Frodingham, and made the recipient of a hide suit case and a purse of gold subscribed for by officials of the firm and the electrical staff. MR. C. R. WHITHAM, assistant electrician, was also presented with a gold watch as a token of esteem from the electrical staff. Mr. Whitham has resigned after 24 years' service with the firm. The musical programme was arranged by Mr. O. Hornsby.

MR. LESLIE C. SPEED, electrical engineer, of Southport, is serving with the Army Service Corps.

MR. STEPHEN CORLETT has offered his services as hon. electrical engineer, and also for clerical assistance, to the Wigan Division of the British Red Cross Society.

MR. CHAS. STAFFORD SCHULTZ, a director of Messrs. Dick, Kerr & Co., Ltd., who is a British subject born at Ingersol, Ontario, announces that on August 19th, 1914, he renounced the surname of Schultz, and then adopted the name of Charles Stafford Stafford.

OFFICIAL RETURNS OF ELECTRIC COMPANIES.

Nairobi Electric Power and Lighting Co., Ltd. (87,728).—Capital, £80,000 in £1 shares (12,000 pref.). Return dated July 22nd, 1914; 12,000 pref. and 17,180 ordinary shares taken up; £1 per share called up on 25,180 shares; £23,180 paid; leaving £2,060 in arrears; £4,000 considered as paid on 4,000 shares. Mortgages and charges: £19,000.

Paignton Electric Light and Power Co., Ltd. (98,437).—Capital, £15,000 in £1. Return dated May 18th, 1914; 11,765 shares taken up; £11,765 paid. Mortgages and charges: £7,500 mortgage debentures and £3,000 temporary loan; list of allotments made up to May 24th, 1914, shows a further 50 shares allotted for cash.

Wellingborough Electric Supply Co., Ltd.—Issue on July 17th, 1914, of £500 debs., part of a series of which particulars have already been filed.

Chesham Electric Light and Power Co., Ltd.—Particulars of £25,000 debs., created July 31st, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

North-Eastern Electric Smelting Co., Ltd.—First mortgage deb. dated August 17th, 1914, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: T. Estall, D. J. H. Cunnick and F. Eley, 15, Bishopsgate, E.C.

A. W. Penrose & Co., Ltd.—Mortgage and Land Registry charge on 9, Little Saffron Hill, London, both dated August 10th, 1914, to secure £2,500. Holders: Bradford Third Equitable Benefit Building Society.

CITY NOTES.

National Electric Construction Co., Ltd.

THE directors report that the gross profit for the year ended 31st December, 1913, was £10,387, and after deducting therefrom expenses of administration, debenture interest, &c., there was a balance of £174, plus £4,472 carried forward at 31st December, 1912, and £2,400 directors' fees for the years 1911 and 1912, which have been waived, making a total of £7,046. Deducting from this £1,550 for the debenture redemption fund, £356 loss on free wired installations sold, and £313, depreciation on rolling stock, Dewsbury and Ossett Tramways, and on furniture, fittings, plant and tools, there was a balance of £4,827, which the directors recommended should be carried forward pending the disposal of points raised in the auditors' report. All the undertakings in operation in which the company is financially interested have made satisfactory progress during the year and the progress was maintained.

RHONDDA TRAMWAYS CO., LTD.—A dividend of 8 per cent. was paid on the Preference Share Capital, being 6 per cent. in respect of arrears for the year 1912 and 2 per cent. on account of the year 1913. The receipts for 1913 amounted to £65,241 as compared with £50,859 for 1912 (the year of the strike).

TORQUAY TRAMWAYS CO., LTD.—A dividend of 5 per cent. was paid on the Ordinary Shares, compared with 3 per cent. for 1912. The receipts amounted to £33,564 against £28,764 for 1912.

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Dewsbury and Ossett Tramways.—The profit, after providing for sinking fund and interest payments to the local authorities, and reserves, amounted to £1,232, compared with £917 for 1912. The receipts amounted to £10,207 against £9,552 for 1912.

Mexborough and Rawmarsh Construction Synd., Ltd.—A dividend of 2½ per cent. was paid compared with 2 per cent. for the year 1912. The tramway receipts amounted to £18,348 compared with £16,706 for 1912, and the lighting receipts show an increase of £1,156 over those for 1912.

Musselburgh and District Electric Light and Traction Co., Ltd.—Although no dividend was declared on the Preference Share Capital, an improvement in results was obtained. The tramway receipts amounted to £16,356 compared with £15,412 for 1912. There was an increase in the lighting receipts from private consumers of over £100, and a decrease of about £400 for current supplied to tramway, due to economies in consumption and car mileage.

Town Lighting Installations.—At Bo'ness there was an increase in the gross profit of £597, and at Carnarvon of £202.

Wisbech.—The works are completed and current was supplied on the 31st July, 1914. The number of consumers already connected is highly satisfactory.

Mr. James Taylor and Mr. G. H. Nisbett accepted the invitation of the directors to join the board.

The directors have for some time past had under consideration the need for a revaluation of the company's assets, particularly in connection with the losses incurred with the Folkestone concession. The result of a careful valuation of the whole of the assets of the company is such as to lead the directors to recommend that the £1 shares of the company be reduced to 10s., thus reducing the issued share capital from £170,000 to £85,000.

The annual meeting was held on August 20th, at 3, Lawrence Poutney Hill, E.C., Mr. L. B. Schlesinger presiding.

The Chairman, in proposing the adoption of the above report, said they would remember that last year he informed them that considerable progress had been made with negotiations for an important contract for the construction of an electric railway on the Continent, and that the concession had been granted to a joint board representing some 30 authorities. The Royal Commission appointed by the Government had been designing the sites for the stations, and the president of the committee had come to London to discuss matters, and he stated that directly the joint board was in a position financially to settle the contract, Mr. Cownie, their managing director, would be notified. Last month Mr. Cownie received an invitation to meet the committee at Copenhagen. He was sorry to say that that appointment could not be kept. He could only hope that when the war was over negotiations would be resumed. The other contract he referred to at the last meeting was one which if brought to a successful issue would have resulted in a contract to the company of probably over £300,000. The contract was for an electric light and tramway undertaking in Bagdad. There were certain necessary street widenings to be made by the municipality, but owing to possible financial difficulties the directors of the syndicate decided that the widenings should be undertaken by the company. Negotiations with the Turkish company with that object in view were entered into, and were entirely successful, and amendments to the concession in favour of the company were obtained as a *quid pro quo*. Mr. Cownie was successful in raising the additional capital, and he and Mr. Stanley, the chief engineer of the company, went to Constantinople last April to conclude the negotiations. They formed a Turkish company with a capital of £250,000, 10 per cent. of which was put up by the syndicate as required by the Turkish law. The concession was now the property of the Turkish company, all the shares of which, with the exception of those allotted to the concessionaire, were the property of the syndicate. At the present moment the representatives of a well-known firm of valuers were in Bagdad preparing the estimates for the widenings, but the shareholders would appreciate that there was no question of finance for the time being. He was informed that there was ample time to deal with the business—he believed about a couple of years—although if an extension were necessary, probably in the circumstances there would be no difficulty in obtaining it, as the syndicate had carried out its obligations to the Government by providing the necessary deposit on the capital of the Turkish company. Proceeding to deal with the various undertakings in which the company was interested, the chairman said that the progress was in the right direction. In the case of the Rhondda Tramways Co. the profit earned in 1913 was £27,685 compared with £18,680 in 1912, the year of the coal strike and the strike of the company's employees. The payment by the company of a dividend of 8 per cent. on its preference shares—6 per cent. in respect of 1912 and 2 per cent. on account of 1913—enabled the liquidators of the Rhondda Tramways Co. Construction Syndicate to make a further distribution of 3 per cent., equal to 10 per cent. on the remaining cash invested in the syndicate. The receipts for 1913 amounted to £65,240, as compared with £50,859 for 1912, and to the 17th of August this year there was an increase in receipts of £986. The war, so far, had not had any serious effect on that undertaking. Within the next few weeks it was expected that the railless traction extension would be opened, which would connect important mining centres with the Rhondda, and there was no doubt it would materially increase the receipts. As to the Torquay Tramways Co. his forecast as to the probable results for 1913 were correct, as a dividend of 5 per cent. was paid on the ordinary share capital compared with 3 per cent. for 1912, and a substantial amount was placed to reserve and renewals account. The improvement in receipts had continued up to the date the war broke out, since when, unfortunately, the increase had been turned into a small decrease. The receipts for 1913 mounted to £33,564 against £28,764. The Dewsbury and Ossett Tramways Co. had again reported an improvement in the results of that undertaking. The receipts amounted to £10,207 against £9,552, and after providing for sinking fund and interest payments to local authorities and reserves there was a profit of £1,231 compared with £917 for 1912. There was an increase in traffic receipts to date of £105, but that amount had been turned into a decrease by the end of the year as, of course, trade in the district was now adversely affected. In the case of the Oxford Tramways Company's concessions in which they had a considerable financial interest, the surface contact system failed, unfortunately, before being installed, and as the corporation would not allow over-head wires the horse tramway system had to be kept running. Last December a local man started running motor 'buses without licences, and he had so much support from the residents that the corporation could take no action. Eventually they granted the man 12 licences and 12 to the tramway company. The company was able to put the 'buses on the street, and shortly afterwards, with the approval of the corporation, they purchased the interest in the twelve private 'buses. After long and difficult negotiations with the corporation the tramways company secured an agreement, subject to Parliamentary sanction, for the exclusive right of licences for motor omnibuses in Oxford for a period of 37 years. He was glad to say that the Parliamentary sanction had been obtained, although it met with considerable opposition. The Mexborough and Rawmarsh Construction Syndicate showed a considerable improvement for the year 1913, a dividend of 2½ per cent. being paid as compared with 2 per cent. for 1912. The tramway receipts amounted to £18,347, against £16,705 for the previous year, and there was an increase in the revenue of the lighting undertaking of £1,155, and that progress had been maintained. The accounts for the half-year to June 30th last showed an increase in profits of approximately £600 over the corresponding six months of last year. The construction of the railless traction system to which he referred last year was now being taken in hand, and it was hoped to have the system in operation by the end of the year. In the Musselburgh and District Electric Light and Traction Co. the tramway receipts amounted to £16,356, as compared with £15,411, an increase of about £945, and the progress had been well maintained since; the increase in the traffic receipts to the 17th of this month over the corresponding period last year being £607. Under the new management considerable economies had been effected, and the development of the electric light undertaking well taken in hand, with satisfactory results. As to their town lighting installations an improvement in receipts was shown both at Bo'ness and Carnarvon. At Wisbech the works were completed and current was supplied for the first time on July 31st. Some 70 consumers had already been obtained and the outlook was extremely healthy. In regard to profit and loss account, the profit on contracts was £2,146, against £7,069, a large decrease, but he was glad to say that there was a considerable increase again in contract work this year. Interest on investments amounted to £5,531, compared with £3,452. That was a satisfactory result, and with normal times, he thought, they could look to a steady improvement in that item. The profit for the year was £174, and adding £4,472, the balance brought forward to December 31st, 1912, and £2,400 directors' fees for 1911 and 1912 which had been waived, there was a total of £7,046, and deducting from that sundry depreciations and £1,550 for redemption of debentures, there was a balance of £4,827, which the directors recommended should be carried forward.

Mr. J. Carr-Saunders, J.P., seconded the resolution and the report was adopted without discussion.

Subsequently an extraordinary general meeting was held, when the Chairman proposed a resolution reducing the capital of the company from £250,000 to £125,000, to be divided into 250,000 shares of 10/- each, such reduction to be effected by cancelling capital which had been lost or unrepresented by available assets to the extent of 10/- per share upon each of the 170,000 shares which had been issued, and by reducing the nominal amount of all the shares in the company's capital from £1 to 10/- per share. He explained that the position had been fully discussed at a special board meeting. A careful valuation of the assets had been made, with the result that they had come to the conclusion that £85,000 was ample to be written off. By reducing the capital it would be possible for the board to distribute future profits. Judging from the large number of proxies received the shareholders seemed to be in accord with the directors in their policy, for only one shareholder, holding 240 shares, had written expressing disapproval.

Mr. Carr Saunders seconded the resolution, which was unanimously agreed to.

Continental.—Spain.—La Sociedad General de Tranvias Electricas de Palma is the name of a new company which has lately been formed in Madrid, with a capital of £22,400.

Newcastle and District Electric Lighting Co., Ltd.—The directors announce an interim dividend at the rate of 3 per cent. per annum (3s. per share), less income-tax, for the past half-year.

Llanelly and District Electric Lighting and Traction Co., Ltd.—Interim dividend on the preference shares for the half-year to June 30th at the rate of 6 per cent. per annum.

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STOCKS AND SHARES.

Tuesday Evening.

The outlook for the Stock Exchange was naturally not improved by the fall (!) of Namur and the steady way in which the enemy pushes forward in Belgium. While this, of course, does not affect the inevitable end, it tends to delay the final overthrow of the Germans, and to this extent acts as a check upon the revolutions of the wheels both of finance and commerce. According to Royal Proclamation, the moratorium was to come to an end next week, but the general opinion in the City leant to the idea that it would be extended—as to which there will no doubt be some official notification within a few days.

Electric supply companies—at any rate, in the Metropolis—have been amongst the first to recover from the shock of the war outbreak: and they are in the van of the movement set in motion with the intention of turning the national misfortune to the national good. The County of London Electric Supply Company is already in the field with various schemes to enable manufacturers and traders to take advantage of the present position.

Besides pointing out the power supply available, the company, in conjunction with others, offers facilities for charging electric vans for the use of tradesmen in delivering goods within limited areas. The many firms who have had horses and vans commandeered for the use of their country are likely to appreciate such an offer as this, which certainly helps to keep business as usual, and is instrumental in fending off the unemployment, which becomes already a pressing problem.

Stocks and shares are changing hands to a small extent, and we have been able to collect a few quotations. Readers must get tired of hearing that prices are more or less nominal, and this shall be the last time the formula is repeated here. With which preface we may set out the following table, giving the prices which ruled at July 30th, the last day on which the Stock Exchange was opened for business:—

Stock or share.	July 30th.	Present price.
Electric Supply.		
City of London	16	16¼
County of London	12	11½
London 4 per cent. Debenture	92½	90
South London Pref.	5¼	5¼
Calcutta Electric Pref.	5 1/16	4¾
Telegraphs.		
Eastern Ordinary	130	130
Eastern Extension	123	123
Western Telegraph	13¾	13¾
Globe Ordinary	11¼	11
Globe Pref.	12⅝	12¼
Anglo-American Preferred	108	107
Miscellaneous.		
Anglo-Argentine Trams Debenture	96	94¼
Brazil Traction	58	52
Para Electric Railways Debenture	89½	84

Holders of electrical stocks and shares who may wish to realise will find themselves able to do so in a few cases in which the dealers have been short of stock for some time. For instance, Globe Telegraph Preference can be sold easily at very much the same price as prevailed before the crisis; and for quite a number of Electric Supply Debentures there is a demand at a point or so below the last-quoted figures.

It may well be imagined how diverse are people's opinions of what prices ought to be at the present time. One illustration may suffice; and although we should greatly like to mention the name of the shares, the journalistic motto of "When in doubt, leave out," stays the desire. A certain share was quoted at 5⅛ on July 30th, and a proprietor of 200 shares happened to want a bid. Some of the regular buyers were approached, of whom all but one declined to make an offer. This one, however, bid 4¼. Five minutes after came along another buyer of 30 shares at 4⅛; and, by odd coincidence, at the end of the day 100 shares were wanted by a provincial centre at 4⅛. This instance we cite as an example of the difference of opinion there may be as to the war-time value of securities.

The re-opening of the Stock Exchange is a matter which continues to occupy many minds that ordinarily are affected only indirectly by the doings of Throgmorton Street. One of the main difficulties is connected with the matter of loans from banks to Stock Exchange customers. A jobber in the ordinary course of his business will buy, let us say, three or four thousand pounds' worth of stock standing at 105. If it cannot be sold at once, the stock is taken up by the jobber, who, as a rule, puts it into the name of his bank and adds the item to his loan account, secure in the knowledge that he will be able to sell it in a week or two at the latest, and that in the meantime the banker is glad to lend him money on it at a fair rate.

Prices descend, however; the £4,000 stock standing in the loan books of the bank at 105, may be worth 100, 90, or even less. If the banker presented the stock to the borrower and asked him to pay off the loan, the borrower in all probability would be unable to do so, for the item we have quoted is one, say, of 20 others, of larger or smaller amount. To repay the loan would obviously be impossible at a time when nothing can be sold, except in driblets; and the loan perforce must go on. Were the Stock Exchange to be opened, the banker might press for repayment, and the jobber, unable to liquidate his position, be hammered, leaving the stock in the hands of the bank at a price still further depreciated on account of the failure. Multiply this transaction by the thousand, and the amount in similar fashion, and some idea may be gathered of the difficulties which confront re-opening of the Stock Exchange.

The Consolidated Gas, Electric Light and Power Company of Baltimore invites holders of the Preferred shares to exchange these for Common, on the basis of share for share. The company has just raised its dividend on the Common from 6 per cent. to 7 per cent., the Preferred dividend being 6 per cent. The Preferred shares, as constituted at present, are redeemable at the option of the directors, at 120, and the price for the Common shares at the end of July was 105—this however, before the dividend was raised—so there seems to be little object yet in making the exchange; for our part, we would advise proprietors of the Preferred to retain these and to see what happens later on. The last quotation for the Preferred was 114-117, the company's 4½ per cent. bonds, by the way, being quoted at 95.

Amongst provincial companies, the Newcastle and District Electric Lighting Company has declared an interim dividend of 3s. per share on the Ordinary, and the Oldham, Ashton and Hyde Electric Tramways Company announces postponement of the interim dividend on the Ordinary shares, which would have been paid in the ordinary way last week. Amongst the very few shares which have risen since the war started are Birmingham Small Arms, which from 42s. have improved to about 46s. Other armament issues are steady.

To what extent the moratorium in the Argentine Republic and the financial crisis in Brazil will affect payment of interest and dividends on stocks and shares in British companies working in South America, has not yet been defined. The trouble lies in transmitting money from the various countries to this side. Exchange rates are quoted, but in such nominal fashion that transactions are of the day-to-day—or, rather, hour-to-hour—variety. The Brazilian Traction Company has announced its intention of paying a regular quarterly dividend at the rate of 6 per cent. on the common shares, the declaration having a decidedly steadying effect upon the price.

Affairs in Mexico seem to be settling down somewhat, and for some of the railway stocks and shares better prices are quoted than prevailed a week ago. The improvement has not yet spread to the issues of the utility companies, but holders of these can await the future with more composure than many others. A man came in the other day, and said that he had fled from Mexico a year ago because of the gravity of the outlook there, but that now he was thinking of going back, because conditions appeared to be more settled in that country than in this.

The rubber market is weak as regards prices, but strong in confidence. Many of the plantations have already partially closed down, while the demand for the produce has been stimulated by the transport of guns, wagons and all kinds of vehicles used in motor-work on active service, both abroad and at home. The price of the stuff has crept up from 2s. 2d. to nearly half-a-crown per lb., and within the past few days there have been a fair number of dealings in the leading shares, although at prices well under those which ruled three weeks ago.

Lobito Benguella and Catumbella Electric Light and Power Co., Ltd.—This company has decided to divide its capital into 100,000 ordinary and 100,000 six per cent. preference and participating shares, and to create 12,000 five per cent. first mortgage debenture bonds of £10 each. The last-named will be used first to provide further working capital, and then to paying amounts due to pre-prior and prior lien debenture stockholders, to whom fully-paid preference shares will be allotted in part-payment.

Parsons' Foreign Patents, Ltd.—The dividends sanctioned for the year ended June 30th, 1914, are at the rate of 19½ per cent. on the ordinary, 9s. 9d. per share on the deferred shares. Of these dividends, 10 per cent. is payable forthwith on the ordinary and 5s. per share on the deferred, the balance being payable when the directors consider advisable, bearing in mind the present necessity for conserving cash resources owing to the general position in Europe.

Aberdeen Suburban Tramways Co.—The directors report a profit for the half-year of £1,650, bringing the balance at credit of profit and loss account to £4,104. They propose to add £2,000 to renewal and depreciation account, making it £14,000, and to pay a dividend of 2½ per cent. for the year, absorbing £781. The sum of £1,293 would be carried forward.

Potteries Electric Traction Co., Ltd.—A financial paper states that the directors, in view of the existing state of war and the consequent necessity of conserving the resources of the company, have decided to postpone the interim dividend on the 6 per cent. cumulative preference shares, which would in other circumstances have been paid on August 15th.

Stewarts & Lloyds, Ltd.—The directors have declared interim dividends for the half-year ended June 30th last at the rate of 6 per cent. per annum on the preference shares, 10 per cent. per annum on the preferred ordinary shares, and a dividend of 6d. per share on the deferred shares, payable August 31st.

Stock Exchange Notice.—An application for an official quotation has been made in the following:—Montana Power Co.—$10,000,000 5 per cent. first and refunding mortgage sinking fund gold bonds.

Mackay Companies.—The regular quarterly dividend of 1¼ per cent. on the common shares is to be paid on October 1st.

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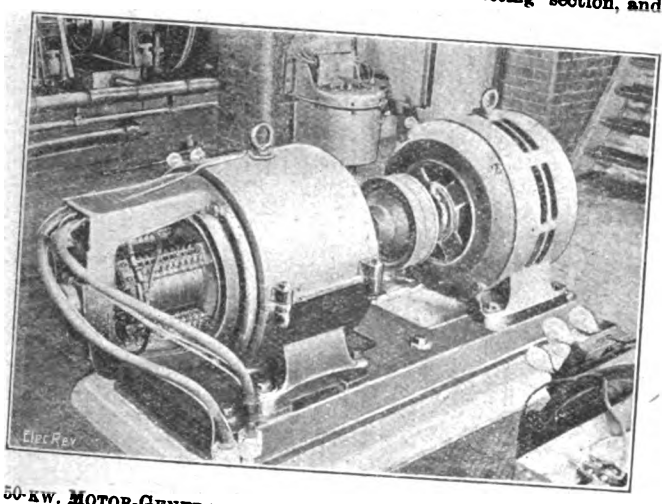
THE CARNARVON WIRELESS TELEGRAPH STATION.

We are indebted to the *Wireless World* for the following description of the new station for trans-Atlantic wireless telegraphy recently erected by the Marconi Co. for communication with the United States.

The stations are situated in North Wales and in New Jersey, U.S.A., and private landlines will connect these terminals with London and New York.

The transmitting section of the British station is situated a few miles east of Carnarvon, on the Cefn-du Mountain, the station building being about 680 ft. above sea level. The receiving section is at Towyn, about 62 miles by road from Cefn-du.

The transmitting and receiving sections are separate to enable duplex wireless telegraphy to be effected. It is not usual to have so large a distance separating the two sections, but it was necessary to do so in this case owing to certain geographical features. In duplex working the receiving section must be placed in a certain definite direction with respect to the transmitting section, and



50-KW. MOTOR-GENERATOR SET, CARNARVON WIRELESS STATION.

here the correct angle could not be obtained with a suitable site at a nearer distance, owing to the configuration of the country.

There are four wires connecting the two stations, carried on the same poles as the Post Office telegraph lines.

The transmitting station consists of one large building measuring approximately 100 ft. by 83 ft., which is divided into three sections, known as the main machinery hall, the annexe, and the extension.

In the main machinery hall are located the transmitting sets, switchboard, transformer room, stores, offices, and emergency operating room. Auxiliary plant, consisting essentially of electrically-driven blowers, D.C. generators, ventilating fans, and some small motor generator sets used in connection with the signalling circuit is placed in the annexe, which also provides an office for the shift engineers and accommodation for the fitting shop. The extension is devoted entirely to experimental apparatus.

On the two upper floors of the north end of the building are arranged most of the actual wireless apparatus, consisting of condensers, bus-bars, jigger, and inductances.

The main transmitting sets are in duplicate, each set comprising a 300-K.V.A. single-phase alternator, generating at 1,750 volts and 150 frequency, directly coupled to, and driven by, a 500-B.H.P. three-phase, self-starting motor, suitable for 440 volts and 50 frequency; this in its turn is directly coupled to a shunt-wound exciter giving 300 amperes at 40 volts.

The alternator is directly coupled to the discharger, which is of the rotating disk type, the coupling being an insulated one. Lubrication throughout the entire set is forced. The disk discharger is enclosed in a sound-proof room.

An insulated foundation is provided for the disk, and should it be required at any time to run this asynchronously, an independent 50-H.P. 110-volt shunt motor, having a quickly removable insulated coupling, is provided for the purpose.

The main switchboard consists of 10 panels, each 2 ft. wide and 8 ft. high, upon which are mounted the necessary instruments and circuit-breakers and switches for the control of the various parts of the plant. The mains and main motor panels are provided with time-limit relays; the cables from the switchboard to the various machines are all lead-covered, and are suspended on racks on the sides of the trenches.

In the transformer room are transformers each having a capacity of 75 K.V.A., as well as low-frequency inductances. There is an electrically-operated safety switch in the transformer primary circuit which is controlled by a master switch. Each transformer is provided with isolating switches in both primary and secondary circuits, carried by an iron framework immediately over the transformers. The low-frequency inductances are arranged to facilitate adjustment of the amount of inductance required.

In the emergency operating room is all the apparatus necessary for transmission and reception from the transmitting station instead of from the distant operating station. In addition there is a master switch, under the control of the operator, which automatically operates (1) the safety switch in the transformer room; (2) the receiving aerial isolating switch; (3) the receiving crystal protecting switch; (4) an illuminated sign "Ready to Transmit," situated in the shift engineer's office, and (5) a disconnecting switch in the main earth lead, to unearth the aerial when required for receiving, thus completely avoiding any possibility of damage to the receivers when the aerial is required for transmitting.

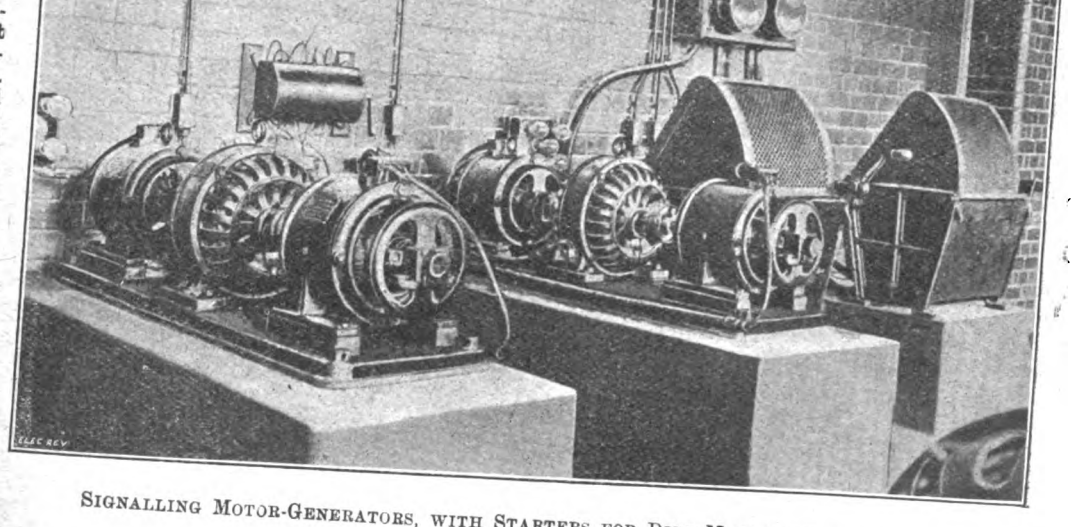
The auxiliary plant is situated in the annexe. Here are motor-generator sets in duplicate, each consisting of a three-phase induction motor directly coupled to a 50-KW., 110-volt, shunt-wound, D.C. generator, in connection with which is used an automatic pressure regulator. The blowers are also in duplicate, each set consisting of a positive rotary blower of the out-board bearing type, driven through spur gearing by a motor suitable for 440 volts, three-phase, and 50 frequency. Air is conducted to a reservoir, and thence distributed where required. The disk discharger chambers are ventilated by means of exhaust fans, each driven by a three-phase induction motor. Duplicate signalling circuit motor-generators are provided, each consisting of a three-phase induction motor running at 1,460 R.P.M., directly coupled on either side to a D.C. shunt-wound protected type generator. Liquid starters for use in connection with the auxiliary disk motors are supplied in duplicate, to guard against any possible temporary interference of the service.

From the shift engineer's office, which is partitioned off from the annexe, an uninterrupted view is obtained of the machinery hall, main switchboard, and the auxiliary plant.

The repair shop is capable of dealing with almost any class of repair work likely to be required, and is equipped with modern power-driven tools.

The latest type condensers are installed, the banks being arranged symmetrically on two floors. The pots are used three in series.

The bus-bars are of copper-sheet, stiffened by Duralumin angle plates; they are supported on standards and separated by means of porcelain insulators. The main bus-bar is extended beyond



SIGNALLING MOTOR-GENERATORS, WITH STARTERS FOR DISK MOTORS ON THE RIGHT.

the condenser banks, and divides immediately over the disk chambers, the ceiling of which is provided with specially-insulated glands, through which pass the main connectors conducting the current from the condenser bus-bars to the side disks. Each branch of the main bus-bar is connected up to one transmitter by means of quickly removable change-over links.

The jigger, of the usual independent primary and secondary type, consists of a suitable number of turns of special H.F. cable, wound

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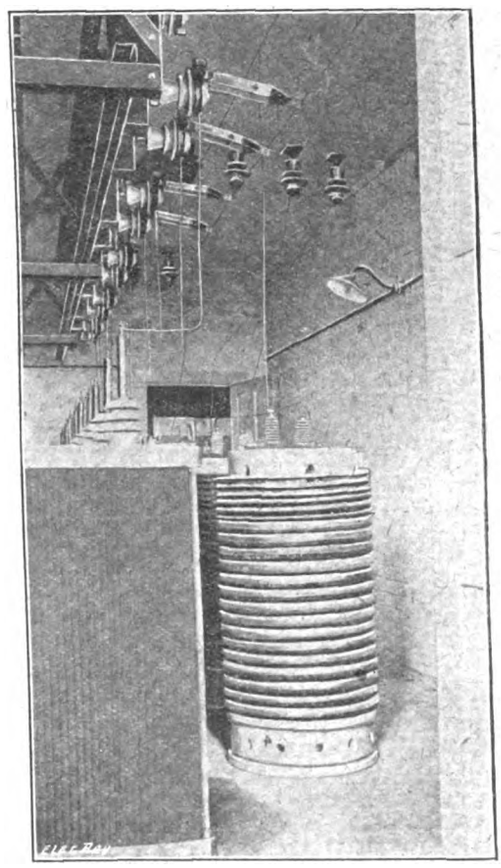
on insulated frames, which are supported so that their axes lie along the axis of the windings. Provision is made for one of these frames to be easily movable in a line along its axis, for the purpose of varying the coupling between the primary and secondary.

The aerial tuning inductances are three in number, and are provided with the necessary tappings for tuning purposes. The aerial is of the directional type, and extends from the building in an easterly direction up the mountain side. It is approximately 3,600 ft. long, and averages 500 ft. in width. Ten tubular masts support the aerial, and these are arranged in four rows of three, two, two and three, each row being 900 ft. apart. The aerial diverges from the leading-in insulator to a line of rod insulators supported by the triatics between the tops of the first row of three masts, thence to the triatic supported by the other rows in succession, the plane of the wires following roughly the contour of the mountain at a height of just under 400 ft. Even tension is kept in every wire by means of a balance weight, thus minimising the possibility of breakage of wire due to wind pressure.

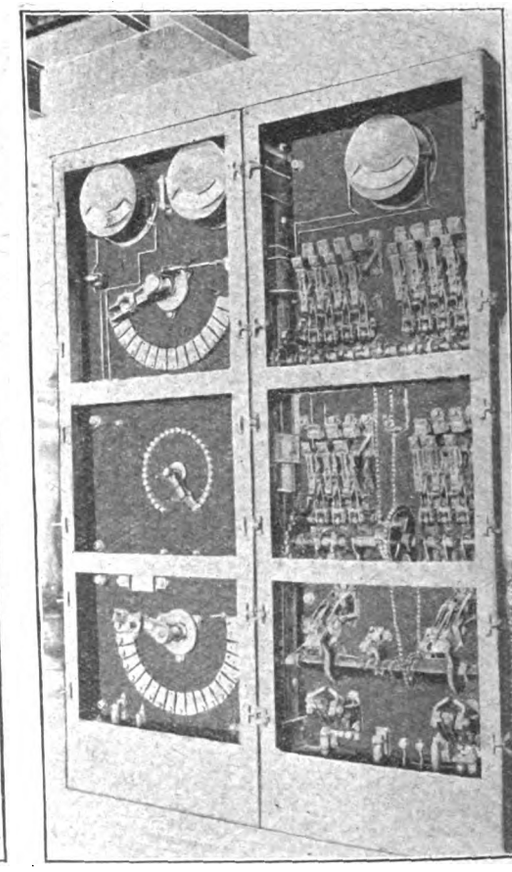
The earth system is briefly as follows:—A ring of metal plates is buried in a circle, with the building as centre. This is connected by means of radial wires with another ring of larger radius. From the outer ring wires are run to the end of the aerial, whilst from the first circles of plates wires are brought overhead to the common earth wire. On two opposite sides of the building are earth terminals, passing through the wall to which the common wire is connected.

There are 10 tubular steel masts, each 400 ft. in height, the lower half being 3 ft. 6 in. in diameter, and the upper half, 2 ft. 6 in. The lower half is built of quarter sections, or quadrants, each 15 ft. in length, and the upper half is built of semi-circular sections, each 10 ft. in length. All the sections have outside flanges, by means of which they are bolted together. Each mast is provided with a gallery at the top, which can be reached by a ladder running up inside, access to the ladder being by means of a manhole. The triatics are attached to a halyard passing through a block at the top of the mast, and another at the bottom, and are made fast to bollards. A winch with warping drums is placed between each two masts. The foundation plate for each mast stands on a block of concrete measuring approximately 12 ft. × 12 ft. × 6 ft., and weighing approximately 48 tons.

Four sets of seven stays of 3-in. steel wire rope with solid core are used for each mast. A stay is insulated about every 100 ft. of its length. The stay anchors consist of concrete blocks measuring about 12 ft. × 12 ft. × 12 ft., and weigh approximately 97 tons. The intermediate pairs of masts are provided with back stays in order to lessen the strain on the mast-head caused by the greater length of triatic which they support.



Transformers, Inductances and Isolating Switches.



Starting and Control Pillar for Main Motor-Alternator Sets.

Power is supplied to the station by means of an overhead transmission line which provides a three-phase supply at 10,000 volts. The power station, belonging to the North Wales Power and Traction Co., is situated at Cwm Dyli, about 11½ miles distant. The prime movers are high-pressure water turbines, the water being obtained from a lake on Snowdon. There is a transformer station adjacent to the wireless station, where the voltage is reduced from 10,000 to 440 volts, at which pressure it appears on the main switchboard.

At the Towyn station the receiving aerial is supported by five masts, each 300 ft. high; these masts are erected on a range of hills at the back of the town, the last mast being about 1,400 ft. above the sea level. A balancing aerial is also provided carried on 80 ft. poles, the purpose of the balancing aerial being to balance out the effect of signals transmitted from the stations at Cefn-du, so that the signals received across the Atlantic are not in any way affected by the signals from the transmitting station at Carnarvon.

The station is equipped with all the latest types of receiving apparatus, and the operating building has been designed to accommodate sufficient operators to deal with a traffic of 100 words per minute duplex. The operators for both stations are all located in the various operating rooms at the Towyn station, as are also the operators for working the landlines.

The signalling switches at the transmitting station are controlled from Towyn, where the punched tape from the Creed instrument is put through a Wheatstone transmitter, which, by means of relays at the Carnarvon station, actuates the signalling switches, making and breaking 300 KW.

The Marconi Co. have opened large new premises at 1, Fenchurch Street, London, E.C., which serve as a main telegraph office. The new premises are connected by direct landlines with the company's offices at Marconi House, Strand, London, W.C.

To ensure an uninterrupted public service and to provide against the risk of fire, the landlines connected to both the Welsh and Irish stations can be worked either from the office in the Strand, or from the main office in Fenchurch Street.

A telegram, immediately it is handed in, is dispatched by a special tube leading from the public office to the instrument room, where it is transferred to punchers. Then it is passed to the man in charge of the Creed transmitter on the next table, which automatically reproduces punched tape at the high-power wireless at Towyn. There another operator transfers the tape to the wireless transmitter by means of which the dots and dashes are flashed into space and received at the station in New Jersey. Here expert telegraphists transcribe and hand the messages to the landline system connecting with all the important cities and towns in the United States and Canada. The same operation is repeated when a message is transmitted from the United States to England—the only difference being that in London the signals, by means of the Creed printer, are recorded in letters on tape, which is automatically gummed, and handled by the scrutineer, who separates the tape and affixes it to the company's forms for delivery to the addressees.

Messages exchanged between this country and the Dominion of Canada will continue to pass through the Clifden-Glace Bay Wireless Telegraph Service.

All classes of telegrams are dealt with—ordinary plain language, deferred night letters, week-end letters, Press, shore to ship and ship to shore messages. Cipher is as easily dealt with as plain language, and the rates have been reduced to a level, effecting a saving of about 33⅓ per cent., as compared with the charges for transmission by other means.

Electric Vehicle Association, U.S.A.—The tentative programme of the fifth annual Convention of the Electric Vehicle Association of America, to be held at Philadelphia, October 19th—21st next, has been arranged. In addition to the presidential address, 28 reports are to be presented, including a dozen sectional reports, also eight papers dealing mainly with the electric truck for general industrial purposes, postal and fire services, &c. Additional papers are to be announced, and further particulars may be obtained from the Executive Secretary, Electric Vehicle Association of America, 29, West 39th Street, New York City.

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BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, AUSTRALIA, 1914.

Irrigation Dams and Hydro-Electric Power.

By E. Kilburn Scott, M.I.E.E., A.M.Inst.C.E. (Lond.).

Read in Section G (Engineering).

One of the most attractive developments of modern engineering is the building of large irrigation dams and the utilisation of the water not only for irrigation, but also for developing hydro-electric power. It is a world-wide development, as may be seen by the locations of dams where such a combination is already at work, or where it is likely to be carried into effect in the near future.

Power generated by the water may be used for a domestic supply of electricity to neighbouring towns, or may be used for the manufacture of such products as fertilisers.

The power may also be used for extending the irrigation area—(a) By pumping water to high lands which cannot be reached by ordinary gravity canals; (b) by draining low-lying

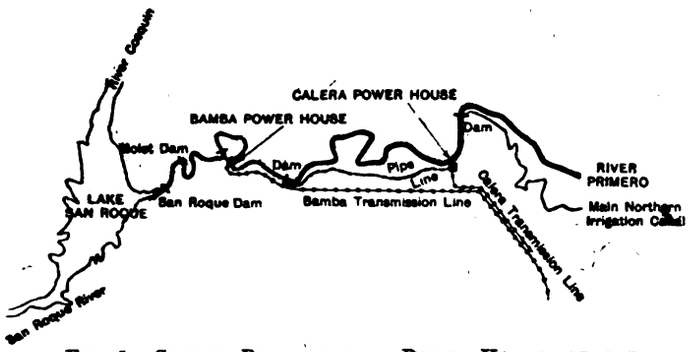

Fig. 1.—Sketch Plan showing Power Houses of the Cordoba Light, Power and Traction Co.

land, the water being raised into gravity canals; (c) by pumping water from wells.

One of the earliest examples is in Argentina, where the Cordoba Light, Power & Traction Co. has for the last 15 years used water from an irrigation dam which was built over 20 years ago. It is a great tribute to South American enterprise and Government that so long ago, a dam impounding two and a half times more water than the then largest one in Europe should have been built for such a purpose as irrigation, and also that in the comparatively early days of hydro-electric development, the water should have been harnessed for power.

As very little information has been published regarding this installation, the following particulars may be of interest.

The irrigation dams utilised by the company are situated about 1,060 feet above the sea, and the main San Roque dam impounds 253 million cubic metres of water. The drainage area is 520 square miles.

The first power house was erected 15 years ago at Bamba, a short distance below the dam (see Fig. 1.) At this point the river has a loop 3½ kilometres long with a very narrow neck. A tunnel 86 metres long was cut through hard granite to connect the two ends of the loop, thus securing an available head of about 31 metres.

The hydraulic capacity of this installation is based on a minimum flow of 15 cubic metres per second. The tunnel has a cross section of 8½ sq. metres, and the maximum velocity is 1.75 metres per second. At the lower end of the tunnel there is a forebay, and the flume pipes from this point down to the power house are 2½ metres in diameter and about 55 metres long, making an angle of 31 degrees.

The power house contains seven McCormick turbines coupled to three-phase generators having a total capacity of 4,000 kw., at 700 volts, 60 cycles. Step-up transformers raise the pressure to 11,000 volts.

Two years ago a second power house was erected at Calera (see Fig. 1). Below the tail race of the Bamba plant part of the flow of the river is diverted to a canal and siphon pipe line 4½ kilometres long to the power house reservoir. This gives a static head of 43 metres, with a working head of about 41 metres.

The power house is equipped with four Escher Wyss turbines capable of developing 1,870 b.h.p., each coupled to a 1,100-kw. three-phase alternator wound for 11,000 volts, 60 cycles.

Both these power houses are connected to a sub-station at Rebaje in the City of Cordoba by means of 11,000-volt overhead transmission lines 15 miles long. From the sub-station current is distributed for light and power in the City of Cordoba in addition to supplying energy for the tramways in the district. As a stand-by there is a steam station in Cordoba having a capacity of 2,200 h.p.

As the water has to be subservient to the requirements of irrigation, about 34 per cent. of the entire rainfall over the catchment area goes to the river, and only about 17 per cent. is available for power. There is, however, a further proposal to build a third hydro-electric power house.

It should be specially noted that the above power houses do not have to contend with a variable head of water as in certain other irrigation schemes referred to below.

Californian Irrigation by Pumping.—In California a unique combination of hydro-electric power and irrigation has been in operation for the last 14 years. Electric energy generated in numerous power houses using high head falls in the Sierra Nevada mountains is transmitted to farming centres where the climate is too dry to make fruit growing practicable without irrigation.

All the hydro-electric power houses in California are linked together by an immense high-tension busbar network, and in some cases the current for irrigation pumping may be transmitted 50 or more miles.

The water is pumped from water-bearing strata which average about 50 feet below the surface. The wells are about a mile apart, and they are each equipped with a 3-phase motor driving a centrifugal pump by means of a vertical shaft.

A 30-h.p. motor will irrigate one square mile of land, the average lift of the water being about 25 feet and the delivery about 3½ to 5 cub. ft. per sec. One man attends to from 8 to 10 wells, which he visits twice a day. By this means barren territory has been made into valuable farm land, yielding rich crops of forage, oranges, lemons, grapes, etc.

Two-thirds of the whole water supply of Southern California is obtained from wells, all of which is pumped by electric power. The water plane is kept about 50 feet below the surface, which results in good drainage and improves the surface soil, for it has been found that it is the rising of ground water and consequent evaporation that increases the deleterious salts and damages land.

Although this method of irrigation is only in use in the States, there must be many places in the world where there are similar geological and climatic conditions. In the Sydney *Daily Telegraph* of December 16th, 1906, I drew attention to this method, pointing out that it might be suitable to certain parts of Australia.

United States Reclamation Service.—Of the high dams built by the United States Reclamation Service the Roosevelt dam, in Idaho, already has a hydro-electric plant. Other large dams built for irrigation are the Elephant Butte or Eagle dam in Arizona, and the Arrow-rock dam in Idaho, and in both these provision for hydro-electric development has been made and plants will be erected as soon as local power demand warrants the expenditure.

The Roosevelt dam measures 1,080 ft. long by 284 ft. high, and about 90 per cent. of its full capacity is held above the 110-ft. level. Although the total head when full is 226 ft., the turbines are designed for a regular operating head of 160 ft. The power house is 125 ft. by 38 ft., and contains six vertical turbines each driving a 1,200-kw. three-phase alternator, 2,300 volts, 25 cycles.

A separate transformer house steps up the pressure to 45,000 volts, at which voltage some of the energy is transmitted to the town of Phornex, 65 miles away. It is contemplated, however, that in the future practically all the power will be used for irrigation.

On the Pima Indian Reservation, 10,000 acres of land are supplied by water pumped from wells by ten electrically-driven pumps similar to those used in California. Eventually there will be about 100 such pumping equipments.

Messrs. O. H. Ensign and J. M. Gaylord, of the U.S. Reclamation Service, give the following very interesting figures regarding this plant:—

The first cost of ten wells and pumping equipments is £20,000, or £2 an acre for the 10,000 acres of irrigated land. The duty of each 50-h.p. pumping unit is 5 sec. ft. for a 55-ft. lift, and at 70 per cent. efficiency, and working 200 days and 24 hours a day, the annual consumption of electric energy is 2,208,000 kw.-hours. The annual cost of this electrical energy is £6,800, or under £7 per acre per annum for the 10,000 acres.

In other words, 24,000 acre feet of water is lifted an average of 50 ft. at a cost of £6,800, or under 6s. per acre foot.

Another interesting irrigation project of the Reclamation Service is that of Minidoka, in Idaho. It comprises 130,000 acres, of which about 80,000 acres are irrigated by gravity canals and the remainder by water pumped from the gravity canal. The power plant is situated at the irrigation dam at Lake Wolcott, and the static head is 46 feet. The power house contains five 1,400-kw. turbine generators, 60 cycles, and two 120-kw. exciter units. The three-phase current is raised to 33,000 volts and transmitted to three pumping stations of 2,500 kw., 3,000 kw., and 1,300 kw. respectively.

No. 1 station has four pumps, each driven by a 600-h.p. motor, and one driven by a 380-h.p. motor. The pumps are of the centrifugal type and are driven by vertical shafts, the motors being on an upper floor.

Assuan Dam Proposal.—This is one of the most interesting irrigation dams in the world, not only for the engineering skill displayed in the building, but on account of its remarkable economic effects on Egypt.

It has been an expensive dam to build, because of its great length, 6,562 feet, the large number of sluices, and the fact that it has been built in two stages.

Nevertheless the tremendous expenditure involved has been found to be more than justified in the irrigation results alone.

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The financial results are, however, capable of still further improvement by harnessing the water which passes through the sluices at certain times of the year.

If all the water of the Assuan dam could be utilised the powers and heads of water at various times of the year would be about as follows:—

	Horse-power.	Head.
May	200,000 ...	26 metres.
June	850,000 ...	24 ,,
September ...	39,000 ...	3 ,,
December ...	190,000 ...	5 ,,

The actual possible utilisation of the power depends to a great extent, however, on the fact that the basin on the up-stream side of the dam has to be kept free from silt, and this necessitates opening certain sluice-gates at particular times of the year, so as always to have a high-velocity current cleaning some portion of the basin.

One of the proposals before the Egyptian Government is to harness the water passing through ten of the sluices at the western end of the dam. It is estimated that this amount of water will develop about 100,000 H.P. with a head of 24 metres, and this higher power would be available for about eight months of the year. With the lowest head of 3 metres the power comes down to about 10,000 H.P. It may be mentioned that one estimate of the power from the ten sluices gives it at 80,000 H.P.

Each of the ten turbo-generators will give about 10,000 H.P., and it is suggested that the machine should generate at 11,000 volts and 25 periods per second. The pressure at which it is possible to generate directly depends to some extent on the moisture in the air, because nitric acid tends to form on the high-tension windings. There is usually a good deal of moisture in the air near irrigation dams, and this is particularly the case at Assuan.

There are two problems in connection with the Assuan scheme. The first is to find some industry which can not only be easily worked in such a hot climate and in so remote a situation, but which can economically utilise electric power for, say, only eight months in the year.

The second problem is how best to generate a constant voltage and constant periodicity from a water power the available head of which varies in the ratio of about 8 to 1.

The scheme of Messrs. Harper Bros. proposes to develop 10,000 H.P. for pumping purposes continuously, and to develop up to 100,000 H.P. for making nitrates during the eight high head months of the year.

If the turbines are fixed at the ends of the present sluices then the walls of the sluices will have to withstand pressures that do not occur at present, so they will have to be lined with steel. This shows how very important it is to take into consideration the question of hydro-electric power development when building irrigation dams.

Escher, Wyss & Co. have suggested that instead of building the turbines into the present sluices a separate power house be provided below the dam. A special advantage of this would be that each alternator could be driven by several turbines on one horizontal shaft, and therefore the speed could be much higher.

Working with Variable Heads.—The problem of driving electric generators from water powers of widely varying heads clearly becomes more important every day, because of the increasing use that is being made of irrigation dams and of water powers on rivers, etc., which have widely varying heads owing to floods.

For heads varying to 2 or 3 to 1, or, say, 150 feet down to 50 feet, the difficulty can be met by a suitable design of turbine, although, of course, the turbine cannot work so efficiently as when it is under a constant head

For constant voltage and periodicity the turbine has to run at a fixed speed to suit the lowest head, and above that the extra head is lost. Of course, less water is required at the higher heads, but the power possibilities of the dam are reduced considerably.

It is specially important to note that when the supply of electricity is required for domestic purposes the voltage and periodicity must be constant, whereas if the electricity is used for certain electrochemical purposes there is a good deal of latitude. For example, the direct method of fixing the nitrogen of the air can be carried on at various voltages and periodicities by slight adjustment of the furnace.

A method which has been considered for Assuan is to have two electrical generators and one turbine, as shown in fig. 2. The large alternators are to be mounted on the top of vertical shafts, umbrella fashion, and the small alternator is to be horizontal and driven by bevel gearing from the turbine shafts. When the large alternators are connected to the circuit the small alternator is thrown out of use by moving the pinions out of gear. When the small alternator is in circuit the large alternators run round as well, and merely act as flywheels. Of course, when the small alternator is in use the turbine speed is reduced.

It is of interest to know that Mr. Blathy has developed an electrical method which is going to be applied to a hydro-electric power on the Danube, where the ratio of head of water is even greater than at Assuan.

Just as with three-phase machines, variable speeds can be obtained by altering numbers of poles, so periodicity might be kept constant at variable speeds. For example, it is possible to cause the rotating polarity of a stator or armature to vary relatively to the rotating polarity of the moving portion of the machine.

Australian Conditions.—The geological configuration of certain mountainous parts of the world is especially favourable to conservation of water. The ideal condition obtains when

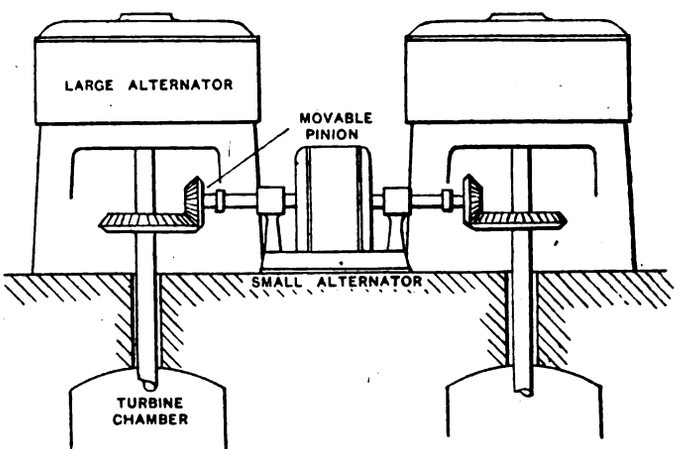

Fig. 2.—Sketch showing proposed method of Driving Alternators at Assuan Dam.

a large valley opens out through a narrow gorge on an extensive flat plain. This happens to be a condition fairly frequently met with in some parts of the United States, and especially in Australia.

Mountainous regions where the hills are either peaky or well-rounded are not nearly so favourable to water storage as the peculiar geological formation of the Australian mountains. This may be readily understood by noting the comparatively short lengths of the Cataract and Burrenjuck and other dams of Australia as compared with the volumes of water which they respectively impound.

The water of the Burrenjuck dam is gravitated to the farms without large balance dams, as at Cordoba, but as Burrenjuck dam is over 160 feet high, it should be capable of developing a fair amount of power. Something ought to be done to harness the water if for no other reason than that the sale of the power would assist in meeting the interest and other standing charges.

In the *British Australian* of September 28th, 1911, I wrote an article dealing with the subject, in which I said:—

"The very high concrete dams which are now being built in Australia, as, for example, that of Burrenjuck, will not only conserve great quantities of water for irrigation purposes, but the same water can also be made to develop power. The power will not be so large as some non-experts think, but it should certainly amount to quite a respectable figure, and be well worth harnessing."

There is no better way of investing public money in Australia than in the conservation of water. Consideration of water storage ought really to precede that of pioneer railways, as otherwise a railway may be built and a township grow up in a valley which ought to be submerged. This happened, for example, at Trawool.

Trawool Dam Scheme.—About eight years ago I collaborated with Messrs. J. M. & H. E. Coane, of Melbourne, in working out the details and financial particulars of a combined irrigation and electric power scheme known by the name of Trawool. That name was taken from the proposed site of the dam on the Goulbourn River, about 70 miles from Melbourne.

The dam was to be 1,800 ft. long and 180 ft. high, and it was estimated that it would impound about 70,000 million cubic feet of water, or about 2,000 million cubic metres. The artificial lake so made would have covered 25,000 acres to an average depth of 60 ft.

Its storage capacity as compared with dams in other parts of the world may be gathered from the following:—

Name of Dam.	Country.	Storage in millions cub. metres.
Mohnetal	Germany	130
Edertal	Germany	202
San Rogue	Argentine	253
Pathfinder	Wyoming, U.S.A.	1,234
Roosevelt	Idaho, U.S.A.	1,730
Assuan	Egypt	2,900
Eagle	Rio Grande, U.S.A.	3,100

The site is favourable for building a dam because the foundation is sound silurian rock, while for the construction there are large quantities of solid granite lying close at hand, and at a higher level.

A large part of the ground to be submerged by the dam consists of the Goulbourn river and its branches and of swampy land which is of no use for agriculture. A certain amount of good land would also have to be submerged, but the loss would be much more than balanced by the enormous increase in productiveness conferred on the immense area of semi-arid but fertile plains to be irrigated by the water.

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The lower Goulbourn River is subject to disastrous floods, and these would be abolished by building such a dam. Instead of dealing destruction and wholesale inconvenience, the millions of cubic feet of water which now pass down the river at flood time would be stored for the growing of wheat, lucerne, fruit, etc.

At the same time the water could be made to develop at least 10,000 H.P. continuously, and 20,000 H.P. for six months in the year, without any loss of water for irrigation purposes. It happens that lower down the river there already exists the Warranga dam, which would act as a balance reservoir, and during six months all the water needed to generate electric power could be stored in the Warranga basin, to be drawn from there during succeeding months. Mr. Elwood Mead has stated that 750,000 acres could be irrigated by water from Trawool and the annual value of the water would be about £375,000.

It will be noted that this scheme differs from that of the Cordoba Light and Power Co. in that the balance reservoir at Warranga could be used for the purpose of storing water passed down from the Trawool dam, so as to keep the power house at Trawool running all the year. The head of water at Trawool would thus vary, but the problem so far as the turbine generators are concerned is, of course, much less difficult than at Assuan.

(To be concluded.)

Temperature Cycles in Heat Engines.

By Prof. E. G. Coker and W. A. Scoble.

(Section G. Abstract.)

Experimental investigations of the cyclical variations of heat-engines and heat-pumps have received much attention, and numerous methods and instruments have been devised to give records of their cyclical changes, such as those of pressure and volume of the working fluid, changes of angular velocity of the crank-shaft, and the like. Temperature changes in the working fluid may usually be inferred very accurately from the pressures recorded on an indicator diagram, since there is usually a definite relation between pressure and temperature of a vapour, as, for example, in heat-engines using steam direct from a boiler without the intervention of a superheater. In other heat-engines, such as those using superheated fluids, and also those of the internal combustion type, the temperature is more difficult to determine, and it becomes important to measure it directly. Platinum resistance thermometers and thermo-electric couples have been frequently employed for measuring cyclical changes of temperature in heat-engines, and a complete record from point to point of a cycle may be obtained if the engine is working with absolute uniformity. As it is usually impossible to prevent some amount of variation in the working of the engine while the measurements are in progress, the resulting curve is a composite one, since each measurement corresponds to a different cycle.

The possibility of obtaining an instantaneous automatic record with an Einthoven type of galvanometer, was considered in our early experiments on the cyclical variations of temperature of the working fluid of a gas-engine, and in the walls of the cylinder, but the difficulties then appeared to be so great that a potentiometer balance method was used instead. Recently, by the kindness of the Cambridge Scientific Instrument Company, we have been able to make experiments with their latest form of short-period Einthoven galvanometer, and this has enabled us to obtain instantaneous records of the temperature-cycles of the working fluid of steam and gas-engines, and also the variations of temperature in the walls. Some of these photographic records are shown, and their detailed characteristics are considered in the paper. They confirm the general accuracy of our former measurements on cyclical variations of temperature in a gas-engine cylinder, and also show some new features due to variations from stroke to stroke caused by misfires and the like.

Irrigation Works in Italy.

By Prof. Luigi Luiggi, D.Sc., M.Inst.C.E.

(Section G. Abstract.)

After showing that irrigation is the principal factor of the advanced state of agriculture, and the principal source of revenue for the Italian nation, the author describes the different ways of getting water for irrigation, and how it is distributed over the cultivated fields. When only small quantities are required, the water is generally raised from the subsoil, either by very primitive means, or by small but very modern centrifugal pumps driven by oil or electric motors, as in many parts of the valley of the Po, where hydro-electric plants are very common. The cost of the water raised electrically—especially during the daytime, when the electric current is distributed at lower rates than at night—varies from 4½d. to 11d. per 1,000 gallons, and it is considered very cheap, for if raised by animals, or worse still by men, its cost would be respectively eight to seventeen times higher.

For irrigation on a large scale resource is had to the rainfall, storing it up in reservoirs, or large artificial lakes of many million cubic metres capacity. The water from these artificial lakes is generally used first for motive power—in some hydro-electric installations, which in Northern Italy are very plentiful—and this helps much in lowering the price of the irrigating water.

The State considers it as its duty to help all these undertakings. Irrigation puts under cultivation large tracts of land of very little value, and almost sterile, and part of the population can thus find useful employment in the cultivation of this land, otherwise nearly useless. Without irrigation Italy would not be able to feed two-thirds of its present population.

The Capacity of Radio-Telegraphic Aerials.

By Prof. G. W. O. Howe, D.Sc.

(Section G. Abstract.)

The capacity considered in this Paper is the actual static capacity, and not the equivalent capacity of the antenna considered as part of an oscillatory circuit. The accurate calculation of the capacity of a multiple-wire horizontal aerial with its leading-down wires would be a difficult mathematical problem, quite unwarranted by the practical requirements of radio-telegraphy.

When raised to a potential above or below that of the earth, the charge is distributed over the antenna in a way which is not easy to calculate, but which must be such that all parts of the antenna are at the same potential. If the antenna were made up of a great number of short pieces, placed end to end, but insulated from each other, it would be possible to distribute the charge uniformly, but the potential would then vary from point to point in a way which is easily calculated. If now we assume that all the separate pieces of wire are connected, electricity will flow from points of high to points of low potential until the potential is everywhere the same. The assumption made in developing the various formulæ is that this final uniform potential is equal to the average value of the potential when the charge was uniformly distributed. This is only approximately correct, but the accuracy is more than sufficient for all practical purposes. This method has been applied to antennæ of all the types usually employed, and formulæ have been established for each type. A large number of numerical examples have been worked out, and the results are given in tables and curves, so that the capacity of any antenna can be read off directly from its dimensions. The corrections due to the leading-down wires and to the proximity of the earth are fully considered, and examples given showing the application of the formulæ to antennæ of any type.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

TUNIS.—The Board of Trade recently issued particulars regarding a new revision of the Tariff of Tunis. The new rates were to come into force on July 1st; those applicable to electrical and similar goods are given below in so far as they have been altered :—

	Francs per 100 *kg.*
Celluloid and other similar plastic materials not specially mentioned—	
In cases, tubes and batons	75 (net)
In sheets, polished, coloured, or washed in any manner	150 „
Carbons for electricity and for other industrial uses weighing less than 3 kg. per piece	12 „
Weighing 3 kg. and more per piece	3
Stoneware pipes—	
Not enamelled nor varnished...	·50
Enamelled or varnished	·65
Articles for electricity of porcelain, faience, white or coloured stoneware without parts of metal or other materials—	
Insulators, bell-shaped	5
Other—	
Weighing 100 grammes or more	7
Weighing less than 100 grammes and more than 10 grammes	10
Weighing 10 grammes and less	20
Articles for electricity of glass, without metal fittings,	
insulators, bell-shaped	5
Others, weighing 100 grammes or more	7
„ „ from 100 grammes to 10 grammes	10
„ „ 10 grammes and less	20
Articles for lighting purposes—	
Reflectors, shades, globes or various, of several colours decorated with gold or otherwise cut or engraved	16 (net)
Other	9 „
Incandescent electric lamps—	
With carbon filaments with mountings	80 (net)
With metallic „ „	150 „
Without mountings	250 „
Pipes and tubes of paper covered with bitumen... ...	1
Transmission bands, muffled or of leather for machinery	60 (net

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Sheets of india-rubber not vulcanised	20 (net)
Threads of vulcanised india-rubber—	
3 mm. or less in thickness	Free
Other	20 (net)
Sheets, plates, or slabs of vulcanised india-rubber mixed or not with other materials	16 (net)
Transmission belts	60 „
Manufactures of india-rubber not specially mentioned	70 „
Asbestos—	
Paper or cardboard	
In sheets (cut out or not) of rectangular form ...	6
Shaped, cut out in forms other than rectangular, with or without thread, cloth or metallic pieces	26 „
Threads, cords and plaits with or without other materials	20 „
Tissues	30 „
Other manufactures, with or without other materials	60 „
Mica in sheets or plates, mica wares, micanite and mica conglomerates, paper and cloth treated with mica ware combined with other materials	35 (net)

N.B.—Unless otherwise stated, duty is calculated on the gross weight of goods with packing.

25 francs = £1 ; kilog. = 2·204 lb.

CANADA.—The Canadian Government have recently made arrangements whereby the duty leviable in the Dominion on catalogues sent through the post may now be prepaid by the sender by affixing Canadian stamps to the wrappers. Formerly the duty has been demanded of the addressee, and this practice has often led to the non-delivery of catalogues. The stamps required can be obtained in denominations of one, two and five cents each, on application to the Commissioner of Customs, Ottawa, Canada, or to the Secretary, High Commissioner for Canada, 17, Victoria Street, London, S.W., on and after August 1st, 1914.

The duty stamps are to be affixed on each package for the amount of duty payable on the same.

The stamps should be affixed towards the upper left-hand corner of the parcel to be exported by mail, as the upper right-hand corner is usually reserved for postage stamps.

Packets bearing Customs duty stamps on arrival at the frontier port of Canada will be transferred to the Customs, to be checked for proper payment of duty and to have the Customs duty stamps thereon cancelled by marking same with the Customs dating stamp, or other cancellation stamp.

The articles specified in Tariff heading No. 178 comprise price lists, catalogues and other advertising matter, as follows, viz. :—

"Advertising pamphlets, advertising show cards, illustrated advertising periodicals; price books, catalogues and price lists; advertising almanacs and calendars; patent medicine or other advertising circulars, fly-sheets or pamphlets, advertising chromos, chromo-types, oleographs or like work produced by any process other than hand-painting or drawing, and having any advertisement or advertising matter printed, lithographed or stamped thereon, or attached thereto, including advertising bills, folders and posters, or other similar artistic work, lithographed, printed or stamped on paper or cardboard for business or advertisement purposes, not otherwise provided for" :—

Under the British Preferential Tariff ...	10 cents per lb.
„ General Tariff	15 „ „

The scale of duties payable in this manner for which stamps may be affixed has been fixed as follows :—

UNDER THE BRITISH PREFERENTIAL TARIFF.

Up to and including 1½ ounces							1 cent.
Over 1½ ounces and not exceeding 3¼ ounces ...							2 cents.
„ 3¼	„	„	„	4¾	„	...	3 „
„ 4¾	„	„	„	6½	„	...	4 „
„ 6½	„	„	„	8	„	...	5 „
„ 8	„	„	„	9½	„	...	6 „
„ 9½	„	„	„	11¼	„	...	7 „
„ 11¼	„	„	„	12¾	„	...	8 „
„ 12¾	„	„	„	14½	„	...	9 „
„ 14½	„	„	„	16	„	...	10 „

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,496. "Heater units for electrical gas meters." H. A. GILL. Aug. 10th. (Cutler Hammer Manufacturing Co., United States.) (Complete.)

18,497. "Relays for electric voltage regulators." BRITISH THOMSON-HOUSTON Co., LTD., A. P. YOUNG, and A. H. ST. C. WATSON. Aug. 10th

18,502. "Electrical switches." SIEMENS SCHUCKERTWERKE G.M.B.H. Aug. 10th. (Convention date, Nov. 22nd, 1913, Germany.) (Complete.)

18,504. "Electric igniting apparatus for gas burners." C. C. CARPENTER. Aug. 10th.

18,509. "Electric switches." B. P. SWYERS. Aug. 10th. (Complete.)

18,511. "Transmission of electrical impulses over circuits of high electrostatic capacity." G. MUSSO. Aug. 10th. (Addition to 17,246/14.) (Complete.)

18,519. "Electric tracks for vehicles." J. VILA. (Aug. 10th. (Complete.)

18,560. "Means for testing electric circuits." H. G. BURFORD. Aug 11th. (F. J. Agabeg, India.)

18,565. "Circuit arrangements for operating the selecting devices of telephone installations by number impulses." SIEMENS BROS. & Co., LTD. Aug. 11th. (Complete.)

18,566. "Incandescent lamps." ALLGEMEINE ELEKTRICITÄTS GES. Aug. 11th. (Convention date, Aug. 18th, 1913, Germany.) (Complete.)

18,598. "Electric starting and lighting systems as applied to motor cars and the like vehicles." W. H. EXLEY. Aug. 12th.

18,603. "Electric switching devices." H. S. HATFIELD. Aug. 12th.

18,607. "Attachments for telephones and the like." K. E. ZIERAU. Aug. 12th.

18,608. "Electric apparatus for ringing bells." L. M. J. D. DEL CASTILLO. Aug. 12th. (Convention date, Aug. 12th, 1913, Germany.) (Complete.)

18,611. "Protective devices for electric circuits." BRITISH-THOMSON HOUSTON Co., LTD. Aug. 12th. (General Electric Co., United States.)

18,660. "Electro-medical apparatus." H. W. COX & Co., LTD., and H. E. DONNITHORNE. Aug. 14th.

18,661. "Electric signalling systems particularly for use in mines." STERLING TELEPHONE & ELECTRIC Co., LTD., & J. W. DUNGEY. Aug. 14th. (Addition to 13,062/14.)

18,677. "Telegraphy." E. C. R. MARKS. Aug. 4th. (Delany Foreign Co., United States.) (Complete.)

18,685. "Electric resistances." BRITISH THOMSON HOUSTON Co., LTD. Aug. 14th. (General Electric Co., United States.)

18,692. "Electrical step-by-step mechanism." I. H. PARSONS & A. E. J. BALL. Aug. 15th.

18,705. "Automatic switchgear and apparatus for electro-dynamic brake circuits." H. V. JAMES. Aug. 15th.

18,707. "Process for banding projectiles." S. O. COWPER-COLES. Aug. 15th.

18,708. "Process for coating metallic surfaces with lead." S. O. COWPER-COLES. Aug. 15th.

18,711. "Wireless telegraphy." W. C. WOODLAND. Aug. 15th. (Complete.)

18,713. "Electric batteries" G. FULLER, G. J. A FULLER, & L. FULLER. Aug. 15th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

16,840. CHANGE-OVER ELECTRIC SWITCHES. H. H. Berry and W. J. Markham. July 22nd.

16,841. COMBINED ELECTRIC SWITCHES AND PLUGS. H. H. Berry and W. J. Markham. July 22nd.

17,038. TELEPHONE SYSTEMS. K. E. Ericsson and G. W. Dahlström. July 24th. (July 26th, 1912.)

17,417. CIRCUIT ARRANGEMENTS FOR TELEPHONE SYSTEMS. Siemens & Halske Akt. Ges. July 29th. (July 30th, 1912. Addition to 10,685/13.)

17,480. MAGNET CORE FOR USE IN FERRARIS ELECTRICITY METERS. Landis and Gyr Ges. July 30th. (July 31st, 1912.)

17,583. OIL HIGH-TENSION ELECTRICAL SWITCHES. Akt. Ges. Brown, Boveri, et Cie. July 31st. (Aug. 19th, 1912.)

17,859. WIRELESS SIGNALLING. R. C. Galletti. Aug. 5th.

18,166. MEANS FOR DETECTING INFLAMMABLE GASES, ESPECIALLY ADAPTED FOR USE IN MINES. J. W. Manley & W. J. L. Sandy. Aug. 9th.

18,907. DYNAMO-ELECTRIC MACHINERY, AND CONDUCTORS THEREFOR. Siemens Bros. Dynamo Works, Ltd., & E. O. Kieffer. Aug. 20th.

20,230. ELECTRIC LIGHTING AND STARTING OF MOTOR ROAD VEHICLES AND OTHER MOTOR DRIVEN BODIES. C. E. Sims, Sept. 8th.

20,684. TIME DIALS FOR RAILWAY AND LIKE SIGNALLING. National Electric Time Co. & H. B. Swift. Sept. 13th.

21,193. COUNTER-WEIGHTS FOR PENDANT ELECTRIC LIGHT FITTINGS. J. M. Doughty & G. H. Gyton. Sept. 19th.

22,458. EAR CAPS FOR USE IN TELEPHONING. J. C. McGowan. Oct. 6th.

23,452. SHADE-SUPPORTING DEVICES. E. C. R Marks. (Benjamin Electric Manufacturing Co.) Oct. 16th.

26,592. ELECTRIC HAND-LAMPS. A. Schrader. Nov. 19th.

26,646. VOLTAGE AND OUTPUT REGULATORS FOR DYNAMO-ELECTRIC MACHINES. T. Ferguson & J. R. Johnstone. Nov. 20th.

26,764. FITTINGS FOR ELECTRICAL CONDUITS AND METHOD OF MANUFACTURING THE SAME. J. R. A. Hemming. Nov. 21st.

27,746. COMMUTATORS FOR DYNAMO-ELECTRIC MACHINES. H. Mensforth. Dec. 2nd.

1914.

560. PROCESS FOR STARTING INTERNAL-COMBUSTION ENGINES. R. Bosch (firm of). Jan. 8th. (April 26th, 1913.)

1,550. MANUFACTURE OF REDUCTION PRODUCTS OF SULPHUROUS ACID AND SALTS THEREOF. Chemische Fabrik Griesheim-Elektron. Jan. 20th. (May 2nd, 1913.)

2,408. ARRANGEMENTS FOR LOADING ELECTRIC INDUCTION FREQUENCY CONVERTERS. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke Ges.) Jan. 29th.

4,356. WATT-HOUR INDICATING MAGNET MOTOR METER. Allgemeine Elektricitats Ges. Feb. 19th. (March 11th. 1913.)

5,514. STARTERS FOR ELECTRIC MOTORS. Siemens Bros. Dynamo Works & E. Schupp. March 4th.

6,628. AUTOMATIC OR SEMI-AUTOMATIC TELEPHONE INSTALLATIONS. Siemens & Halske Akt. Ges. March 16th. (June 18th, 1913.)

7,437. APPARATUS FOR WINDING LAPPINGS, WIRES, OR THE LIKE, UPON RING-SHAPED COILS OR OTHER BODIES OF SIMILAR SHAPE. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.) March 24th.

7,685. CONTACTS FOR ELECTRIC SWITCHES. R. Bosch (firm of). March 26th. (Feb. 21st, 1914.)

8,025. APPARATUS FOR ACTUATING VALVES, SWITCHES, OR THE LIKE AT PREDETERMINED TIMES. A. C. Frost and A. C. Wright. March 30th.

8,711. STARTING OF ROTARY CONVERTERS. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke Ges.) April 6th.

8,814. ELECTRICALLY-HEATED INSTRUMENTS. J. A. Chapman. April 7th. (May 6th. 1913.)

8,889. MOTOR-STARTING SWITCHES, RHEOSTATS, AND THE LIKE. Siemens Bros. Dynamo Works, Ltd., & E. Schupp. April 8th.

10,170. ELECTRIC INCANDESCENT LAMPS. C. Ficq. April 24th.

11,309. SUPPORTS FOR OVERHEAD CONDUCTORS FOR ELECTRIC RAILWAYS. British Westinghouse Electric & Manufacturing Co., Ltd. (Westinghouse Electric & Manufacturing Co.) May 7th.

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THE

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Vol. LXXV.] CONTENTS: September 4, 1914. [No. 1,919.

	Page
The War and British Electrical Industry	321
German Exports	322
Rubber	322
British Trade in Australia	323
West Indies and Cables	323
Some Notes on the Electric Vehicle Equipment of the London Fire Brigade (*illus.*) (*concluded*)	324
Cinder Removal at New York Power Stations (*illus.*) ...	325
New Electrical Devices, Fittings and Plant (*illus.*)	326
War Items (*illus.*)	328
Correspondence—	
Panama, Berlin and Fraternity	332
British (?) Firms: a Suggestion	333
Wireman or Electrical Fitter?	333
What Constitutes a British Firm?	333
Business Notes	334
The British Thomson-Houston Co.'s Works (*illus.*)	335
Balderton Electric Lighting (*illus.*)	338
Notes	341
City Notes	345
Stocks and Shares	345
Market Quotations	346
Reviews	347
British Association—	
Irrigation Dams and Hydro-Electric Power (*concluded*) ...	348
The Limiting Conditions for the Safe Use of Electricity in Coal Mining	350
British Trade in Australia	350
Electric Furnaces and Electric Steel Production	351
New Patents Applied For, 1914	352
Abstracts of Published Specifications	352
Contractors' Column ... ... Advertisement page	xviii

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THE WAR AND BRITISH ELECTRICAL INDUSTRY.

DURING the last few weeks we have received a number of communications, intended for publication, respecting electrical and allied firms carrying on operations in this country. Some of them have been unaccompanied by the writers' names, and these we accordingly put aside. Others have asked questions relating to particular companies, and while it may be that there is some justification for the implication they seek thus to make, we prefer in such a connection to have statements of fact rather than suggestions. Several of the communications appear in our "Correspondence" pages to-day.

Clearly the international upheaval that is in progress at this moment is going to have many other consequences besides alterations on the maps. The affairs of firms appearing to be British manufacturers are being very searchingly examined in these days of war, and the facts brought to light will be remembered in days to come. Questions are being asked in Parliament, in the Press, and amongst the public as to the extent to which certain firms may be regarded as British. One of our correspondents advances a suggestion which we commend to the attention of the British Electrical and Allied Manufacturers' Association. Doubtless that organisation, either officially or through its members, knows better than anybody else the extent to which firms connected with the trade are under British ownership and control, and how far they are under the influence of alien enemies or alien capital. From an answer given by Mr. Runciman in the House of Commons on Monday last, respecting the well-known firms of Siemens and the large German holding of the capital therein (referred to in our "War Items" to-day), it will be seen that the general position of limited companies in this country which are controlled by alien enemies is at present receiving attention at the hands of the Government. Messrs. Siemens Bros. & Co., Ltd., have issued a statement to the effect that they have made a special reference to the Government, and have received a most satisfactory reply as to carrying on their business as usual. We may know more as to the result of the Government investigation before we go to press, but it seems to us that the present is pre-eminently a suitable moment for the B.E.A.M.A. to place its special knowledge at the disposal of the Government and the public, for it is not possible to ascertain the extent to which any particular business connected with the electrical industry is British without something in the nature of special knowledge.

We venture to suggest to some of our correspondents that there is a danger in jumping to the conclusion that everything and everybody with a German name is of German sympathies, and has interests and connections amongst our present enemies. It is also a question for consideration how far

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works giving employment to thousands of British workmen should be considered German because the shares are held by aliens resident here or in the countries with which we are at war. Let it not be forgotten that German Industrial Banks (which, however, have no counterpart here), owing to their constitution and ability, have long assisted industrial enterprises more readily than British Banks. One of the great objects of the Patents Act of 1907, too, was to compel foreigners to engage in manufacturing operations here. We have no doubt that the Government which has inspired such confidence everywhere by its conduct of affairs since war broke out, may be trusted to adopt a reasonable and appropriate course of action respecting such concerns for the period of the war, and to see that profit on Government contracts does not find its way to Germany.

We are aware that while many electrical firms are working at full pressure, or are short-handed, others are temporarily inconvenienced, and there are not wanting those who think that it would assist recruiting to close down operations to some extent instead of our trying to keep all workmen employed. Some engineering firms have actually dismissed all their single men, giving them an undertaking to keep places open for all who serve under the colours. Unfortunately there is already much unemployment, and we shall do well not to add to it unless for supreme national reasons it is necessary to do so.

The Government has already ruled in its stipulations respecting trading with the enemy that the important thing to consider is where the foreign trader resides, and carries on business, and not the nationality of the foreign trader. "Consequently, there is, as a rule, no objection to British firms trading with German or Austrian firms established in neutral or British territory. What is prohibited is trade with any firms established in hostile territory." Further: "If a firm with headquarters in hostile territory has a branch in neutral or British territory, trade with the branch is (apart from prohibitions in special cases) permissible, as long as the trade is *bonâ fide* with the branch, and no transaction with the head office is involved." It remains to be seen whether and how far the Government, as the result of its present investigation, will see fit to amend the terms of its proclamation.

It is very satisfactory to note the progress that is being made with the Prince of Wales's Fund. We will not, however, in expressing our satisfaction, attempt to conceal our regret that cases are not unknown of electrical and allied firms who, after giving generously to this fund, have reduced wages and salaries. The dismissing of men and the reduction of wages are measures to be strongly deprecated, save in cases of absolute necessity; and these of which we hear certainly cannot be described as such. It is reported in several papers that British electrical manufacturers have already secured about a million pounds' worth of contracts which have been cancelled with alien firms. It is unlikely that such work has been undertaken at unprofitable prices—why, then, make the workers suffer?

German Exports.

On page 330 we publish an analytical statement of the exports of electrical goods from Germany, which we have had specially prepared, and which should be of considerable interest to British manufacturers at this time. We print also a map, similar to that published in our issue of August 14th, showing broadly the principal markets to which the German manufactures are consigned.

In comparing this with the map previously published, the reader should bear in mind that the figures for German exports relate to *the whole of the year* 1912, whilst in the case of the British exports the *average monthly* figures for the current year are given. It will be seen that there is abundant scope for British enterprise, especially in Russia and Italy, both friendly European countries; in South America; in Japan; and in the British Empire itself.

While the United States is also in a position to manufacture for export, its competition is at present hampered by the lack of transport facilities, for the American mercantile marine is of inconsiderable dimensions and is largely occupied in coastal trade; moreover, a large proportion of the German exports has been carried in British ships, most of which are at the disposal of our trade. Good prices can be obtained in the absence of German competition, and if the opportunity is seized our industries should reap a rich harvest.

Rubber.

As was only to be expected, business in the rubber market has been conducted upon a very narrow basis during the last few weeks, and, indeed, for the earlier part of the month things were in a state of suspense. The prime consideration was, of course, the extent to which supplies would be interfered with from the East. At the end of July the stocks of plantation rubber in London totalled about 3,200 tons, and it was not lost sight of that this was only a very moderate quantity for the trade to take hold of, should it happen that there was a protracted withholding of supplies from the East.

That this consideration acted as a stiffening factor goes without saying. The periodical auctions, which were suspended for a time, were resumed last week, after an interval of nearly a month, and the market was watched therefore with an unusual amount of interest. The total quantity on offer was small, only about 380 tons, of which some 300 tons were of Malay production and the remainder from Ceylon, and the main feature which aroused comment was the exceedingly small supply available of the fine crepe sorts. It appeared that during the period when the auctions were suspended, there had been a capital demand for this description, and the quantities which could be dealt with were mostly disposed of on private terms. Otherwise the assortment of rubber on offer was rather poor, and competition none too brisk.

There was a pretty encouraging inquiry recently for the United States, and at times spot parcels displayed a considerable amount of firmness, but as soon as the buying on this account fell away the market at once took on an easier appearance. It may seem strange, under trade conditions, that the American demand should have attained any proportions until it is remembered that the United States took fright over the war, importers and consumers being afraid that their supplies from the East and from Brazil would be cut off by the paralysis of the world's carrying trade by sea, owing to the war, and also by the impossible position of the foreign exchanges. This was responsible for a jump of a sensational character in the American price, and Ceylon rubber for the first time on record went in America to over fine Para—the advance being 100 per cent., with few sellers even at that remarkable appreciation. The rise was followed, however, by a big fall. There is a decided shortage in the available stocks of rubber in the United States, and responsible organs across the Atlantic have been preaching prices even higher.

If the seas can be cleared of piratical German cruisers masquerading as peaceful liners, the position should at once assume a different complexion, and as it is, the situation has cleared considerably. The United States, of course, has to import every ton of rubber which it uses, and is particularly fond of the Brazilian product, the output of which is

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falling off, being last year 42,000 tons, and estimated this year at 39,000 tons. Nevertheless it must be recognised that the prices recently ruling in America are quite artificial, and that a resumption of values more in accord with the actual position is assured with improved shipping and financial facilities.

A cable received by the Malay States Information Agency from the Colonial Secretary, Singapore, states that the exports of plantation rubber during July amounted to 1,584 tons, compared with 1,480 tons in June last and 1,120 tons in July last year. The total exports for the seven months amount to 10,090 tons, against 5,938 tons in the corresponding period last year.

British Trade in Australia.

A report on the trade of Australia for the year 1913, by Mr. G. T. Milne, H.M. Trade Commissioner in Melbourne, has just been issued by the Board of Trade. Both imports and exports in 1913 show a slight decline as compared with the figures for 1912, but the Trade Commissioner holds that conditions are prosperous, and that the outlook is generally favourable to further expansion of trade. The report, which gives a review of the trade in particular classes of goods, and discusses generally the main features of the trade position, should be of interest to firms trading, or desiring to trade, with Australia. On another page we print certain extracts from the report of more particular interest to our readers. It will be sufficient to refer here to one or two broad questions raised. In the first place, Mr. Milne apparently considers that the next few years will witness a growth of American trade with the Commonwealth. The revision of the American tariff whereby wool and meat are placed on the free list, the increase in shipping facilities between the Pacific seaboard of the United States and some of the ports of the Commonwealth, and the advantages that will be conferred on the manufacturers in the Eastern portion of the United States by the opening of the Panama Canal, are all-important factors favourable to the development of the trade of the Commonwealth with that country. In view of this fact, the Trade Commissioner advises increased activity on the part of British manufacturers, and suggests a visit of a number of manufacturers representative of British industries similar to that recently paid to Australia by representatives of the National Association of Manufacturers of the United States. The total imports into Australia in 1913 amounted to £77,248,000, but a considerable deduction must be made from this total in order to arrive at the total of competitive trade (*i.e.*, trade from which the United Kingdom is not able to compete). The details of this deduction for 1913 are not available, but in 1912 it amounted to £17,000,000. The proportion of the imports of competitive merchandise supplied by the United Kingdom was 62·58 per cent. in 1912; the respective proportions supplied by United States and Germany were 11·76 and 11·42 per cent.; and it is noticeable that while the British percentage, though higher than in 1911, has decreased from 63·61 per cent. in 1909, the American percentage shows a steady increase. Dealing with the question of preference, Mr. Milne points out that "there exist not only a fiscal preference but also what may be termed commercial and sentimental preferences in favour of the Mother Country," but adds that although in some cases buyers may be prepared to pay a higher price for the British-made article, it is not advisable for our firms to count too much on this factor. As regards the fiscal preference, he touches lightly on the vexed question of the neutralisation of the advantage of preference to British goods by the lower freight rates from foreign countries, observing that this circumstance, combined with certain others, may be taken to explain the fact that in metals and machinery, notwithstanding the preference, our foreign competitors have materially increased their relative and actual positions. Though the report is short, it gives a useful summary of the present position in Australia, with some hints as to the methods by which British trade with the Commonwealth may be improved. It is of particular interest at this juncture, having in mind the important trade which Germany has been able to work up and which she will now certainly lose, that trade in electrical goods is by no means the least important part of Germany's total; and in view of the prosperity existing in Australia, and the extensive electrical work under way, some in German hands, our firms should find a particularly valuable field in that Dominion.

West Indies and Cables.

Some considerable time has elapsed since the famous Ottawa Conference took place, when questions of trade and commerce, as well as of communications between Canada, Great Britain and the West Indies were fully discussed and various resolutions passed. It is, therefore, somewhat of a relief to know that a definite step has been taken and progress registered. The agreement between His Majesty's Government, the Government of the Dominion of Canada, and the West India and Panama Telegraph Co. has just been published as a White Paper, the House of Lords having approved the agreement on August 12th.

A substantial reduction of rates has been secured, and the differential treatment of the route afforded by cables laid between Jamaica and Halifax, Nova Scotia, has been abolished, but we regret that apparently nothing has been done to secure an all-British connection to the British Islands beyond Jamaica. Generally, the Governments are to be congratulated on having concluded a very advantageous contract, as, having in view the restricted traffic ground, the important reductions of rates secured for both local and general business cannot lead, in our opinion, to an increased revenue sufficient to meet the consequent loss. The giving of additional subsidies is, therefore, quite justifiable, but whether they be sufficient remains to be seen, particularly as after the fourth year they become merely traffic guarantees.

It would appear that for the purposes of the guarantee the subsidy received from the Danish Islands is to be included in the gross revenue.

Perhaps the most important aspect of the agreement is dealt with in Clause 7, where provision is made that the chairman and the majority of the other directors shall be British subjects, and the West India and Panama Telegraph Co. shall not at any time be or become directly or indirectly controlled by foreigners or a foreign corporation. It is a very wise provision, and we think the drafting of this clause might well have been even more drastic. It might have provided, in view of even British directors being possibly substantially or mainly interested in foreign-owned or controlled concerns, that anybody was barred from serving in the capacity of director or other official who by way of salary, directorship, agency or in any other manner, was interested in undertakings of a similar nature controlled by foreign corporations or persons. Nobody will deny that in view of the present political situation, this is a very serious question, and personalities should not be allowed to weigh in the matter, for a dependent or servant of a foreigner must either do as he is told or leave, and no man would be human if his inclination did not stray in the direction either of his major interests or of his living. We particularly deplore that foreign directors should be permitted on the board of a company looked upon as "British," for they would acquire important knowledge of Government requirements with full liberty of communicating them to other Governments. Little purpose would be served by asking them to resign in the event of war, for by then the damage would have been done. In our opinion, the affairs of such undertakings as the West India and Panama Telegraph Co., or any other company or undertaking upon which the safety and well-being of our Colonies and the Empire depend, should be managed and controlled by British subjects, uncontrolled by and not interested in a foreign or foreign-controlled business or person, and a representative of the particular Government Department interested should be specially appointed to the board to see that the Empire's interests were absolutely safeguarded.

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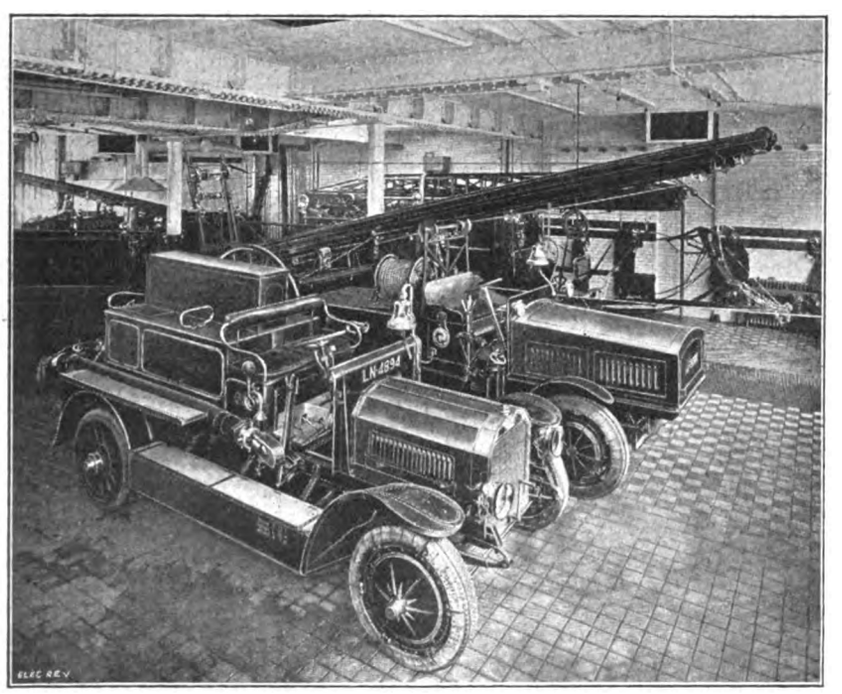
SOME NOTES ON THE ELECTRIC VEHICLE EQUIPMENT OF THE LONDON FIRE BRIGADE.

(*Concluded from page* 297).

The conditions of fire brigade work in London being entirely different to those existing in Berlin, it would be impossible to make any useful comparison with the running and maintenance costs of the vehicles in the German capital, as shown in our issue of August 14th, even if corresponding figures were available for the metropolis.

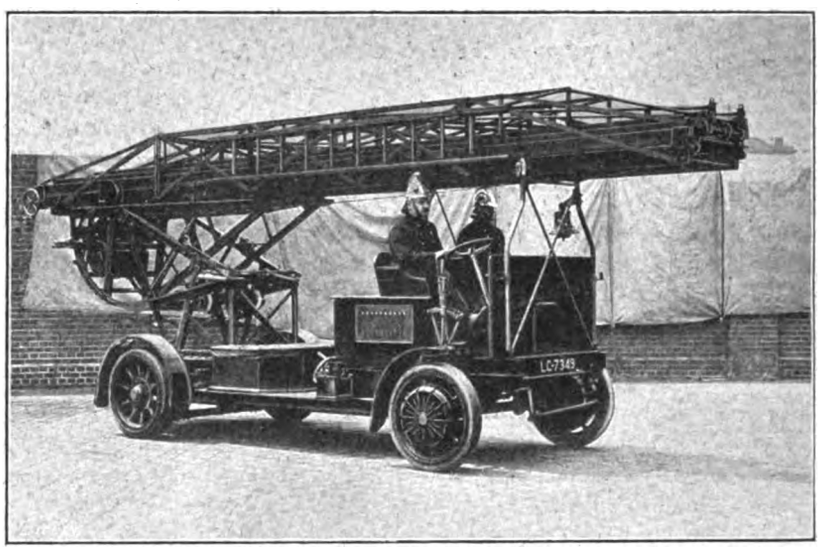
From the figures prepared last year by Mr. Dyer, we learn that the average annual cost of an electric escape van, under the heading of repairs to chassis and body, and tire renewals—the figures for each not being separately available—is £25. It may parenthetically be stated that so far the tire bill, owing to the relatively small mileage that has been covered, has been practically *nil*. Allowing £8 per annum for energy, and 3s. for oil and grease, the running and maintenance costs for an average mileage of 659 miles are £33 3s. per year. Taking the average first cost of the vehicle at £950, and spreading the depreciation over 10 years, plus interest on the outlay at 3½ per cent., there is an additional charge of £115 per annum, bringing the total costs per vehicle up to £148 3s. per year. This is Mr. Dyer's estimate of a year ago. At a meeting of the Institution of Electrical Engineers in March last, Lieut. Sladen, the Chief of the Brigade, put the annual cost of repairs, including battery renewals, at £40, which would increase Mr. Dyer's figure to £163 3s. Averaging, however, over the Brigade's whole fleet, the Chief considered that, taking into account the first cost, depreciation and maintenance, an electric escape-van and a petrol escape-van came out to practically the same running and maintenance cost, viz., £150 per annum.



Interior of London Fire Brigade Station, Cannon Street, E.C.

Comparing these figures with the cost of horse-drawn escape-vans, it has first to be mentioned that the London Fire Brigade owns no horses, but hires them from contractors at an average rate of £70 per annum per horse, this figure including bedding, fodder and harness, and the contractor taking all risks. On this basis, and taking the average cost of a horse escape-van at £65, Mr. Dyer works out the annual cost as follows:—Depreciation spread over 25 years, and interest at 3½ per cent., £3 15s. 8d.; repairs, £9; two horses at £70, £140; total, £152 15s. 8d. Thus, from the financial point of view, leaving out of account the increased speed and efficiency, there is a saving in favour of the electrical vehicle.

In the course of our article on the Berlin Brigade, we pointed out the futility of endeavouring to work out the running and maintenance costs of fire brigade vehicles, whether horse-drawn, steam, petrol, or electric, on a so-much-per-mile basis, the prime factor of importance being that such vehicles must be constantly in full working order, ready to answer calls at any time—calls that may come several times in one day, after which there may not be another for several days—the only possible way of getting any idea of the possible mileage being to strike averages for previous periods. So far as experience has gone, the average of electric escape vans has been about 659 miles per annum—with minimum and maximum figures of 400 and 800 miles—and of petrol escape vans, roughly, 522 miles. It was because of the relatively small mileage that Lieut. Sladen was led to remark, at the Institution meeting already mentioned, that "It would perhaps be a shock to those who thought they could run electric vehicles cheaply, when he told them that the vehicles in use by the London County Council cost about 1s. 1·3d. per mile to maintain, and that did not include the driver's wages, first cost, or depreciation. But perhaps the feelings of those gentlemen who expected to hear something more favourable would be changed when he said that for similar petrol vehicles the cost was about 1s. 3d. per mile." The great point is that, whether the mileage be 600 miles per annum or even less, the vehicles are always ready to respond to a call, and that while they are more efficient than the old horse-drawn machines they have superseded, their annual cost is less.



Cedes Electric Motor Turntable Ladder, with Hub Motors in Front Wheels.

On the point of efficiency, to those interested in electric vehicles it will be pleasant reading to learn that the officials of the London Brigade have no reason to regret the decision arrived at early in 1911 in favour of the adoption of electric escape vans and motor turn-table ladders. They report that among their advantages are the facts that the

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vehicles can be driven by much less skilled men than are required for petrol or steam machines, and that from the point of view of rapidity of turn-out they are absolutely unequalled by any other form of traction. The vehicle starts off at a good speed, and, owing to its high rate of acceleration, quickly attains its top speed, while the others require time to get fully going. It is no uncommon thing for an electric escape van to turn out in seven or eight seconds, whereas, with other types of motor vehicles, the best time is 15 seconds. As the runs usually only average half a mile this is a matter of considerable importance. Another important point in favour of the electric vehicle is the electric braking as an addition to the ordinary mechanical brakes. We are also informed that the vehicles are very rarely held up for repairs, and that the cost of the same, apart from the batteries, is much lower than for petrol vehicles, there being no clutch or gear box, while the torque is even, so that there is but little wear on the working parts.

The following table shows the present actual number of motor vehicles—electric, petrol-electric, and petrol—owned by the London Fire Brigade, and the number still required to complete the conversion of the equipment.

	Present equipment of London Fire Brigade.	Still required to complete conversion of Brigade from horse to motor traction.
Electric escape vans	11	32
„ motor turn-table ladders	4	23
Escape vans, petrol or petrol-electric	22	31
Petrol or petrol-electric motor fire pumps	31	63
Motor lorries	3	8
Motor tenders	6	—
Motor canteen vans	—	1
Motor smoke-fighting vans...	1	—
Motor cars	15	—
Total	93	158

At the present time, out of the 85 stations of the London Brigade, 19 are entirely equipped with motor vehicles, and 11 partially so. New motor vehicles are, however, continually being ordered by the London County Council, and as the Brigade becomes more and more motorised, it is evident that London will not only be provided with a more efficient fire-fighting equipment, but that this will be controlled from fewer centres than has hitherto been found necessary. Thus, at a recent meeting of the London County Council the Fire Brigade Committee reported that the 12 motor fire engines and 12 escape vans, which are to be acquired during the current financial year, would shortly be delivered, and that arrangements could now be made for closing three sub stations—at Chelsea, Rushey Green and Sydenham. Tenders were also recently invited for the conversion of three horse-drawn turn-table ladders to electric traction.

From the foregoing it will be evident that the London Fire Brigade, so ably controlled by Lieutenant Sladen and his officers, has not merely kept abreast of the times, but is well in advance of the same, its equipment of motor fire-fighting vehicles being without a rival in any part of the world.

CINDER REMOVAL AT NEW YORK POWER STATIONS.

A series of interesting articles appeared recently in our contemporar, *Power*, describing the difficulties met with by the New York Edison Co. in connection with the discharge of cinders from the chimneys of its Waterside stations, and the means adopted to cure the trouble.

The problem of catching the cinders in the flue gases had confronted the authorities for many years, and the various schemes tried with a view to solving it included the precipitation of the cinders by reducing the velocity of the gases, which proved futile; the use of settling chambers, baffles, screens and water sprays; and, finally, high gas velocity, with sharp changes of direction of flow, and impingement on films of water, &c., which has proved effective.

The load conditions of the Waterside plants are very severe; in April, 1907, a 54,000-kw. rise occurred during one hour, and recently the stations took on nearly 52,000 kw. in 20 minutes, resulting in the forcing of fires, increased draughts and great production of small cinders. Close observation of the wind conditions showed that 75 per cent. of the cinders emitted from the chimneys was blown into the East River, and therefore less than one-quarter of the total fell in the inhabited area from which complaints arose.

With the intercepting arrangement in use now, about 95 per cent. of the solid matter is removed. At the Waterside No. 2 station boiler house, 48 650-H.P. boilers are installed on each of two floors; blocks of six boilers—three on either side—are coupled to sections of flues 50 ft. long, there being eight such horizontal flues on each floor. The boilers are equipped with Taylor stokers and operate with forced draught.

Figs. 1 and 2 show the apparatus in position, and fig. 3 shows diagrammatically a section of flue fitted with the cinder catcher, which has been patented jointly by Messrs. Murray and Grady, of the New York Edison Co.; in this A A are the smoke connections from the boilers to the flue B, which has a combined baffle and trough C extending the entire length. Fitting closely to this baffle is a large movable damper D, extending the length of the flue, and ordinarily allowing a gap of from 3 to 6 in. at E for the gases to pass through. The damper is counterbalanced by weights F, and when it is raised, the link G controls the movement of the lower edge, so that sufficient area for the passage of gases is maintained above the water in the bottom and between the damper and flue side.

An 8-in. water pipe, H, extends along each trough, perforated with 1 in. holes spaced 4 in. apart along the bottom; the water in the bottom of the flue is circulated through these pipes, filling the troughs and overflowing in a sheet down the baffles D, back again into the flue bottom. About 75 gallons of water per minute per boiler is circulated, and about 8 gallons per minute per boiler is added to make up for loss by evaporation, sprays, &c.

The gases coming through A are deflected downwards by C, impinging on the sheet of water on D, and then pass through the wedge-shaped duct at the flue side at high velocity on to the water in the flue bottom; from 10 to 15 per cent. of the cinder is taken out by the water on the damper, and from 80 to 85 per cent. is removed by the water in the flue. It is estimated that the cinder is projected towards the water surface at about 50 ft. per sec.

The boiler capacity is not seriously interfered with by the cinder catcher; the position of the baffle is maintained so that the velocity of the gases leaving the baffle is the highest possible with the chimney draught obtainable, and, under normal conditions, with boilers operating at 110 and 150 per cent. rating, the baffle

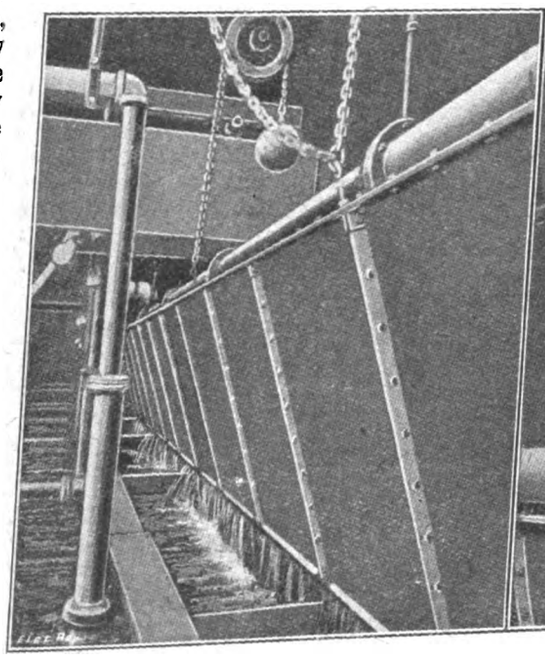

Fig. 1.—Damper and Flush Pipes.

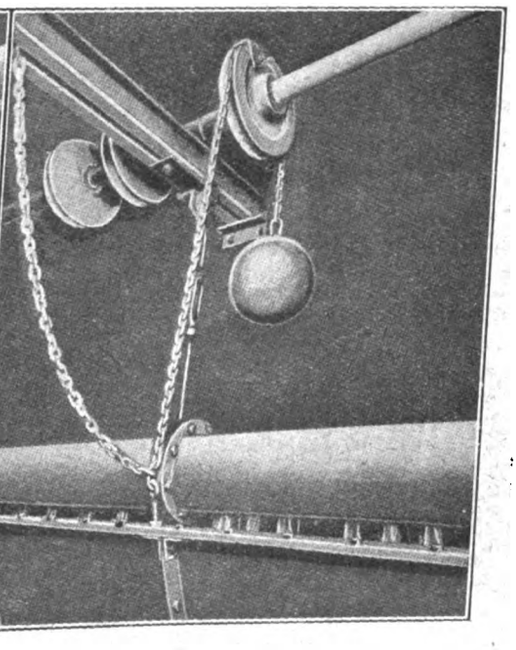

Fig. 2.—Weights and Water Main.

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opening would be 3 to 6 in., increasing to 14 in. at 225 per cent rating.

The gases at the Waterside stations contain about '06 per cent. sulphur dioxide gas, and sulphurous and sulphuric acids are formed by contact with the water; the latter in the flue tank contains about '025 per cent. of those acids and a small amount of hydrochloric acid.

These acids have given much trouble; a sheet-iron baffle was eaten away in two weeks, and with enamelled sheets the enamel cracked off owing to the heat. Asbestos board became soft, and a wire-glass baffle failed as soon as installed. Up to the present No. 8 gauge copper baffles, flanged and fastened with ⅝-in. copper bolts, the ends reinforced with 2½-in. copper bar, have given the best results, no deterioration being shown on the side over which water runs, and very little on the other side after several weeks' service.

The flues of ⅜-in. steel plate are painted inside and out with linseed oil and red lead, and have a lead lining ⅛ in. thick in the bottom forming the water tank. These cinder catchers reduce the solid content of the gases to '02 gr. per cb. ft., which compares favourably with the scrubbers and washers used for cleaning blast furnace gas.

The apparatus was made by the Metropolitan Engineering Co., Brooklyn, N.Y., and has been applied at other stations.

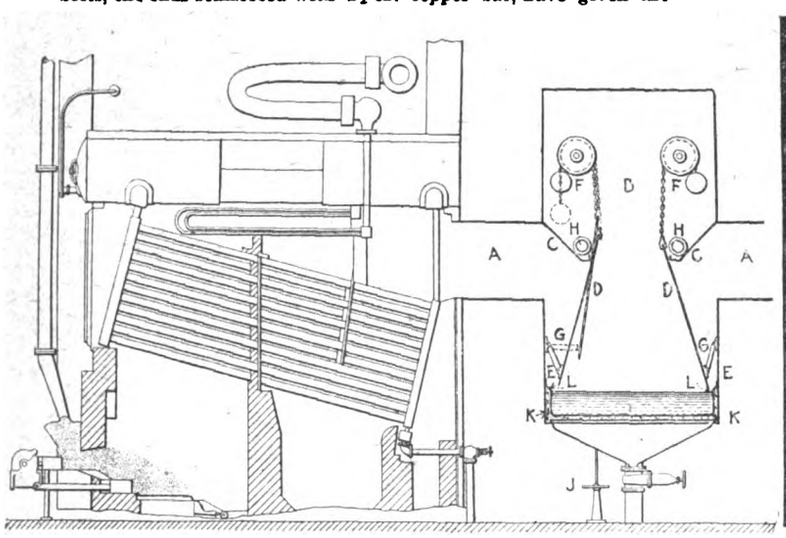

Fig. 3.—Section of Boiler and Cinder Catcher.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

An Electrically-driven Furnace-charging Machine.

A very interesting machine from the electrical as well as from the mechanical standpoint is the furnace-charging machine in a steel works, which lifts the charging boxes which have been previously filled with pig-iron or scrap and empties them into the furnace.

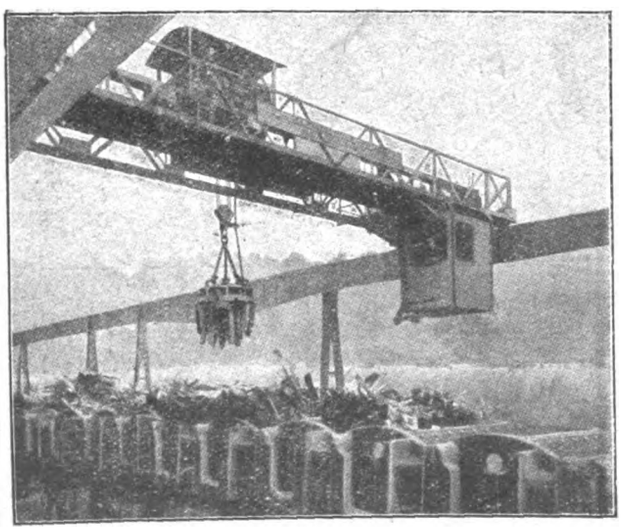

Fig. 1.—Charging Furnaces with Lifting Magnets.

A modern method of loading the charging boxes is by means of "Witton-Kramer" lifting magnets in the manner shown in fig. 1.

In fig. 2 a large horizontal steel bar may be seen on the left-hand side. This is carried by the charging machine and slides horizontally into sockets in the charging box. By slewing round the arm together with the box the charging machine traverses the length of the building, until it arrives opposite the particular furnace to be charged. The arm is then adjusted in height, and the box thrust into the furnace, upon which the bar is revolved through 180° and the contents emptied into the furnace. On the completion of this operation the bar is withdrawn, together with the emptying box, slewed round and the process repeated.

There are in all seven motions, and although the duty imposed upon the machine is heavy—the loaded charging box weighing as much as three tons—the motions are fairly slow, and motors of no great size are needed. The following gives the sizes of the motors and the speeds of the operation:—Hoisting, 20 H.P., at 40 ft. per min.; cross traverse, 40 H.P., at 220 ft. per min.; long travel, 60 H.P., at 300 ft. per min.; slewing, 10 H.P., at 6 revs. per min.; bar turning, 10 H.P., at 6 revs. per min.; auxiliary hoist, 10 H.P., at 20 ft. per min.; auxiliary traverse, 10 H.P., at 150 ft. per min.

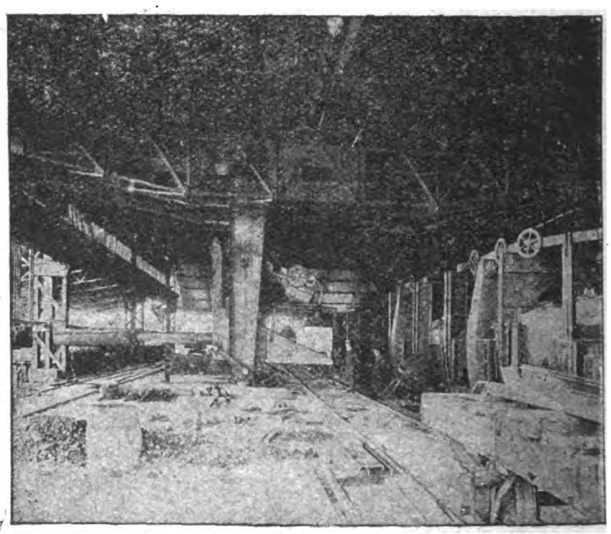

Fig. 2.—Electrical Furnace-Charging Machine.

The charging machine illustrated was constructed by Messrs. Wellmann, Seaver & Head, of 47, Queen Victoria Street, London, E.C.; the motors were supplied by the General Electric Co., Ltd., of Witton, Birmingham, whilst the lifting magnet was manufactured by the Witton-Kramer Electric Tool and Hoist Co., for whom the General Electric Co., Ltd., are sole selling agents.

Sliding Contact Resistances.

The accompanying illustrations show one of the sliding contact resistances introduced by Messrs. Micklewright, Ltd., of Well Works, Alperton, Middlesex. These resistances consist of a vitreous-enamelled steel tube, which is wound with high-temperature enamelled resistance wire. Contact is made on the wire with a laminated copper brush, guided on two rods, the latter ensuring that the brush shall not be over-strained. The regulation which may be obtained is very gradual and accurate. The apparatus is

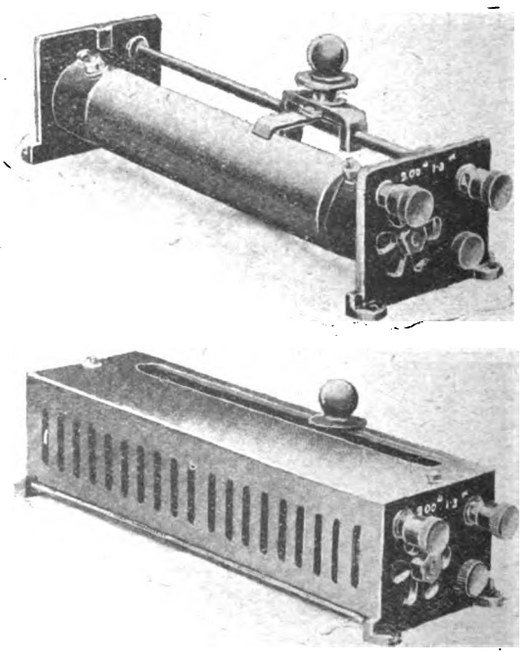

Fig. 3.—Micklewright Sliding Contact Resistance, with and without cover.

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well ventilated, and light in weight, and all live parts are enclosed. The insulation is fireproof throughout, and the device is neat and compact in appearance. Six sizes are made, varying in capacity from 9½ amperes at 7½ ohms, to ½ ampere at 2,000 ohms. They are in use for the regulation of speed of small motors on kinematograph projectors, dimming lamps, testing, charging small cells, cautery, and similar purposes where fine regulation of small current is required.

Neutral Point Earthing Resistance.

Messrs. Ferguson, Pailin & Co., of Edward Street, Higher Openshaw, Manchester, have recently completed for the Bradford Corporation electricity department a neutral point earthing resistance, which we illustrate in fig. 4.

This resistance was built for the 6,600-volt three-phase system, and allows 500 amperes to pass to earth for three minutes without injury, the resistance being 8 ohms, so that the power dissipated is approximately 2,000 kw. for three minutes.

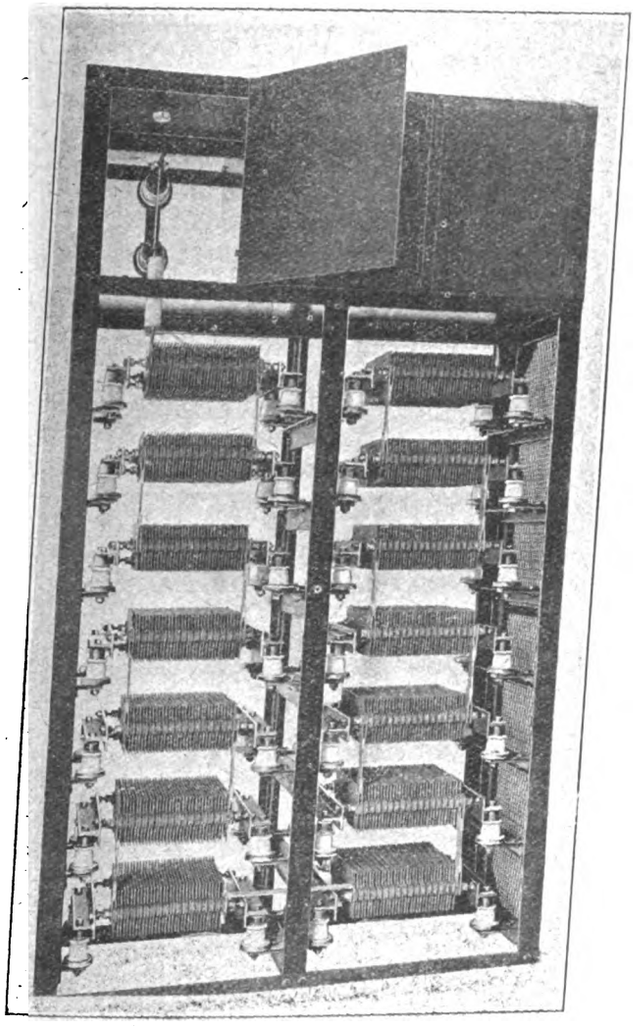

Fig. 4.—Neutral Point Earthing Resistance for Bradford Electricity Department.

The grids are of cast-iron and are supported on three mica insulated steel rods; the centre rod prevents buckling, a defect which many grids, supported in two places only, are subject to. Each bank of grids is carried on lengths of tee-iron, which are supported on porcelain insulators.

The insulation between grids consists of mica washers. The grids are slotted so that if it is required to replace any one of them it is only necessary to slacken the bolt and put in the spare grid.

The complete resistance is divided into halves which are placed in parallel, and isolating switches are provided at the top in completely enclosed chambers, for selecting the alternator to be earthed.

"Eye-Rest" Wall Bracket.

One of the latest applications of the B.T.H. "Eye-Rest" system of indirect lighting takes the form of ornamental wall-brackets carrying flambeaux, each of which is fitted with a small X-ray reflector and a 40-watt Mazda drawn-wire lamp; the light is thrown upon to the ceiling in the same way as with the ordinary bowl fitting. The lamps and reflectors are invisible from the ground. These brackets can be had in several period designs, with one, two, or three arms. Particulars can be had from the British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, London, E.C.

"Dim-a-lite."

The Wirt Co., of Germantown, Philadelphia, U.S.A., whose agents in this country are the Benjamin Electric, Ltd., 1A, Rosebery Avenue, London, have placed on the market a neat little dimming attachment, known as "Dim-a-lite," for use in conjunction with the glow lamp. It consists of a small rheostat which is inserted into the lampholder, while the lamp is fixed in a bayonet holder under the device; by pulling a small cord attached to it resistance steps are inserted and the light may be used either "full," "dim," "low," "night light," or may be put out.

The "Dim-a-lite" device is manufactured regularly for 110 and

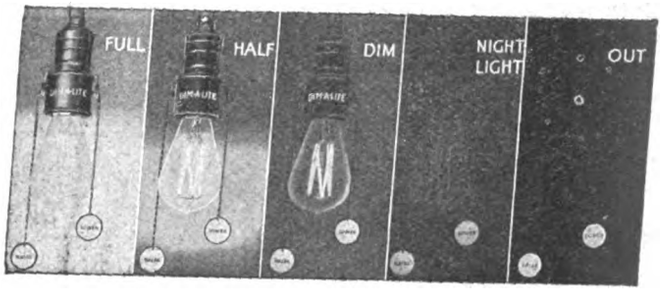

Fig. 5.—The "Dim-a-lite" in Use.

220-volt supply, either A.C. or D.C., and either of these types successfully operates with a range of pressures over and under those mentioned. The device is claimed to save from 20 to 70 per cent. in energy consumption, is easily attached and has been approved by the American Fire Underwriters. It can be fitted to a bracket lamp and operated by turning the shade if desired.

E.A.C. Ironclad Switchgear.

For the last 12 months the Electrical Apparatus Co., Ltd. of Vauxhall Works, South Lambeth Road, S.W., has been developing a new type of ironclad switchgear to comply with the new Mining Regulations, but at the same time to be of such a form that it can be used for central-station work where a more robust type of gear is required than the slate or marble panel type usually installed. Sample pillars are already working in some of the largest collieries in the country, and have proved satisfactory in service, so that the apparatus is already well past the shop

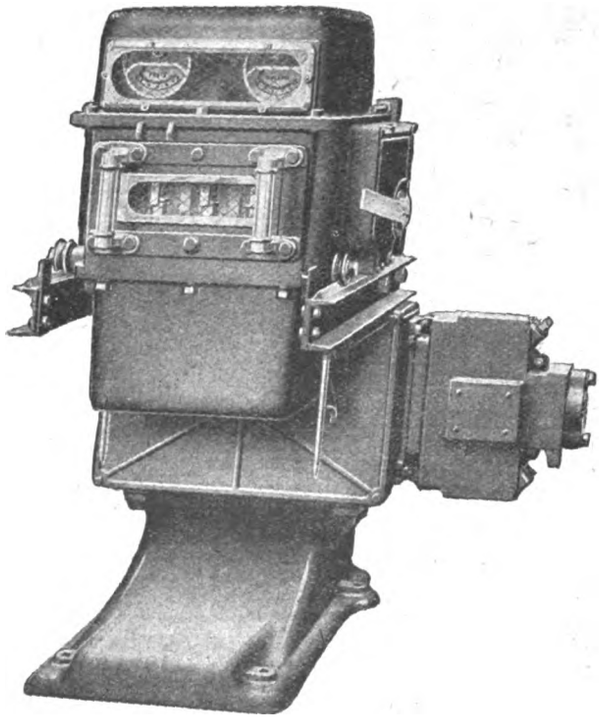

Fig. 6.—E.A.C. Ironclad Switch Pillar, Type C.

experimental stage. As shown in fig. 6, the whole of the electrical gear is contained in a cast-iron casing, no sheet steel being used for this purpose; the only exception is that two small inspection windows are fitted with thick wired glass; behind one of these the meters are mounted, and the other gives a view of the overload trip scales. The whole of the joints in the casing consist of broad machined faces 1½ in. wide which bed together without any packing; the gear may therefore be termed flameproof as well as oil immersed. The complete pillar is supported on a heavy cast-iron base, a portion of which forms a level stand immediately below the oil tank, so that the latter can be lowered directly on to this while inspection of the contacts, &c., is being made. Immediately above this pedestal is bolted the bus-bar and isolating switch chamber. This also carries rails on which the switch runs when being isolated. The bus-bars are of drawn copper rod, insulated throughout with mica. Connections from these bus-bars are made to three switch jaws above, with which the isolating plugs of the switch engage when the latter is

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in position. Above these three jaws is a further set of jaws to which are connected feeder cables controlled by the switch. These isolating jaws are again insulated throughout by mica. The bus-bar and isolating chamber is covered by a removable cast-iron front having six holes, through which the switch isolating plugs pass, and a hinged cover for these is provided, on which are cast the words: "Danger. Close door when switch is away."

When in position the switch is supported on the rails mentioned above, and stands immediately in front of the isolating chamber. It is provided with rollers which make running easy; a 6,000-volt switch can easily be withdrawn from the isolating plugs by one man. While open air spaces inside have been avoided, ample room is provided for making adjustments and repairs, &c.

The insulation of the switch is mica throughout, even to the isolating plug connectors, which pass through the switch casing in a mica sleeve and are clamped to the case by a special packing gland. This is a great improvement over the usual method of cementing the connectors into porcelain insulators.

The switch contacts can be either of the laminated brush type with butt arcing tips bedding on to stationary copper blocks, or "V"-shaped solid copper contacts bedding on to laminated stationary contacts with arcing tips, as preferred. Either the "main" or "arcing" contacts can be removed without disturbing the others. The oil tank is wood lined, and wood separators are fitted between the phases. The overload trips are mounted directly on the main conductors, thus obviating the use of current transformers. Each trip is entirely independent of the others and of the no-voltage trip, but all operate on the same tripping bar. The overload trips are, of course, adjustable, and time lags can be fitted if desired. The arrangement of the trip gear is such that all trip coils can be fitted on to the load side of the switch; thus the no-

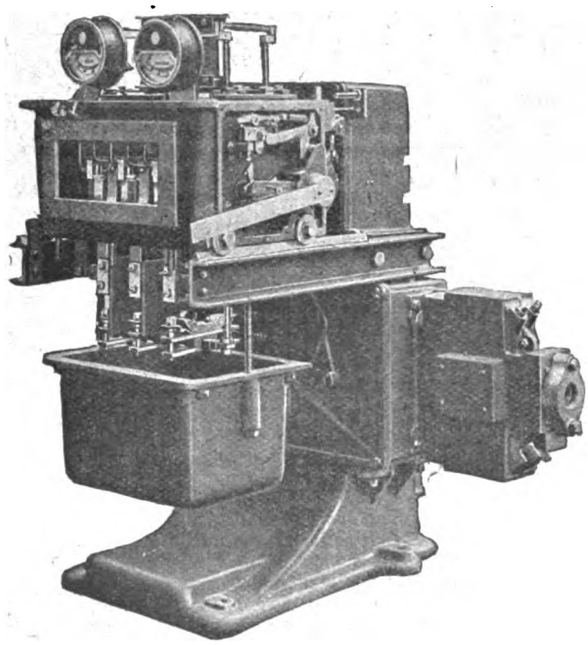

Fig. 7.—Ironclad Switch with Covers Removed.

voltage trip circuit is not broken on the isolating plugs. The tripping bar passes through the switch casing to a separate self-contained trip mechanism chamber on the right-hand side of the switch. This chamber contains no live parts, and is not interlocked with the other covers (see below); thus the tripping gear can be cleaned and adjusted without isolating or even opening the switch. The trip gear is loose handle, and a trip control lever is provided with "off" "automatic" and "non-automatic" positions. It can be left in the two former, but has a spring return to the automatic position from the non-automatic. If this trip lever is in the "off" position the switch cannot be closed, as it will trip before the switch contacts engage. The switch can be opened either by the trip control lever or by the main operating handle. The instruments are mounted inside the switch case, the voltmeter being provided with a reducing transformer and fuses on voltages above 650. The ammeter, like the overload trips, however, is mounted directly on the main conductors. Double interlocks are provided, that is to say, no portion of the switch casing (with the exception of the covers of the trip mechanism chamber mentioned above) can be removed if the isolating plugs are engaged, and the switch cannot be pushed back into the isolating chamber if any cover is off. These interlocks have purposely been placed in the most inaccessible positions so that they cannot be "fooled." The switch, of course, can only be withdrawn or placed in the isolating chamber if it is in the "off" position. The oil tank is provided with lowering screws. Arrangements are made so that the cables can be brought in or taken out in any direction.

The sizes at present placed on the market range up to 500 amperes on low pressure and up to 6,000 volts on high pressure.

A large stock of parts is being kept in order to effect prompt deliveries. The gear, although primarily for mining work, is suitable for the control of the high-pressure side of rotary converters, &c., in sub-stations.

Stamped Steel Pulleys.

Messrs. W. A. Walber & Co., of 38, Victoria Street, Westminster, send us particulars of their British "Keystone" all-steel stamped pulleys, of new design, which are guaranteed to run dead true on the shaft; the arms are fixed into the hub and rim in such a way that when the pulley is tightened up on the shaft the contour is not affected in any way. All the parts are carefully annealed. The bushes being of stamped steel are lighter than solid bushes, and are interchangeable, and the driving torque is distributed equally over all the arms. The pulleys are made in a great variety of sizes, from 6 in. in diameter × 3 in. wide, up to 30 in. × 9 in. wide, or 24 in. × 12 in. wide, the larger sizes being provided with double arms. No key-way is required.

WAR ITEMS.

Carbon Manufacture.—In view of the interesting position that the war has forced us into in connection with British-made carbons, it may not be out of place to remind our readers that at different periods during the last 30 or 40 years attempts have been made to carry on the manufacture of carbon rods for electric lighting purposes in this country. Though these efforts have had to be abandoned for various reasons, the matter possesses particular interest at the present time; it will be remembered that the owners of the Witton carbon works have incurred in connection with them during the past 12 years a loss of £70,000 or £80,000. Among the attempts referred to was that of the India-Rubber, Gutta-Percha and Telegraph Works Co., which dates back to 1878, and covered both carbon plates for battery purposes and carbons for lighting. The plant installed for the manufacture of these at that date is still in existence, and though devoted to the production of plates it could, no doubt, easily be brought into operation again if the market price of the product justified it. Some five or six years after the company began its carbon-making operations severe price-cutting was carried on by American firms, who, later, were themselves driven out of the field by the Austrian and German makers. Through all these years—very trying ones from the British point of view—the Silvertown company continued its operations with a diminishing output of carbons for lighting service. The remaining section of this class of the business disappeared in 1893, when British selling developments brought British as well as Continental price-cutting competition, and since then the factory has been devoted entirely to plates for batteries.

Names of Makers or Suppliers Wanted.—The Board of Trade have received a very large number of inquiries for names of sellers or buyers of articles of which the sources of supply or markets have been interfered with by the war. Special arrangements have been made in the Commercial Intelligence Branch of the Board (73, Basinghall Street, E.C.) for dealing with the inquiries, and lists are being prepared and circulated of articles which inquirers desire (*a*) to purchase and (*b*) to sell. The first lists are now ready and may be obtained on application to the Branch. Firms interested in any of the goods mentioned, either as buyers or sellers, should communicate with the director. An enlarged sample room will also be established very shortly for the purpose of exhibiting samples of German and Austrian or Hungarian goods or materials which have competed with British products at home or abroad, especially those which are necessary for the continuance of British manufacture, but which it is now impossible to obtain from their previous sources. Firms who may wish to exhibit goods are invited to make application to the Branch. It should be expressly understood, however, that the exhibition is intended exclusively for samples of goods which have formerly been obtained in Germany and Austria-Hungary alone, and which firms may now desire to purchase in the United Kingdom. Notice will be given of the opening of the exhibition. A catalogue library will also be opened, and firms who may not desire to exhibit samples are invited to furnish catalogues of goods formerly received by them from Germany and Austria-Hungary; these catalogues to be classified by trades in order to be readily accessible to inquirers.

In the list of articles which inquirers desire to purchase the following appear:—

Aluminium—Disks; powder; rods and sheets.
Asbestos—Fibre jointing.
Brassware—General.
China and earthenware—For electric fittings.
Electrical apparatus—Celluloid cases; enamelled copper wire; magnets; magnetos; papier maché covers; vulcanite mouldings.
Fibre—Board.
Glass and Glassware, General—Blown glass; for electrical fittings; for optical instruments; heat-resisting.
Lamps—Carbons for; electric incandescent; globes for; glass bulbs and tubes for.
Lighters—Automatic.
Machinery for making electric lamps.
Paper—For Morse telegraphy.
Rubber—Thin gutta-percha.
Sheet Metal—Aluminium; brass; iron plates; zinc.
Vulcanite—Mouldings; rods and sheets.
Wire—Enamelled copper.

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Japan.—The Board of Trade has received the following information from H.M. Commercial Attaché in Japan:—"Chiefly owing to rapid buying the consequent rise in prices of accumulated stocks, and the special conditions resulting therefrom, payments have improved. The financial position is said to be fairly satisfactory, but it is difficult to say precisely whether regular payments will be possible in the event of the market becoming congested. H.M. Commercial Attaché is of opinion that the German Empire's large share of the trade is almost entirely due to excessive credit facilities, and although (presumably under ordinary circumstances) he would not consider such a course desirable, it may be necessary for British interests to extend credit facilities. Export trade is seriously disorganised owing to the stoppage of Continental purchases of silk and the big fall in prices in the United States. Transactions in habutae, braids, and in general export trade, are being very much interfered with on account of serious difficulties as to shipment and exchange, but the present position is slowly improving on account of assistance promised by the Japanese specie banks. Prospects for the rice crop are encouraging. The following are German or Austro-Hungarian goods with which British manufacturing interests should be able to compete:—Drugs (especially); galvanised iron wire, worsted yarns and electrical machinery. The iron and steel supply is calculated to suffice for six months; wire gauge No. 8 has advanced to £9 15s. c.i.f., and other gauges in the same proportion. Mild steel bars, round, basis sizes, have advanced by, roughly, 40 per cent., and sheets in the same proportion. The above prices are for stocks, and there is no forward business being carried on. There has been a very large rise in the price of drugs, especially santoninum, acid carbolicum, cocaine hydrochlor, morphia, German proprietary medicines. British manufacturing interests are strongly recommended to take advantage of the opportunity which must offer for the supply of enemies' goods, but it is absolutely essential that experts should pay a visit to Japan. The present stock of yarns is believed to be small, on account of the depression in the mousseline trade early in the year. There has been a 20 per cent. rise in prices of paper owing to the shortage in the supply of pulp and other necessaries for its manufacture. Domestic pulp is only suitable for newspapers. There has been no change of importance in the textile import trade. No better opportunity is likely to occur for the supply of dyes and malt if supplies are forthcoming. There has been a big rise in price of industrial chemicals and glass sheets. The greatest energy is being displayed by American firms, and Japanese firms will also take advantage of the opportunity."

Lancashire Notes.—Mr. Webber, who is connected with a large North of England firm interested in the sale of electric lamps and other lighting goods, was one of the chief speakers at a meeting of business men and publicity men which was held at the Grand Hotel, Manchester, on August 28th, for the purpose of discussing the business conditions and trading possibilities arising out of the war. The meeting had been convened by the Column Club, which embraces in its membership business men of all kinds and advertising men.

Mr. Webber said that his firm had been largely interested in the importation of German and Austrian goods into this country. Immediately after war broke out foreign supplies were cut off, and they were faced with the possibility of having to close down their business entirely. They were wanting supplies of a certain article, and he wrote to the firms in this country who were manufacturers in that line of business. There were six firms only, and five replied "full up." The sixth firm replied to the effect that they would be pleased to supply any sort or make of the article required. The quotation he afterwards received was 10 guineas per gross. The German price was 14s. per gross. ("Oh!") Manufacturers in this country, said Mr. Webber, were far too conservative. An instance of this was to be found in an experience which he had just had. He wrote to a large Birmingham firm from whom he wanted glass to replace the Austrian glass which, up to the present, had been reputed to be the best in the world for use in connection with lighting. The Birmingham firm said they would quote, and they did so. He offered them a big order, and received from them a reply that they were "full up," and that to fulfil the order would necessitate the manufacture of a special mould and special machinery, and they did not see fit to entertain the proposal. His reply to that was that he would be pleased to pay for the mould and the cost of producing the necessary machinery. The firm said they could not entertain it. Personally, he thought it was a great shame. Germans had come over to this country with nothing but a satchel, had stayed a short time, paying no taxes, and had gone back with orders amounting to hundreds of thousands of pounds, which had kept their workshops busily employed and found work for hundreds of people. In his opinion the best service the Column Club could render to the people of this country would be to invite capitalists and manufacturers to be more broad-minded and to lay themselves out to supply the needs of this country and of the Colonies by opening up factories and making goods which had formerly been made only in Germany and Austria. Banking institutions might be prevailed upon to assist such projects. He was convinced that if that policy were adopted they would have a walk-over, because they had a good start.

The Chairman (Mr. W. H. Veno) presented a long list representing a summary of the value of electrical imports from Germany during 1912 retained in this country. He moved the following resolution:—"That this meeting considers there is now no real basis for any panic in business. Home demand in a large degree still continues; all Colonial and many foreign markets are open to us. Britain's ultimate success can best be gained by a return to normal conditions of trade, and to help to secure this end manufacturers of branded goods are urged to continue their advertising both at home and abroad, especially having regard to the many opportunities there are at present of securing trade which has hitherto gone to Germany and Austria."

Mr. S. C. Peacock, who seconded the resolution, said that the worst had happened, business men now knew how they stood, and he calculated that within a month the business which would be done would be 90 per cent. of the normal.

The resolution was adopted, and it was decided that a committee should take steps to give practical effect to the resolution, and to secure the co-operation of the Press.

The Stalybridge Joint Tramways and Electricity Board has decided to pay half wages (minimum 10s.) to men in the service of the board who join the colours, and to keep their situations open for them.

The St. Helens Cable Co. have lost the services of 22 employés who have been called up, and the company are looking after their dependants and keeping their situations open. The works are running full time, and it is not anticipated that any difficulty will be experienced in keeping them going.

At the next meeting of the Bolton Town Council one of the members is to move a resolution that the salaries of all Corporation servants receiving over £100 per annum be reduced according to a scale commencing with a reduction of 5 per cent. on the first £100, and rising to 25 per cent. on amounts over £500.

The staff of Darwen electricity and destructor departments have decided upon a weekly voluntary levy to be given to the relief fund, the scale to be:—Those receiving wages of 20s. and under 30s., 6d. per week; 30s. and under 40s., 9d.; 40s. and under 50s., 1s.; 50s. and under 60s., 1s. 3d. Councillor Thornley (Electricity chairman) will contribute 5s. per week; and Mr. Garnett, manager, 4s. 6d. per week.

Our Manchester correspondent writes:—"The British Westinghouse works at Trafford Park, Manchester, are running full time, and the staff have decided to make a donation to the relief fund, made up of a certain proportion of their salaries, which will amount to about £800. Electricity and tramway employés in the service of the Manchester, Salford, Blackburn, Oldham, Darwen, Wigan, Rochdale, Hyde, and Stockport Corporations have decided to support the national relief fund, either by way of voluntary levies of proportions of their salaries and wages, or by weekly collections. By permission of the B.I. and Helsby Cable Co., the Recreation Hall at Helsby is being converted into a hospital for the Red Cross Society. Messrs. E. O. Walker & Co., of 26, Cannon Street, Manchester, who installed the electric lighting for the rifle range of the Hollins Mill Co., Ltd., have generously offered to fit up, free of cost, one or two others on similar lines, if someone else will find the room."

Australia.—H.M. Trade Commissioner in Australia, under instructions from the Board of Trade, has recently collected certain samples of foreign hardware, hollow-ware, and tools which compete with similar goods of British origin in the Australian market. These samples, which include a large number of German goods, have just been received from Australia, and in connection with the campaign which the Board of Trade has recently started with a view to assisting British firms to secure trade formerly in German and Austro-Hungarian hands, arrangements have been made for their immediate exhibition in this country. The samples, which number about 430, divide themselves into the following main headings:—Aluminium ware, enamelled ware, general hardware (bolts, staples, hinges, butts, bells, choppers, hooks, padlocks, stoves, lamps, spoons, &c.) and tools. The aluminium ware, enamelled ware and general hardware have been dispatched to Birmingham for exhibition at the offices of the Birmingham Chamber of Commerce, and the tools to Sheffield for exhibition at the offices of the Sheffield Chamber of Commerce. All the samples will then be exhibited in London and in any other industrial centres where it may seem desirable to send them.

A report relating to these samples, giving full information as to country of origin, prices, &c., is being circulated to firms in the country who may be interested, and copies may also be obtained on application at the offices of the Commercial Intelligence Branch, 73, Basinghall Street, London, E.C.

The employés of the Edison & Swan United Electric Light Co., Ltd., have joined almost in a body the rifle club formed by the company, in which the directors have interested themselves in more ways than one.

Belgian Iron and Steel Works.—The *Practical Engineer* states that during the Liége bombardment the Ougrée-Marihaye Steel Works at Liége are reported to have been demolished, and the Cockerill works at Seraing partially so. The Cockerill works employ 10,000 workmen, and large number of turrets have been turned out for Belgian forts, the special steel of which is about 9 in. thick, of tremendous strength, and owes it great defensive powers largely to the curving, produced by hydraulic pressure. Recently, the firm produced turrets for the Antwerp forts, while Fort Seraing, recently attacked by the Germans, was equipped from these works. One of the lathes for dealing with these turrets has a span of 35 ft. The firm built the first locomotive, manufactured the first steel rails produced on the Continent, and for many years was the leading establishment in Europe in output and number of workmen employed. The chief, Dr. Adophe Greiner, was in May last elected president of the Iron and Steel Institute, and would have presided at the Paris meeting in September. In 1897 Dr. Greiner installed at Seraing the first gas engine driven by cleaned blast furnace gas, and this engine is still in use. The Germans have seized the works and are trying to carry them on, but cannot get workmen. The Ougrée-Marihaye works cover 264 acres, and comprise 60 coke ovens, eight blast furnaces, and a steel-producing plant covering 91 acres, and turning out nearly three-quarters of a

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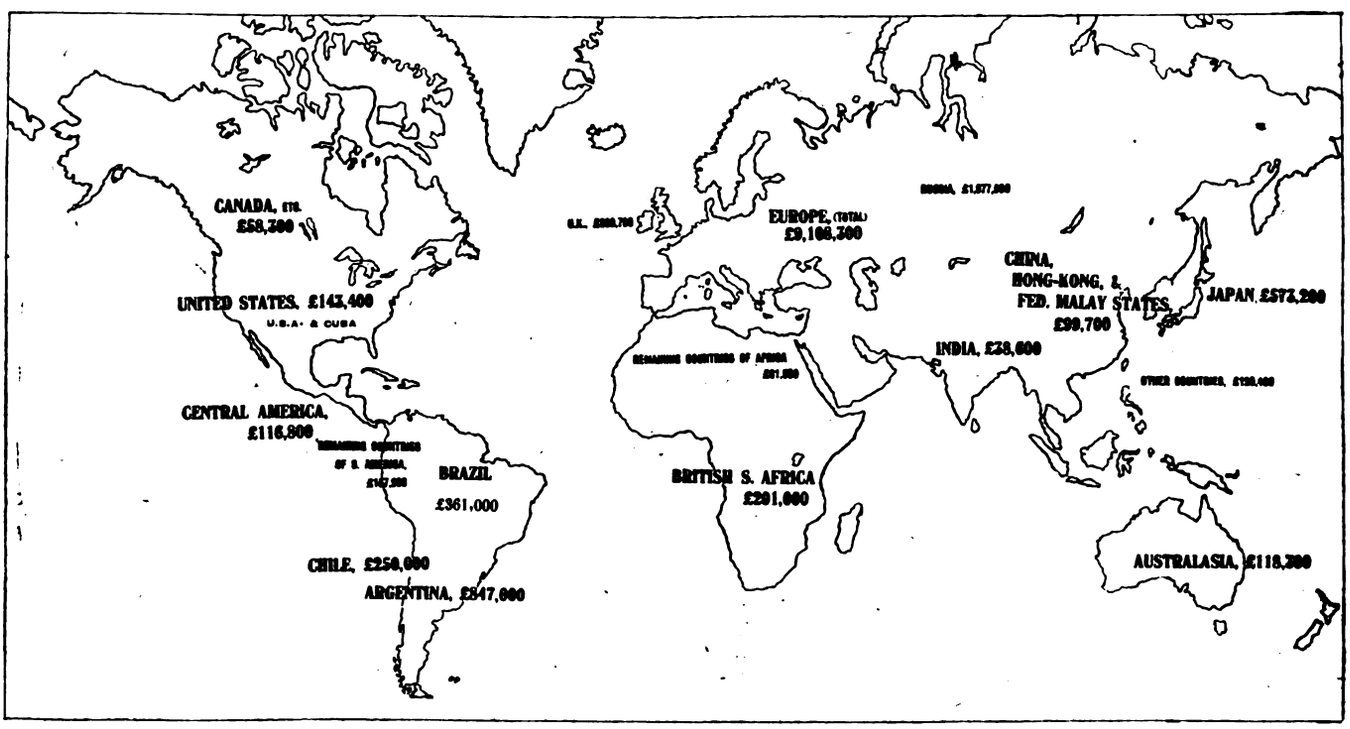
million tons of steel annually for railways, bridges and all sorts of structures, and the firm employ at least 12,000 workmen.

Change of Name.—Messrs. A. W. & A. G. Oppenheimer, directors of Messrs. Hick-Diesel Oil Engines, Ltd., both of whom are British-born subjects, have adopted the surname of Fowler in place of Oppenheimer.

An "All-British" Directory.—The British Engineers' Association has issued the second edition of its Official Directory. The objects of the Association are already very fully known to our readers. The combined capital of the firms on its membership roll amounts to about £100,000,000, and it is stated that the members between them cover the whole range of engineering plant and accessories. This Directory gives a list of firms who are members, and it also contains a full classification of these members according to manufactures. From the paucity of entries under some of these classes one is persuaded that there are a good many British electrical manufacturers who have not yet seen the wisdom, or else the necessity, for joining this organisation. Obviously they must have their own reasons, for we have given the work of the Association Co., Ltd., announce that in consequence of the great advance in the price of all raw materials and the unsettled state of the markets generally, they are compelled to withdraw all net prices and previous quotations, and to reduce the discounts off the list prices of all goods in their telephone catalogues. Their future stocks of telephones and signalling apparatus, including their well-known mining material, will be of British manufacture throughout; the manufacture is well in hand, and they do not anticipate any undue delay in the execution of orders.

The Sterling Telephone and Electric Co., Ltd., also inform us that they are compelled to withdraw all previous net prices and quotations. The discounts off the list prices of all goods in their catalogues will be reduced. The advance of 10 per cent. hitherto in force on the "S" Section of their catalogue (bells, indicators, &c.) is now withdrawn. With the facilities of their large works at Dagenham, they anticipate being able to maintain supplies of the majority of the articles listed by them.

The Empress Club sends us particulars of a scheme which it has inaugurated for collecting all kinds of articles required in con-



Principal Electrical Markets of Germany, Showing the Total Value of Exports of Electrical Goods from Germany in 1912.

To Europe—		To America—		To Africa—		To Asia—	
United Kingdom	£880,700	United States	£116,400	British South Africa	£201,000	Japan	£573,200
Norway	345,400	Canada	55,000	Egypt	26,800	China	96,000
Sweden	454,000	Mexico	105,000	German S.W. Africa	8,200	British India	88,600
Denmark	222,600	Panama	1,500	German E. Africa	5,800	Dutch E. Indies	93 700
Holland	591,600	Salvador	800	Portuguese E. Africa	5,800	Siam	10,700
Belgium	761,800	Nicaragua	250	Morocco	4,000	Phillipines	6,100
France	498,500	Honduras	750	Spanish Africa	2,600	Kiao Chau	4,300
Spain	523,000	Guatemala	5,500	British W. Africa	2,500	Ceylon	2,700
Portugal	62,100	Costa Rica	2,700	Cameroons	1,900	Corea	2,400
Italy	898,200	Argentine	847,000	Tunis	1,000	Straits Settlements	1,900
Switzerland	395,500	Brazil	361,000	Togo	1,000	Hong Kong	1,800
Austria	1,062,700	Chile	250,000	Brit. E. Africa	800	Other Asia	500
Bulgaria	20,900	Uruguay	116,000	Other Africa	1,600		£831,900
Servia	21,900	Bolivia	12,000		£262,500		
Roumania	188,800	Peru	16,000				
Greece	22,900	Colombia	7,000				
Montenegro	600	Ecuador	2,600				
Turkey	44,800	Venezuela	2,600				
Russia	1,877,500	Paraguay	1,700				
Finland	140,800	Cuba	27,000				
Gibraltar, Malta and Cyprus	900	Br. W. Indies and Newfoundland	8,800	To Australasia—		Summary.	
	£9,108,300	Other	300	Australia	£101,800	To Europe	£9,108,300
			£ ,984,400	New Zealand	8,600	,, Africa	262,500
				German New Guinea	7,800	,, Asia	831,900
				Other	100	,, America	1,984,400
					£118.800	,, Australasia	118,300
							£12,255,400

sufficient publicity in our pages to keep it well before them. The offices of the Association are at 32, Victoria Street, S.W.

British Thomson-Houston Co., Ltd.—The company estimated that some 200 of their men from the shops and staff would enlist, but so prompt have been the answers to the call, that instead of 200 the number from the staff and works is well beyond 400 to date. This is over 10 per cent. of the adult male employés, there being a large proportion of women employés in the lamp factory.

Joint Box Compound.—The Dussek Bitumen Co. have been asked if they anticipate any difficulty in obtaining supplies of the raw material used in connection with the manufacture of their "Trinidite" joint box compound, and as a large number of engineers are at the present time employing "Trinidite," the company wish to state that they hold stocks sufficient to ensure deliveries for 18 months or more. Shipments of further raw material are coming to hand from the Colonies, so that there will be no interruption whatever in the manufacture or supply of their materials. "Trinidite" compound is used by the Admiralty on board battleships and in other important situations.

Telephones and Telephone Accessories.—The Adnil Electric nection with Red Cross aid in time of war, including clothing, linen, games, medical appliances, &c. Address the Hon. Secretary, Emergency Voluntary Aid Committee, the Empress Club, 15, Berkeley Street, W.

Not a German Firm.—Messrs. Julius Sax & Co., Ltd., write as follows:—

"On several occasions recently it has been suggested that we are a German firm, and we should like an opportunity of correcting this entirely erroneous impression, and stating that the firm is capitalised and worked by Britishers. The original founder, Mr. Julius Sax, M.I.E.E., who died in 1890, was born in Russia in 1828, and came to London in 1851. Soon after this date he started the present business, and amongst other things invented the fire alarm system which is still being used in Metropolitan Fire Brigade stations. Since the establishment of the firm, over half a century ago, a number of specialised lines have been added to its manufactures, and in every instance materials and labour are entirely British. As we do not rely on the Continental markets for parts or raw materials, we are in a favourable position to fulfil those orders which have previously been placed with agents for German goods."

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The Safetee Controlling Appliances Co., Ltd., inform us that they are working their usual hours, and will continue to do so. They have large stocks of all sizes of their standard types of combined switch fuses, and are prepared to quote for any other type of switchgear for all purposes. They have a complete range of combined switch fuses made to Admiralty specifications, which can be dispatched in a day or so. Their other specialities are complete starting panels and all types of switchboards.

The Iron and Steel Institute.—The Secretary informs us that the Comité des Forges de France has been obliged to cancel all arrangements for an autumn meeting of the Institute in France this year. Under the circumstances, the Council has decided that it would be advisable to postpone for the present the organisation of any alternative arrangements for an autumn meeting for the reading and discussion of papers. A number of papers have been submitted with a view to their presentation at the meeting which was to have been held at Paris, and the Council proposes to print in the usual way advance copies of those papers approved for publication and to invite discussion thereon by correspondence. It is expected that the copies will be ready for issue about the second week in September. Members who desire to send in written communications in discussion of any of the papers can be supplied with copies of those in which they are interested on application to the Secretary. The papers and correspondence thereon will be published in the next number of the Journal.

The Council express their most sincere sympathy with their President, Mr. Adolphe Greiner, and his family in the great anxieties under which they are at present suffering, in common with his countrymen, at whose hands the Institute experienced such kindly hospitality in the autumn of last year.

The following is the list of papers that have been submitted :—

E. D. Campbell, "Note on the theory of hardening and on the constitution of steel."
G. S. Cooper, "By-product coking industry and its relation to the manufacture of iron and steel.
L. Dufty, "Determination of cobalt in high-speed steels."
L. Guillet, "Electrolytic iron, its manufacture, properties and uses."
G. Halistone, "Transverse testing of cast-iron."
W. L. Johnson, "Utilisation of heat contained in slags."
N. G. Kapp, "Mechanical charging of blast-furnaces."
P. Nicou, "Iron ore deposits of Lorraine and the West of France."
H. de Nolly and M. Veyret, "The transformations of steels."
J. A. Pickard and F. M. Potter, "Oxygen content of open-hearth steel."
A. M. Portevin, "Decarburisation of the steels in salt hardening baths."
A. M. Portevin and V. Bernard, "Influence of coalescence on mechanical properties of steels and alloys."
A. Sahlin, "Use of liquid ferro-manganese in the steel processes."
A. Spannagel, "New process for heating blast-furnace stoves."

A Compleat Englishman.—Mr. Justus Eck writes as follows :—"In the interest of my colleagues and those who serve with me on Boards, Councils and Committees, it has been suggested that I should make it clear that, although my grandfather was a Russian, my father was naturalised an Englishman in 1850, while I was not only born in London, but also educated at King's College School, University College, and the Cambridge University. My whole business career has been in Great Britain, with the exception of short periods with British Colonies and Italy. Quite a number of my relations are serving with his Majesty's colours, both with and without commissions.

"I should not have troubled you with the above had not organised trade competitors endeavoured to harm the interests of the organisations with which I am connected, and I wish, therefore, to state that every employé of the Union Electric Co., Ltd., during the 14 years of its existence has been, and is, a British-born subject (with the exception of a Dutch stenographer, whose appointment was due to her competency in English orthography and stenography, and three young men, two of whom stayed under six months ; the third, who stayed longer, left ten years ago), and the same applies to the majority of the board of directors.

"Deeply as we all feel the sufferings imposed on our land and its brave defenders, by this insane outbreak of German militancy, I am sure no Englishman desires to take any unfair advantage due to the trade disturbance, and I for one would be very sorry to impose any hardships on any honest Austrian or German resident here, who had hitherto lived amongst us a friend and conscientiously carried out his duties.

"I see very many names of German origin amongst the officers and past Presidents of the Institution of Electrical Engineers ; were they placed there for other than their good work for British electrical engineering ?

"Finally, many Britishers may, like myself, have to thank business acquaintances in Germany or Austria for their present care of loved ones ; should we show ourselves less noble ?"

Chloride Co. Assist Recruiting.—The Chloride Electrical Storage Co., Ltd., of Pendlebury, Manchester, have posted the following notice up in their works :—

"The directors of the Chloride Electrical Storage Co., Ltd., consider that the best and most immediate service they can render to the country in the present time of national stress and emergency, is to facilitate as far as is in their power response from employés of the company to Lord Kitchener's appeal for recruits for the second army. They have accordingly resolved—

"1. To grant to the dependants of married men enlisting an allowance of 10s. a week to the wife from the date of acceptance and to continue until the war is ended, together with a further allowance according to circumstances for children.

"2. In case of unmarried men with dependants to grant an allowance which will be settled according to circumstances.

"3. In addition, in all cases whether married or single, to give to every employé who enlists and is accepted, the sum of £5, to be paid in such way and at such times as the works manager may think fit, under the circumstances of each particular case.

"4. The directors will treat in the same spirit all applications for re-employment on return."

Street Lighting.—Municipal authorities are acting patriotically during the existing crisis not only by refusing to curtail work in progress, but also by undertaking work which is necessary but which is not immediately urgent. The Electric Street Lighting Apparatus Co., whose business is largely among these authorities, have received a number of such orders for street lighting fittings, the most important being from West Ham and Battersea, and this despite the fact that the increased price of raw materials has added somewhat to the cost. In addition, the orders received in connection with Admiralty and War Office work have enabled the company to employ a greater amount of labour beyond that necessary to replace the large percentage who were mobilised and who were called away to assist in the Admiralty repair shops.

"As Usual."—Messrs. C. Jennings & Co., timber importers, of Bristol, state that they are giving the usual credit terms on both old and new accounts. They are endeavouring to keep the whole of the works going, and are trying to catch the spirit of the times and start the manufacture of new lines of woodwork that were previously foreign.

Cables for Edinburgh.—The Corporation some time ago placed a contract for cables for extensions with the agent of a German firm. As that contract cannot now be fulfilled, the E.L. Committee has turned to a home firm, the British Insulated and Helsby Cables, Ltd., and placed the order with them.

German Brass Trade.—One of the series of special memoranda issued by the Commercial Intelligence Department of the Board of Trade, for the assistance of British firms, gives full statistical and other information respecting the German and Austro-Hungarian export trade in brass and brass wares, &c.

Another similar publication details the German and Austrian exports of machinery belting, of leather, wool, cotton, or other materials, with observations on the position in the neutral markets.

L.C.C. Tramway Employés.—At a representative meeting of all grades among the 12,000 employés of the London County Council Tramways Department, presided over by Mr. A. L. C. Fell, the manager, a scheme to contribute to the Prince of Wales's National Relief Fund was decided upon. It was agreed that the men should be invited to state on specified forms what weekly sum they would be willing to contribute. Subscribing is purely voluntary and the amount optional.—*The Times.*

English Electrical Employés in Berlin.—A communication dated August 18th has been received by *The Daily Mail* stating that the Allgemeine Elektricitäts Gesellschaft was treating well its British employés, who include 19 men and 11 women.

City and Guilds Technological Examinations.—The City and Guilds of London Institute has issued a notice stating that students of technological classes and others preparing for any of the examinations of the Institute's Department of Technology will not, so far as possible, be prejudiced in competition for certificates and prizes, if they have been prevented from fulfilling the Institute's regulations as to attendance at classes or otherwise, by reason of their having joined the military forces of the Crown, or having accepted temporary civil employment in connection with the defence of the country.

Government Orders.—The works of the Aster Engineering Co. (1913), Ltd., at Wembley, are working at high pressure, having a number of orders in hand for H.M. Government. Time and a-half is being worked in nearly all departments, and some 50 extra hands have been taken on during the past fortnight.

The British Electric Calibrated Fuse Co. inform us that they are exceedingly busy with Government orders, and also that their commercial orders show no signs of falling off up to the present. They have adopted the policy of taking on as many new hands as possible, so as to give the maximum amount of employment. They are in a position to execute orders promptly for any type of fuse (except where porcelain is employed), and in a great number of cases, where at present porcelain fuses are in use, they can supply other forms of fuses for the same terminals, as they have already done. A number of strip and glass barrel fuses, slate fuse bases, &c., were previously made in Germany ; these can be supplied, made from British materials in their entirely British works. Prices are the same as usual, except where they themselves have to pay more for raw materials ; but, by their policy of carrying large stocks, this is not often the case. The employés are making a weekly subscription to the Prince of Wales's Relief Fund, and the firm are doubling the total amount received.

Commandeered Chassis.—The Manchester Corporation motor-bus services from Palatine Road to Cheadle and Northenden, which had to be discontinued because the military authorities commandeered the chassis, have now been resumed, the Tramways Committee having got some chassis on loan from the London General Omnibus Co.

The Prince's Relief Fund.—The boxes on Manchester tramcars, into which passengers drop their tickets upon leaving, have been converted into collecting boxes for the National Relief Fund.

British Firms Now.—The *Financial News* states that the Port of London Authority placed contracts just before the war with three German firms to the extent of £250,000 for two pairs of lock gates, a caisson swing bridge, a bascule bridge, and five locomotives for the new Albert Dock, the India, and the Millwall Docks. Tenders have now been invited from English firms for all this work.

Alien Control of Companies.—In the House of Commons, on Monday (according to the *Financial News*), Mr. Joynson-Hicks asked the President of the Board of Trade whether he was aware that Messrs. Siemens Brothers, under the title of the Siemens Dynamo Works, Ltd., were announcing publicly that they had received a contract to supply the British Government with electric

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lamps for the ensuing 12 months; and whether he was aware that though this business was registered in England as a limited company with £600,000 capital in 120,000 shares, these shares were largely the property of alien enemies, 70,465 being held by Arnold W. von Siemens, Karl von Siemens, and George von Siemens, all of Berlin, 19,783 by Alexander von Siemens, and 19,210 by G. von Chauvin, who was registered here as an alien enemy; and other blocks of shares were held by persons with German names, thus ensuring that practically the whole of the profits on such Government contracts, and other orders for cables, &c., which had been given by his Majesty's Government to this firm would, in the ordinary course, accrue to the advantage of these alien enemies; and whether he would take steps to ensure that a receiver be immediately appointed, so that while the plant and factories were used for the production of articles required in this country, so that British workmen should not be thrown out of work, there should be no profits sent during the currency of the war to the King's enemies.

Mr. Runciman: I think the best answer I can give to the hon. member is to assure him that the general question of the position of limited companies in this country which are controlled by alien enemies is at the present time receiving the most careful consideration of his Majesty's Government. I cannot say more at present.

Sweden.—The Swedish Government has issued a proclamation forbidding the exportation of "accumulators, mounted or partly mounted, elements or batteries," during the period of the war.

Marble Scarcity.—In view of the scarcity of marble, Messrs. John Williams & Co., Dinorwic Slate Wharf, Rotherhithe Street, S.E., announce that they have a large stock of slate for switchboard purposes.

For the Front.—The services of Trooper Frank A. Blood, 6th Dragoon Guards, Reserve Regiment, have been accepted by the authorities. On his return from the South African War in 1903, he rejoined the B.T.H. Co. at Rugby, afterwards joining Messrs. Ferranti, Ltd., as their assistant superintendent of switchgear erection in London and the South of England. At the time of rejoining his regiment he was the Liverpool and district representative for Messrs. Crowther & Osborn, and the Sceando Lamp Co., Ltd., of Blackfriars Street, Manchester. The regiment has been warned to be in readiness to leave for the front at any moment.

Recruiting.—Messrs. Eckstein, Heap & Co., Ltd., manufacturing electrical engineers, of Manchester, have expressed the hope that all their employés who are fit to assist the country will take advantage of an offer they make to pay grants of money weekly to wives or parents of their employés who enlist. The grants are to continue from the day an employé is accepted for service to the conclusion of the war.

Down to Wednesday morning 75 employés of all grades from the generation and distribution departments staff of the County of London Electric Supply Co., Ltd., have left for naval and military service.

Clocks not "Made in Germany."—Messrs. Gent & Co., Ltd., of Leicester, write to point out that "Pulsynetic" impulse clocks are a "home-made" production, being manufactured at their own well-appointed works.

It may be also mentioned that "Invar," or non-expanding, nickel steel for pendulums was almost exclusively a German production until Gent & Co., Ltd., some years ago introduced British-made "Sinevar" non-expanding nickel steel. "Sinevar" steel has a coefficient of expansion of only ·0000010 per cent. per degree C., and all Pulsynetic time transmitters are fitted with pendulums of this useful alloy.

G.E.C. Men with the Colours.—At the beginning of the week close on 10 per cent. of the total number of employés of the General Electric Co., Ltd., had joined the colours. The actual numbers for the various offices and works are as follows:—Head office (67, Queen Victoria Street, London, E.C.), 75; provincial branches, 70; Union Street Works, 8; Salford Electrical Instrument Works, 8; Peel-Conner Telephone Works, 24; Witton Works (including the engineering works, carbon works, conduit works, and the Ileene works), 165. Mr. H. Clifford Palmer (manager, publication department) is a lieutenant in the London Scottish, and Mr. W. E. Curtis (manager, bought ledger department), is also an officer, his regiment being the Army Service Corps (Territorials).

A British Firm.—Messrs. H. Hartjen & Co., of 35 and 37, Noble Street, London, E.C., write that the sole partner in the firm is a born Englishman, and with the exception of a non-German foreign correspondent, the staff are all British. The name alone is of foreign extraction (Norwegian).

Egypt and South America.—The Board of Trade has received the following information from H.M. Consul at Alexandria:—

"If the cotton crop is successfully financed, the conditions and prospects of trade will be favourable. The United Kingdom should secure a large proportion of the German Empire's very valuable trade with Egypt, in all manufactures of good quality, such as machinery—especially artesian-well apparatus—canvas hose, machine tools, gauges, wrought-iron pipes and tubes, files, bolts, &c., and in textiles imitating popular patterns. Successful competition is improbable in inferior, 'cheap and nasty' goods such as crockery, pewter, ironmongery, hosiery and haberdashery. Our serious difficulty is that long credit (six or twelve months) is indispensable, as fellaheen pay only by instalments."

H.M. Consul-General in Rio de Janeiro reports:—

"According to telegrams from New York, United States of America firms are preparing to send a veritable army of commercial travellers to South America, especially to Brazil, Argentina and Chile, with a view to the capture of German trade in those markets."

Glassware.—Messrs. Holophane, Ltd., referring to the stoppage to the importation of Continental-made glassware, inform us that Holophane is the only form of prismatic glass which is made in this country. Their works at Gateshead are well equipped for dealing with any demands which may be made upon them, and it is not anticipated that any difficulty will arise in regard to supplies of raw material. For these reasons, the prices of Holophane glassware will remain as before, although the shortage of ordinary reflectors has led to a very substantial increase in prices.

Limited Companies and Alien Shareholders.—The Board of Trade has issued a notice warning all joint stock companies and their officers that:—

1. No dividends or interest declared or becoming due after the outbreak of war should be paid during the war to or in accordance with instructions from any person resident in enemy territory. Such dividends or interest should be paid into a separate account at a bank to be disposed of after the conclusion of the war.

2. No transfer of any shares or debentures from any person resident in enemy territory should be registered during the war.

Supply Meters.—The Bastian Meter Co., Ltd., wish it to be known that they hold large stocks of raw materials and will have no trouble in expeditiously meeting all orders. The Bastian meter is manufactured throughout in England with British labour and British capital.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Panama, Berlin and Fraternity.

It is not usually the policy of your journal to interfere in matters of politics, more especially when such matters assume an international aspect, but at the present time, when all conventions of peaceable life are being ruthlessly upset, I should like to refer to an aspect of the present struggle which concerns in a very direct manner the electrical engineering industry not only of this nation, but also of one to which we are bound by ties of blood and memory. In the past we have received from the American technical journals such evidence of their genuine interest in our commercial and technical well-being that we feel sure that at the present time, when the resources of the British nation, both military and commercial, are being subjected to a test such as has never before been experienced, we shall find a hearing not only among Britishers who have influence in the world's markets, but also in the United States of America, where our cousins have stood for the most advanced principles of commercial and technical progress.

The United States and ourselves are in a commercial sense neighbours. No cause or state of war exists between us. Commerce to us and to them is equally a vital thing, and the world's markets are wide. Pressure of competition from Germany, a competition which has been rendered possible very largely by the use of low-priced labour, has been temporarily removed, opening a valuable prospect to those who can take up the trade. As for ourselves, we are still in business, but it must not be denied that while our attention and our resources are largely occupied in safeguarding our national interests and even existence, we cannot devote quite the same attention to business expansion as we could otherwise do. Supposing that a man were busily employed in kicking an intruder out of his front garden, it would not be a neighbourly act of the man next door to steal his poultry from the backyard, and while we may feel that the electrical engineering fraternity of America would not consciously do anything so mean, they might be asked not only as a matter of courtesy, but as a measure of common interest, to refrain from doing anything which would undercut or curtail the present volume of British export business.

I say this not because I think that citizens of the United States would desire to weaken us at the moment of our greatest need, but because there is always the temptation of an open market and weakened competition. Under normal circumstances competition is a fair test of merit; under abnormal circumstances it is not merely courtesy, but preservation of safety to blunt the keen edge of competition when this is directed against friends. I appeal on the ground, first, of that spirit of fairness which has only recently demonstrated its power in a magnificent way in the

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United States over the force of money grubbing. For some time the Panama Canal presented the possibility of acute misunderstanding between us. The magnificent determination of President Wilson saved the world from witnessing the imposition of what in many quarters would have been considered an undue balance in the administration of the canal charges. We can therefore with confidence appeal to a nation which has already manifested in a commercial matter its sense of international fairness.

This appeal may also be made on the ground of common safety. Great Britain is not at present waging war either in a military or commercial sense due to a lust for territory. It is taking part in a struggle in which free commercial peoples are ranged against nations whose undoubted genius for commerce and technical progress is overshadowed and strangled by an all-absorbing militarism, whose power is vested in the hands of a very few persons not directly concerned in the progress of the nations as a whole. As Mr. H. G. Wells has pointed out in the tremendous appeal which he has made to America, "Let us not attempt to deny the greatness of Germany and of Germany's contributions to science and art and literature and all that is good in human life. But evil influences may overshadow the finest peoples, and it is our case that since the victories of 1871 Germany has been obsessed by the worship of material power and glory, and scornful of righteousness; that she has been threatening and overbearing to all the world. There has been a propaganda of cynicism and national roughness, a declared contempt for treaties and pledges, so that all Europe has been uneasy and in fear." The result of the present struggle will be felt almost as acutely by the United States as by Great Britain, because it is a struggle of enlightenment against the autocracy which although obsolescent, has yet sufficient remaining force to shake the fabric of present day existence. On the ground of fraternity of interest, therefore, we claim from American engineers not merely the policy of "hands off" as regards British markets for electrical engineering goods, but all the assistance which they can in fairness to themselves give to our struggle against the policy of militarism which, fostered by German philosophy and cast into a mould of blood and iron by the descendants of Bismarck and Von Moltke, has found its focus in the councils of Berlin. Obviously if the sole or main use of the electric arc were its employment in the military searchlight or if high-tension electricity were chiefly used in energising wire entanglements for the slaughter of human beings, the output of the world would be enormously restricted as compared with its possible expansion under conditions of assured peace free from the menace of militarism, and it is precisely this position that I am attempting to determine.

As one practical example of the way in which our American cousins can help us, there is the question of Canada. From Great Britain and also from America there has flowed in recent years a steady stream of progressive men and women, who have peopled the north lands and rendered them to a large extent productive and fertile. New industries are springing up, and a tremendous opportunity has been given to business expansion. Now that the call of need has come, Canada has sent back a return tide of thousands of her best born to help in the military defences of the British nation. To a corresponding degree Canada is weakened commercially. America has up to now shown the utmost brotherhood to the new nation across the border. No vessels of war ply on the Great Lakes. Commerce has been keen, but above board. We rely upon the American nation to stand by Canada in this hour when Canada is standing by us. One of the American technical journals says: "England became great largely through its isolation in a former European war. There is no reason why America should not emerge from the present world disaster with the advantage entirely on her side." While we may wish America every possible technical and commercial success, is it too much to ask her to follow the memory of her fairness with regard to Panama by an equally striking demonstration of her determination not to reap "advantage" at the expense of that nation which is fighting a battle of progress which is so essential to America?

Innocens.

Wireman or Electrical Fitter?

I think your correspondent "El-Les" of last week has called attention to a matter that stands urgently in need of revision.

As things stand at present, anyone can style himself a wireman or electrician as the case may be, in fact, a case came to my notice last week of a man who was a 'bus conductor 18 months ago, but is an "electrician" now at 10½d. per hour. There seems to be no compensation at all for the man who sacrifices his spare time to attend the various Polytechnics, to attain the technical knowledge that is so essential.

How many, I wonder, of the so-called wiremen could pass last year's City and Guilds Final Wireman's paper?

Hopeful.

British (?) Firms: A Suggestion.

At the present time it appears to me of vital importance that consulting engineers, architects and electrical contractors should have some ready and easy means of acquiring information as regards manufacturing and factoring firms in this country. I am sure you will readily agree that these gentlemen should wherever it is possible deal exclusively with firms whose financial interests are entirely British, who employ British labour, and, in the case of manufacturers, who use British material.

I feel sure that you would be doing the greatest possible service to the electrical trade if you compiled such a list and notified it boldly in the Review for several weeks that readers desirous of such information could apply for same. I would suggest that firms should be classified under various headings; something of this description:—

British throughout.

German or Austrian throughout.

Financial interests partly held by Germans or Austrians, stating if possible proportions.

Financial interests entirely owned by naturalised Germans or Austrians.

Financial interests partly owned by naturalised Germans or Austrians.

To each report could be added particulars as to whether any foreign labour is employed.

There are many firms at the present time registered under an English title whose interests are almost exclusively German.

Trusting that the above will receive your serious consideration—

Sydney S. Galsworthy.

London, *August 29th*, 1914.

What Constitutes a British Firm?

I notice on page 312 of the current issue there is a letter from a member of a well-known firm of consulting engineers with regard to the constitution of the Stafford firm of Siemens. It is quite possible that the present generation of engineers are not entirely conversant with the work done by the various members of the Siemens family in this country, but at the same time one must bear in mind that these gifts have been made with one object in view, and that is the advancement of Siemens business in this country. Whilst one would not style it as "corrupt practice," there is no doubt that these gifts have had the effect of large orders being placed with the Stafford firm, the general idea being that the orders themselves were to be executed and manufactured at Stafford, but, as a matter of fact, the greater proportion comes from the Continent, and if we are to be patriotic at all, such firms should be entirely barred, because by placing orders with them we are supporting an alien enemy. I would suggest that the Government place this firm in the hands of a public trustee, and all dividends which may accrue should be utilised in repaying this country for the fearful expense it is being put to by the German nation.

Our present war is not against individuals, but against the whole combine of the German States, and we cannot deal with individual cases on their merits.

The Walsall Electrical Co., Ltd.,
J. Delebecque, *Works Manager.*

Walsall, *August 31st*, 1914.

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In your last issue appeared some remarks from a firm of consulting engineers with reference to German-backed companies in England, and the fact that they had been asked apparently by some rival firm to transfer their orders to the entirely British concerns. It is hard to believe that any rival representative would wish to see the English employés out of jobs, but the idea of losing orders, knowing that 90 per cent. (to take the consulting engineer's figures) of the profit on such orders goes to our enemies, is rather sickening. A suggestion appeared in the daily Press which seems to meet the case, namely, that the foreign holding in such firms should be attached, and placed in the hands of the Public Trustee. Any profit earned during the war period or before the final settlement would then not go to help our enemies to foot the bill they are running up.

Fairplay.

August 31st, 1914.

I notice a paragraph in your paper, "What Constitutes a British Firm"? and you quote some consulting engineer (who also is probably a German, because he is ashamed to sign his name) supporting Siemens. The very fact that 90 per cent. of the capital of this company is held in Germany is sufficient to an Englishman, one would think, to condemn them, but when you think that in the past this German firm, with 90 per cent. of its capital in Germany, has been able to quote to the Secret and Confidential specifications of our War Office and Admiralty, one hardly wonders that representatives should ask that this firm should be barred.

A very large number of their employés were German, and, no doubt, held positions in this country that, if they could have remained, would have been most useful to the German army at a later date.

Sir (*sic*) Alexander Siemens has got one thing to his credit, and that is that he has never been ashamed of his name, and has kept it Siemens. The time surely has come when loyal consulting engineers should support at least concerns which are financed with English money, and not 90 per cent. German money. Obviously the work that Sir (*sic*) Alexander Siemens has done, has been done for the advertisement of Siemens Dynamo Works and Siemens Bros. There was no reason why a German should give a laboratory to King's College, or do any other similar work, unless he had fish to fry for his country.

I suggest that in the interests of Englishmen you publish the name of the consulting engineer who sent you the article, and if this is done I shall have pleasure in your also publishing my name. Otherwise I ask you to publish this without my name, and enclose my card.

X.

August 28th, 1914.

It would be of great assistance to a large number of buyers who desire to purchase only English material if you would give some guidance in the purchase of metallic-filament lamps.

Owing to the complicated ramifications of the foreign manufacturers with their inter-working agreements, &c., it is indeed difficult to know which is really all English, including the glass ware, and which is only partly so. You need not, I think, specify those firms who are only partially English, as this may appear somewhat vindictive; it would, I think, meet the case equally as well if you merely set out the names of the few firms known to you as manufacturing and selling metallic-filament lamps made in England, and whose share capital is English, and where all the material is actually manufactured in England.

If you could do this I am sure it would be a great boon to those who have the purchasing of material and the influencing of customers' requirements, and who desire, as far as possible, to keep the trade in our own country.

H. F. Friederichs.

West Hartlepool, *September 1st*, 1914.

[Other letters, received too late for inclusion here, will be found in our "Notes" columns.—Eds. Elec. Rev.]

BUSINESS NOTES.

Trade Announcements.—Mr. H. H. Williams, late of Messrs. H. R. Williams & Co., electricians, of Barnstaple, has opened business at Falmouth.

Messrs. A. E. Hornsby & Co., electrical engineers, of 130, High Street, Gillingham (Kent), have removed their business to the Invicta Works, High Street, Old Brompton.

Mr. E. Arthur Pinto, of Ramsgate, Dover and Hythe, is opening new showrooms at 119, Northdown Road, Cliftonville, Margate. He will be glad to receive catalogues, lists, &c., at that address.

Messrs. Simplex Conduits, Ltd., have removed their Liverpool branch from 1, Dawson Street, to more extensive premises at 96, Whitechapel, Liverpool, where greatly increased stocks are now held. The new premises contain, in addition to large and convenient counter trade accommodation, a well-appointed private showroom to which all contractors and architects are invited to bring their clients.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., announce that owing to the rapid increase of business at their branch for the Midland district at 167, Edmund Street, Birmingham, they have found it necessary to take additional and adjoining premises at 165, Edmund Street. They will now hold much bigger stocks for the convenience of their customers. Their address is now 165 and 167, Edmund Street, Birmingham.

Panama Exhibition.—The British Committee has dissolved owing to the war. The Exhibition will open on February 20th next and close in December.

Bankruptcy Proceedings.—The Bristol International Exhibition, Ltd., Exhibition Offices, Ashton Avenue, Ashton Gate, Bristol.—In this matter the winding-up order was made on the petition of creditors, and, according to the statement of affairs prepared, the liabilities amount to £28,866, while, after deducting the claims of the preferential creditors, the assets were insufficient to meet the claims of the debenture-holders. As regards the contributories, there is a deficiency of £33,750 odd. It appears that the company was registered in May, 1912, as a private company, with a nominal capital of £2 000, divided into 2,000 shares of £1 each. The objects of the company were to carry on an exhibition of machinery, arts, industries, &c., in or near the City of Bristol. The capital was increased to £5,000 under an agreement dated May 5th, 1913, by the addition of £3,000, which was divided into 3,000 shares of £1 each. Charles Howes, of Knowle, Bristol, commission agent, was the promoter of the company, and a meeting was called on November 24th, 1911, at his instance, when it was decided that a limited company should be formed to carry on an exhibition of arts and industries in the year 1914, the exhibition to include a pageant of Bristol. It was considered, about February, 1912, that the exhibition and the pageant could not be run conjointly, and it was decided that a company should be formed to carry on the exhibition of arts and industries, and enter into a contract with a limited company which was to be formed. Memorandum and articles of association were framed for the last-named company, but they were never registered. The Bristol International Exhibition, Ltd., instituted a guarantee fund in Bristol and the West of England to obtain the necessary working capital, and a further guarantee fund, with the object of raising £120,000 in all. The Bristol guarantee fund amounted to £259 odd, while guarantees for £80,000 were obtained under the other guarantee fund between June, 1913, and January, 1914. In consideration of the company giving them a charge on the guarantee funds and the revenue policy, Lloyd's Underwriters issued six policies, amounting to £70,000, to five creditors of the company, for moneys advanced and work done on behalf of the company. A policy was also effected by the company with Lloyd's Underwriters under which the latter undertook to pay the difference between £95 000 and any less sum which might be received from all sources in respect of moneys due to the company. The policy is subject to certain warranties, which, however, had not been fully complied with. Fourteen creditors had obtained judgment against the company at the date of the winding-up order, and the company had for some months experienced some difficulty in meeting its debts as they fell due. The failure of the company is due to inability to obtain the support of prominent Bristol citizens, insufficient capital, heavy commissions and premiums in respect of the guarantee fund and Lloyd's policies, extra cost of construction, chiefly labour, through endeavouring to complete the buildings for the opening of the Exhibition on May 28th, 1914, and the inclement weather experienced after the opening, which seriously affected the takings.

The following are among the creditors:—Avery, W. & T., Ltd., £120; Colston Electrical Works, Ltd., Bristol, £213; Electrical Engineering and Equipment Co., London, £830.

Archibald Atkinson, cycle and electrical engineer 30, Great George Street, Leeds.—Receiving order August 27th. Debtor's own petition. First meeting September 9th, at Official Receiver's office, 24, Bond Street, Leeds. Public examination, September 29th, County Court House, Albion Place, Leeds.

(*Continued on page* 339.)

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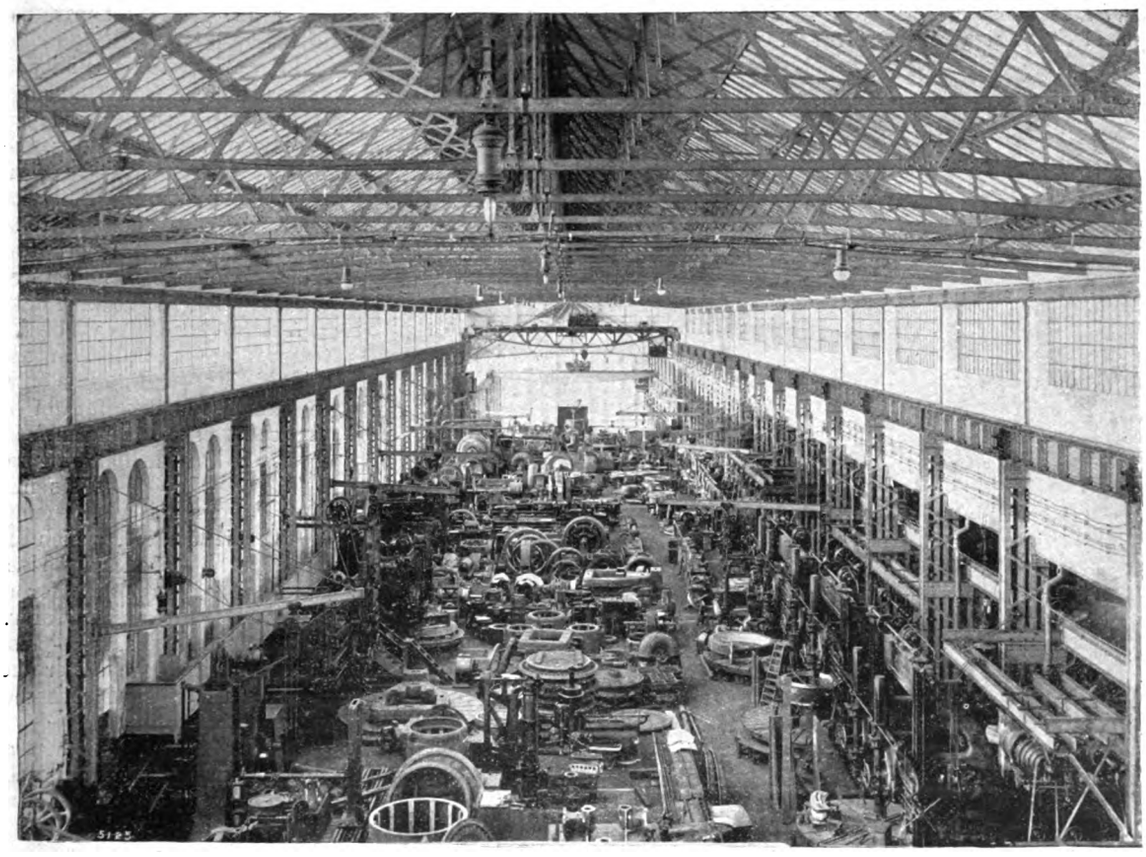
THE BRITISH THOMSON-HOUSTON CO.'S WORKS.

This great manufacturing organisation has its head offices and works at Rugby, but is also represented directly or indirectly in all parts of the world. The apparatus produced by the company cover a very wide range of electrical manufacture, and include tramway and railway equipments, Curtis steam turbines, A.C. and D.C. generators and motors, rotary converters, transformers, the Mazda drawn-wire and the Mazda half-watt incandescent lamps, electrical measuring instruments, high and low-tension switchgear, and electrical heating and cooking devices.

Bird's-eye View of the British Thomson-Houston Co.'s Works, Rugby.

The erection of the Rugby works was commenced in 1900, and when the factory was opened in the following year it provided work for some 500 operatives, the total floor space covered being 200,000 sq. ft. The present Rugby works occupy a site some 39½ acres in extent, of which about 24 acres are covered by roads and buildings; these works have a total floor space of 800,000 sq. ft., the floor area of the company's three factories at Rugby, Willesden and Coventry aggregating well over a million sq. ft. The majority of the buildings at Rugby are of steel and brick construction, but the two latest buildings are of reinforced concrete; the arrangement provides for minimising as far as possible internal handling.

The works are connected with the London and North-Western and the Midland Railways, and the handling of material in the works yard is taken care of by a locomotive and two travelling cranes running on standard-gauge tracks which connect all the principal buildings, while all light



Turbine Shop in the B.T.H. Co.'s Works.

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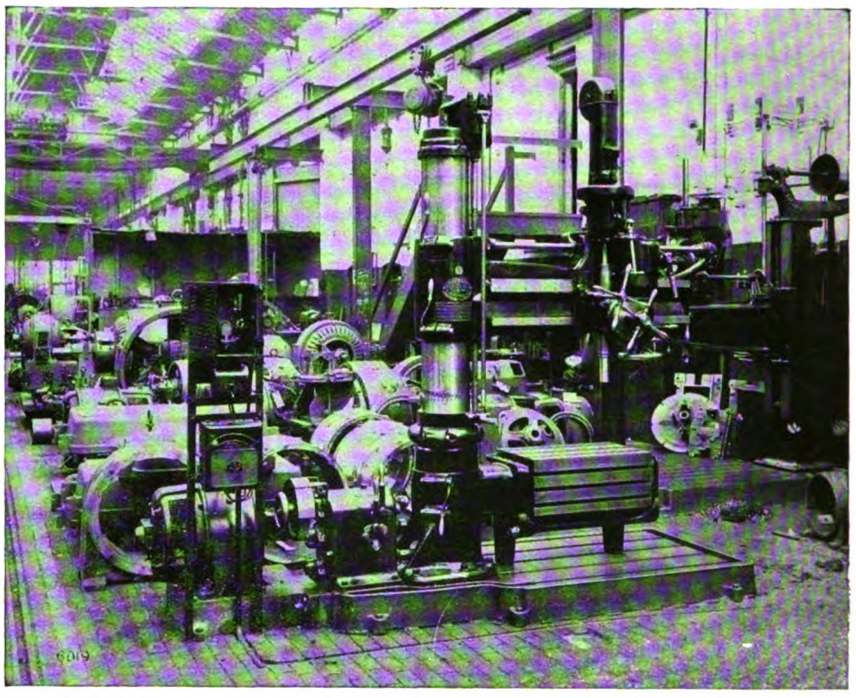
shunting is provided for by electric capstans placed at convenient points. As the floor level of the large ferro-concrete building is some 17 ft. below that of the remainder of the works, a 40-ton electric lift is provided to transfer loaded trucks to and from this building. Material inside the buildings is handled by over 30 electric travelling cranes, the largest of which has a capacity of 40 tons and a span of 66 ft., and a large number of fixed cranes, in addition to which a comprehensive narrow-gauge railway system connects all parts of the works.

The fire-extinguishing equipment of the works has been carefully thought out so as to eliminate, as far as possible, all chance of a fire gaining headway, and the company has organised an efficient volunteer fire brigade among the members of its staff.

The heating for the majority of the buildings is planned on the hot air blower system, air being drawn in from outside, passed over steam-heated coils, and distributed throughout the buildings.

The tool equipment is thoroughly up-to-date, consisting chiefly of English makes, with some American and Continental machines, all of which, with the exception of a few pneumatic and hydraulic machines, are electrically driven. A large number are operated by individual D.C. motors, while small machines are group driven. Wherever possible the machine work is done by the aid of jigs, to ensure interchangeability of parts; the variety of work carried out requires a large number of special tools and jigs, and the company's tool room provides these important apparatus. The power for operating the various electrical appliances is obtained from the works power house, which contains machines of an aggregate capacity of 4,760 KW., the full-load output of the station being 3,110 KW. This station is interesting as showing the tremendous development which has taken place in the design of electrical machinery during the past 10 years, the machines installed ranging from low-speed reciprocating engine-driven sets to the latest high-speed turbine-driven generators of the company's own manufacture.



Radial Drill with Individual Motor-Drive, in Main Machine Shop.

The thorough testing and inspection of all apparatus in the finished state and in the various stages of manufacture are features to which great care and attention are given; thorough examination after each operation reduces to a minimum the possibility of defective or inaccurate work reaching the assembly department. A very elaborate and complete equipment, which is kept thoroughly up-to-date, is provided for the testing of all finished apparatus, this work being carried out as nearly as possible under actual service conditions, and complete records are preserved, together with details of the original manufacturing instructions, thus enabling the company to duplicate or supply spare parts for any piece of apparatus shipped from the works since their inception.

Top Floor of Foundry; Moulding Machines for Resistance Grids on the right.

In view of the necessity for rapid extension of its manufacturing facilities the company has acquired premises at Willesden and Coventry, to which the switchgear and electrical instrument factories respectively have been removed. In addition to electrical instruments, the Coventry works also take care of the manufacture of electrical heating and cooking devices, &c.

Although many distinguishing features are embodied in the design of B.T.H. apparatus, it is only possible to describe here a few of the most important of the company's manufactures, of which the following are typical.

The company specialises in turbines of the impulse type, as exemplified by the Curtis turbine, which has been manufactured at Rugby since 1904. Such turbines are made for capacities of about 40 H.P. and upwards, and are of two main types, high-pressure and mixed-pressure, the latter being designed to utilise the exhaust steam from reciprocating engines.

B.T.H. motors, both A.C. and D.C., are designed as standard machines, of which a certain number are always kept in stock, thus enabling demands for these machines to be readily met; they are designed for all ordinary voltages and in the sizes most in demand. The company's wide experience in this field, however, enables it to design and construct machines suitable for any special set of conditions with the minimum of delay.

The B.T.H. rotary converters are built for capacities up to 3,000 KW. for any standard voltage up to 1,500 volts D.C.

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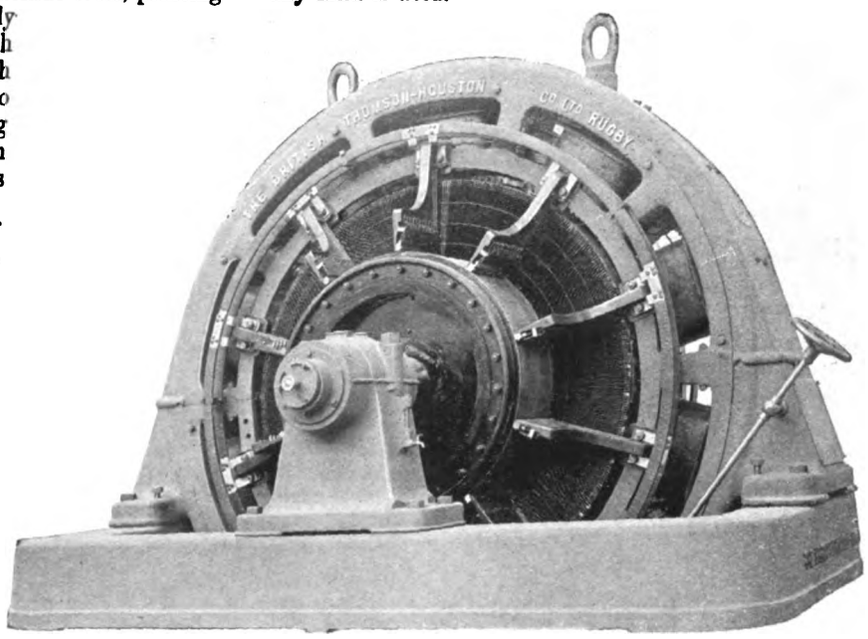
on 25 cycles, and 750 volts D.C. on 50 cycles, and are suitable for reactance, booster, or induction-regulator control. The company has also patented a two-part split-pole method of controlling the voltage ratio on its 25-cycle machines, which is free from the defects inherent in the three-part pole system, and has met with great success wherever installed.

A large number of different types of controllers are manufactured for traction, haulage, machine tools, printing presses, &c., each type being carefully designed to enable the machine with which it is used to be handled with absolute safety. The company also manufactures many automatic starting and regulating equipments for use with motors operating under the most arduous conditions.

One of the best known products of the B.T.H. Co. is the Mazda drawn-wire tungsten lamp, which was introduced by the company in 1911, and is now supplemented by the half-watt lamp, in sizes above 600 C.P.

The company's employés number nearly 6,000, of whom 4,013 are employed in the Rugby works and offices.

The Coventry factory occupies a site of some 42,000 sq. ft., and consists of four buildings, one of which is devoted entirely to the various offices, which provide employment for a staff of approximately 170; the three manufacturing buildings, which are arranged for the accommodation of 1,500 employés, are single bay structures of steel and brick. The machine tool equipment, which is thoroughly up to date, has been carefully arranged for group driving by electric motors. As most of the work handled is of a light nature, an elaborate transport equipment is unnecessary. A thorough examination of all parts of apparatus is made by the inspection department at various stages of manufacture, and the finished apparatus are subjected to rigorous tests in a testing department provided with a thoroughly modern and complete equipment.



B.T.H. Compound-wound, Interpole Rotary Converter, 1,500 kw., 25 cycles, 300 r.p.m., 600 volts, for L. & S.W. Ry.

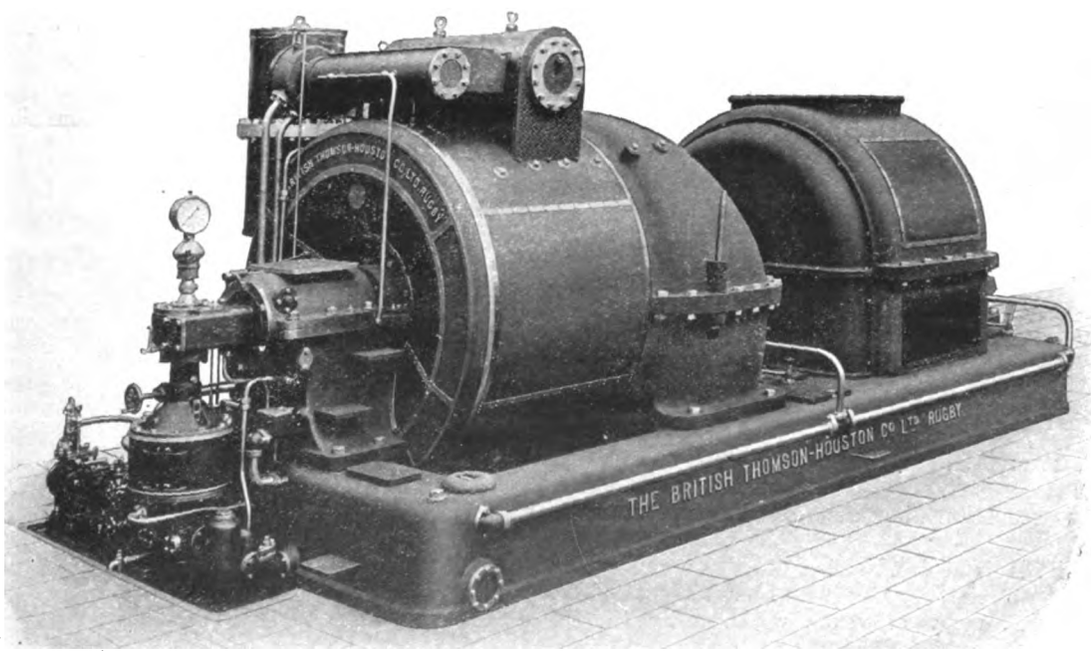
The apparatus manufactured at this factory is all of a light nature, and includes electric supply meters, measuring instruments, reverse current and overload relays, high and low-voltage cut-outs, Tirrill voltage regulators, electric heating and cooking devices, contactor gear for traction work, arc lamps, speedometers, &c. A few of the most important of these are briefly described in the following notes:—One of the best-known products of this factory is the Thomson watt-hour meter, suitable for voltages up to 650 volts, and currents up to 3,000 amperes on three-wire, or 10,000 amperes on two-wire circuits.

An ampere-hour meter of the mercury type is also manufactured in large quantities; this is distinct from other forms of mercury meter in that no compounding device of any kind is used.

B.T.H. single-phase A.C. meters are of the induction type, and are characterised by high torque, small losses, and very good accuracy characteristics.

Meters for two and three-phase circuits, in which two single-phase elements are employed, are also manufactured; the two disks are mounted on the same spindle, one of them being damped by means of permanent magnets in the usual manner. These meters are connected in accordance with the well-known two-wattmeter method of measuring power on polyphase circuits. They are made for both switchboard and house service. Single-phase meters fitted with a prepayment mechanism are also manufactured in large quantities for house service.

The Tirrill regulator, which provides a satisfactory and reliable method for automatically and instantaneously regu-



B.T.H. Curtis Turbo-Alternator, 5,000 kw., 1,500 r.p.m., 2,200 volts, 50 cycles, for the County of London Electric Supply Co., Ltd.

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lating voltage, is also manufactured in these works, and is capable of limiting voltage variation within one half of 1 per cent. above or below normal under all conditions of load or power factor, provided the exciter voltage range for which the regulators are designed is not exceeded.

A large variety of electric heating and cooking appliances is manufactured, including radiators, water heaters, kettles, flat-irons, grills, glue-pots, stoves, &c. The distinguishing feature of these devices is the heating element, which is composed of Calorite, a metal possessing a very high resistance and a melting point in the neighbourhood of 3,000° F., while it will withstand oxidation to a very high temperature, being, in fact, for all practical purposes thermally indestructible.

BALDERTON ELECTRIC LIGHTING.

The subject of village lighting is one of increasing importance, and one to which greater attention is being given every day. Throughout this country there are many small communities which possess no light, or a very inadequate supply, provided either by gas or oil. In these small towns and villages there is a growing demand for better and cheaper lighting, and engineers are doing their best to grapple with the solution of this problem. That the field is large is unquestionable, and we may point to what has been done in the North of Yorkshire towards developing small water-power plants for this purpose. Where energy is available in bulk at a cheap price the question is greatly simplified, and the installation of electricity becomes a

Balderton Street-Lighting.

paying proposition, which appeals to the ordinary councillor.

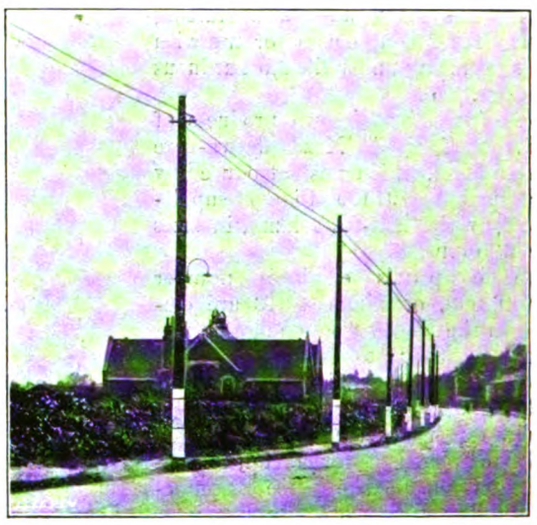
The village of Balderton is one of the latest to go in for an electric street-lighting scheme, and there are several points about the installation that give it more than usual interest.

The district is situated in Nottinghamshire, near Newark, and adjacent to the growing works of Messrs. James Simpson & Co., many of whose workmen live in the village.

By arrangement with this company, electricity is supplied by it to the Council for all lighting at 1d. per unit. The system of distribution adopted was overhead wires erected on wood poles. In order to cheapen the cost of the installation, bare stranded aluminium wire was used throughout, and by this means a considerable saving, not only in first cost of material, but also in the labour of erection, was effected. It may be pointed out that for this class of work aluminium is growing in favour, and it is now being largely used, after severe trials, by the War Office; but, as far as we know, this is the first installation put up under a Local Government loan, in which the use of wooden poles and bare aluminium wire was sanctioned. The period of repayment of the loan was fixed at 15 years.

The district which is lighted includes about a mile of the Great North Road, and finishes at the Newark boundary. The lamps erected number 24 100-watt and 49 60-watt street-lighting Mazda lamps, the voltage being 220. The 100-watt lamps are used to illuminate the Great North Road, and the 60-watt lamps for the village and side streets.

The main cables carrying the current from the works are 7/·148 stranded aluminium, and about 3,000 yd. of this



Side-street Lighting.

were erected. In the main streets 7/·103 strand is used, and in the side streets 3/16 S.W.G. strand. In all, about 12,000 yd. of cable have been erected.

The poles vary in size from 36 ft. long and 13 in. in diameter to 32 ft. long and 8½ in. in diameter, and are spaced about 100 ft. apart, every alternate pole being a lamp pole.

The lamps are carried on simple brackets clamped round the poles, combined with a fuse-box containing double-pole fuses to protect each lamp. The wiring to the brackets is aluminium rubber-insulated wire cleated to the poles, the chief object being to use nothing but aluminium wire, so

Lighting the Great North Road.

as to simplify jointing. The joints are of the usual torsion type, with special twist joints for the tappings. At suitable points the circuits are controlled by sectional switch boxes clamped on the poles.

Choking coils and lightning arresters are fixed near Messrs. Simpsons' works. Where the mains cross the road,

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and the trunk telephone lines, armoured bitumen cable laid direct in the ground is used; all other crossings are overhead.

The cost of energy for the whole installation is about 6d. per hour, and it is calculated that by economy in lighting hours the cost can be kept down to about £45 per annum, where the same illumination by gas would cost roughly £80. The installation has now been working for some months, and has given every satisfaction.

The consulting engineer was Mr. F. C. Geis, of New Balderton, and the installation was erected by Messrs. Loxley & Co., Ltd, of Leeds.

BUSINESS NOTES.

(*Continued from page 334.*)

Liquidations.—THE EUREKA CLOCK CO., LTD.—Particulars of claims must be sent in by September 23rd, to the liquidator, Mr. A. E. Tilley, 8, Staple Inn, E.C.

THE MORDEY-FRICKER ELECTRICITY METER CO., LTD. — At extraordinary general meetings of the company, held on August 12th and 27th, it was resolved and confirmed: "That the assets and business of the company be sold to the British Insulated and Helsby Cables Co., Ltd., for £8 500, and that the company be wound up voluntarily, with Mr. F. Miller, of 82, Victoria Street, S.W., as liquidator."

Book Notices.—*Commercial Year-Book of the Birmingham Chamber of Commerce.*—This is the fifth edition of a useful Year-Book relating to the industrial resources and manufactures of the City of Birmingham. It is circulated extensively in the Colonial and foreign markets, and its issue at the present time fits in well with the campaign to secure trade that has hitherto gone to Germany.

"Science Abstracts," Sections A and B. Vol. XVII, Part 8. August 25th. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

Private Arrangements.—ACCUMULATOR INDUSTRIES, LTD., Oriental Institute, Woking.—In accordance with the resolutions passed at the recent meeting of creditors of the above, an application has been made to the Court, and Mr. G. E Corfield, of Messrs. Corfield & Cripwell, accountants, of Balfour House, Finsbury Pavement, E C., has been appointed to act as joint liquidator in the voluntary liquidation of the company. According to the approximate statement of affairs which has been prepared, the liabilities amount to £46,229, while the issued capital is £37,318. At book values the assets are valued at £8,592, but at a forced realisation they are only expected to produce £3,627. From the latter figure has to be deducted £187 for preferential claims, leaving net assets of £3,440, or a deficiency as regards the creditors of £42,789. The following are creditors:—

American Hard Rubber Co. ..	£40	Matthews Bros.	£18
Baird & Tatlock	16	Morgan, R. L.	100
Brewster & Co.	58	McLaren, W.	38,883
Buck & Hickman	30	Morris, H. M., & Co., Ltd. ..	31
British Oxygen Co.	92	National Gas Engine Cor ..	19
Campbell, Hooper & Todd ..	785	Pilchars, Ltd.	36
Crow, W. R. & Son	25	Pirelli, Ltd.	72
Denny, Mott & Dickson ..	111	Raetsch, Ltd.	89
Francis Barnet Mfg. Co. ..	154	Redfern & Co.	1,011
Garland, A. E.	27	Skeet, Fooks & Jefferies ..	33
Holzapfel & Hilghs	56	Smith & Sons	47
Ingram, J. E., & Son	15	Sully, J. & A. W., & Co... ..	173
Kingsford, Dr.	28	Twyford, R. J.	1,271
"Bankers"..	945	Tudor Accumulator Co, Ltd...	100
Lees, W., & Co.	20	Vacuum Oil Co.	15
London Electric Wire Co. ..	41	Wilcox & Co.	15
Macdonald, J.	24		

THE NATIONAL ELECTRIC TIME CO., LTD., 15, Great Sutton Street, London, E.C.—Pursuant to the provisions of the Companies' (Consolidation) Act, a meeting of the creditors interested herein was held a few days ago, when a statement of affairs was presented showing liabilities of £632. The assets were estimated to realise £162, less £89 for preferential claims, leaving net assets of £72, or a deficiency as regarded the unsecured creditors of £559. It was reported that the company was registered on November 21st, 1912, with a nominal capital of £5,000 in £1 shares. The company took over an existing business, for which it paid £1,250. Of the purchase price £350 was paid in cash, and the balance by the issue of fully paid shares. Some 750 shares had been issued for cash. An approximate trading account was presented which showed that up to December 31st last the company had traded at a loss of £600. It was stated that negotiations were in progress for the sale of the business as a going concern, and the opinion was expressed that the negotiations should be carried through. After a short discussion it was decided to confirm the voluntary liquidation of the company with the liquidator appointed by the shareholders.

Catalogues and Lists.—MESSRS. VENNER'S SIGNS, LTD., 6, Old Queen Street, London, S.W.—New catalogue of 32 pages, containing illustrations of a number of examples of electric sign work carried out on their Venner patent system. It should be interesting and useful to all concerned with electric sign installation and progress.

MESSRS. P. A. LUNDBERG & SONS, Pioneer Electrical Works, Islington, N.—New list, No. 837, of bell-pushes, push-keys and kindred accessories, giving prices and particulars of a variety of improved devices of the press-button type and plug connections.

THE PREMIER ACCUMULATOR CO., LTD., Northampton.—12-page illustrated price list of their portable batteries for lighting and ignition purposes for motor-cars; various sizes and sets for starting batteries, lamps, &c., are shown. The firm are supplying a large number of these batteries.

MESSRS. ED. BENNIS & CO., LTD., Little Hulton, Bolton.—A handsome brochure on "Recent Developments in Machine Stoking," showing how smokeless combustion of coal can be attained by the use of an efficient chain grate together with economy of fuel and the ability to use cheap grades of coal. The essential feature of the Bennis chain grate—the Bennis-Miller-Bennett halved links, which prevent the admission of excess of air—is described, as well as other improvements in detail, and some remarkable instances of increased output and lower fuel cost are quoted. Many illustrations are given, and details of tests. Copies can be had on application to the company.

ELECTRICAL APPARATUS CO., LTD, Vauxhall Works, South Lambeth Road, S.W.—Leaflet H 48 describing new high-pressure oil-immersed ironclad switchgear for collieries, sub-stations, &c.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Price list No. 7,201 A, dealing with B.T.H. small-power motors for A.C. and D.C., in sizes from $\frac{1}{10}$ to ½ H.P., and for voltages of 110 and 230.

LIGHTING and POWER NOTES.

Argentina.—The Municipality of Lincoln has applied to the Government of the Province of Buenos Ayres for leave to sell its electricity and water-works. These works cost $400,000, which is still owed. The Mayor forwarded at the same time two forms of contract with Mr. Mauro Herlitzka for the working of the stations for 20 years.

A local company has been formed in Viedma (Rio Negro), with a capital of $120,000, for the erection of an electricity works.—*Review of the River Plate.*

Australia.—The Premier has set aside £100 for preliminary inquiries into the schemes for the generation of electricity for the proposed irrigation works in connection with the Yarragamba, Nepean and Hawkesbury rivers.

Barford.—PROPOSED E.L.—The Warwick R.D.C. has passed the plans of a local company for an electric lighting scheme for Barford. Mr. Smith Ryland is to be chairman of the company, and overhead mains are to be used.

Bolton.—The annual report of Messrs. Tootal, Broadhurst, Lee & Co, cloth manufacturers, states that the change from steam to electric power at their mills in Bolton has been completed, and the results, both from a working and an economical point of view, are satisfactory.

Bradford.—The B. of G. has appointed a sub-committee to consider the advisability of converting the exterior lamps from gas to electricity.

Cleckheaton.—BOARD OF TRADE REPORT.—A B. of T. report has just been issued upon an inquiry held by one of its surveyors with reference to the bursting of a feed delivery pipe at the electricity works in April last, whereby a stoker was seriously scalded. The report states that the casting appears to have been defective, and that if a suitable hydraulic test had been applied the latent defect would have been discovered.

As the Yorkshire E.P.S. Co. has offered a supplementary supply of electricity in bulk, the T.C. has deferred the scheme recently adopted for the extension of its electricity works, at a cost of £8,500, with the exception of additional switchgear and feeders.

Clones.—E.L. INAUGURATED.—The inauguration of the electric lighting of Clones took place last week at the power house of the Clones Electric Light and Power Co. Centrally-suspended clusters of lamps are used in the main streets, and the side streets are lighted by single lamps suspended from brackets clamped to the poles carrying the wires.

Deal and Walmer.—E.L. SCHEME.—A Joint Committee of the Deal T.C. and the Walmer U.D.C., after instructing Mr. E. M. Lacey to report upon the E.L. question for the two towns, asked Mr. Lacey if, owing to the war, he would agree to the instructions being withdrawn. Mr. Lacey replied suggesting that the instructions be postponed until the Committee considered the conditions sufficiently normal. The Joint Committee referred the matter to the respective Councils, and the Deal T.C. has decided to instruct Mr. Lacey to proceed with his investigation, leaving the Walmer U.D.C. to co-operate if it so desires.

Farnborough (Kent).—MAINS EXTENSION. — The West Kent E.L. and S. Co. has informed the Bromley B. of G. that it will shortly be extending its mains to Farnborough, and would be prepared to supply electricity to the Board's workhouse and infirmary.

Holmfirth.—PROPOSED NEW GENERATING STATION.—The D.C. has decided to apply to the B. of T. for sanction to construct a generating station at Newtown, in connection with the Holmfirth E.L. Order, 1912.

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India. — Calcutta Electricity Charges. — The Calcutta Trades Association has approached the Bengal Public Works Department with a view to a reduction in the charges for electricity. The present charges are 8 annas (= 8 pence) per unit for lighting, and 4 annas per unit for fans, with a discount of 25 per cent. for prompt payment, compared with 4½ annas per unit for lighting, and 4½ annas, less a monthly discount of 1 per cent. on every 250 units used, with a maximum of 35 per cent., and also a rate of 4 annas per unit for residential premises, for power, in Bombay. In Calcutta it is necessary, in order to obtain the lower rate for fans, to have the premises wired separately for lighting and power, and to install two meters. The meter rent of Rs. 12 per annum is also objected to. The Association suggests a maximum charge of 4 annas per unit, with a discount of 25 per cent. for prompt payment, for all purposes, and considers that where more than one meter is installed, a charge of 8 annas per meter per mensem would be sufficient. The company has since reduced the charge for lighting by ½ anna per unit, but the Association considers this altogether inadequate.

The application of the Madras Electric Supply Corporation, Ltd., for permission to introduce the alternating-current system into the city in addition to the existing three-wire direct-current system has received the sanction of the Madras Government, which has also accorded sanction to a change of frequency from 25 cycles, as at present authorised, to 50 cycles per second.

Kingston-on-Thames. — L.G.B. Inquiry. — A note appeared under this heading in our last issue referring to proposed extensions of cables and the erection of a transformer sub-station; we regret to learn from Mr. J. E. Edgcome, borough electrical engineer, that the particulars were wholly incorrect. No special extensions of mains are in prospect in connection with his undertaking.

The note, we find, should have referred to Wimbledon, and is reprinted under that heading to-day.

Llandudno.—Street Lighting. — The U.D.C. has deferred further consideration of a report on the suggested electric lighting of Mostyn Broadway.

Maidstone.—Sale of Plant.—The T.C. has sold one of the original 150-kw. sets at the electricity works to the military authorities for £750, exclusive of all charges for removal, and the set has gone to Egypt.

Supply to Tramways.—The price of energy for the tramways, from April 1st last, has been fixed at 1½d. per unit, subject to revision in case of any alteration in the price of coal.

Portrush.—E.L. Scheme.—The U.D.C. has adopted the report of Messrs. John Woodside & Co., of Belfast, with reference to the proposed electricity supply works. The engineers have been directed to proceed with it immediately, and it has been decided to apply for a loan of £8,000.

Saddleworth.—E.L. and Tramways Extensions.—As the result of a conference between the Saddleworth D.C. and the Stalybridge, &c., Electricity Board to consider an extension of the tramways from Mossley to Greenfield, and the supply of electricity for lighting purposes to Saddleworth, it is proposed to seek powers to extend the tramways and to supply electricity.

Shipley.—Street Lighting and the War.—Owing to the scarcity of carbons, the U.D.C. has instructed the electrical engineer to replace the arc lamps in the streets with metal-filament lamps.

Todmorden.—Loan Sanction.—The L.G.B. has sanctioned the T.C.'s application to borrow £1,000 and £200, for the purposes of the electricity undertaking.

Whitstable.—Overhead Wires.—The E L. Co. has applied to the B. of T. for permission to use overhead wires throughout the urban district for the supplying of electricity at 230 volts.

Widnes.—L.G.B. Inquiry.—An inquiry was held on August 25th into the application of the T.C. for a loan of £6,300, for a refuse destructor. There was no opposition.

Wimbledon.—L.G.B. Inquiry.—An inquiry was held on August 20th into the application of the Council for a loan of £8,500 for two extra-high-pressure cables and the erection of a transformer sub-station. There was no opposition.

TRAMWAY and RAILWAY NOTES.

Argentina.—The Government of the Province of San Juan has approved the plans presented by the constructing syndicate for a tramway system connecting the city of San Juan with the surrounding suburbs.—*Review of the River Plate.*

Sheffield.—Annual Accounts.—The total revenue of the Corporation Tramways undertaking for the year ended March 31st last was £392,397, against £364,903 in the previous year. Working expenses amounted to £232,761, against £207,690, and, after paying interest and sinking fund, £78,723, and income-tax, £3,306, there was a balance of £77,608, of which £30,123 was placed to the renewals fund and £30,582 to the relief of the rates. The car-miles run totalled 8,883,576, against 8,071,188, and the passengers carried numbered 104,851,408, against 96,330,242. The department generated 18,601,705 units, against 16,500,208, and also purchased 207,655 from the Electricity Supply department. The total cost per unit was ·679d., against ·673d., and the energy used per car-mile averaged 1·933 units, against 1·873. The average total revenue per car-mile was 10·527d., against 10·760d., while the total working expenses per car-mile were 6·79d. (including power, 1·39d.), against 6·654d. (power, 1·325d.). The cost of fuel increased from £17,216 to £21,738. The Corporation's motor-omnibuses showed an income of £9,128, and a working expenditure of £5,974. After paying interest, sinking fund, and income-tax, and allowing £1,360 for depreciation, there was a balance of £1,271, which was transferred to a special reserve fund.

U.S.A.—The New Orleans Dock Board has closed a contract for energy supply to six electric trucks for haulage service on the water front, after a careful test of their merits. The docks are to be equipped with an electric conveyer system.—*Electrical World.*

TELEGRAPH and TELEPHONE NOTES.

Argentina.—The Ministerio de Marina has given instructions for the erection of two additional wireless stations at Iguaza and Posadas respectively. Both stations will be of power sufficient to communicate with Paz (Entre Rios) and Darcena Norte, and in conjunction with the existing stations at Puerto Militar, Cabo Virgenes and the Island of Ano Nuevo, provide a complete wireless system throughout the Republic.

Canada.—The capitalisation of telegraph companies operating in Canada for the year ended June 30th, 1913, as reported by the companies, was $202,468,041, of which $160,342,873 was in stocks, and $42,125,168 in funded debt, these figures being practically the same as in the previous year. The total revenue was $6,095,212, an increase of $879,041, and the expenses were $4,034,480. The ratio of operating expenses to gross revenue was 66·84, as compared with 65·83 for the year 1911-12. The wire mileage for the year was 152,918, against 167,939 miles in the previous year. The number of land messages transmitted was 11,176,753, against 9,252,540 in the previous year, and cablegrams sent were 877,534, against 768,559. The number of employés was 6,006, against 4,828, and salaries and wages cost $2,962,159, against $2,703,032.—*Canadian Railway and Marine World.*

Panama.—The Government telegraph and telephone services of the Republic are to be improved, an appropriation of $143,350 having been made for that purpose.

United States.—Both Germany and Great Britain have accepted proposals that the wireless stations at Tuckerton (New Jersey) and Sayville (Long Island) should be permitted to send code messages to belligerent countries, subject to the censorship of the American naval authorities.

Wireless and the War.—According to the *Financial Times*, the sinking of the *Kaiser Wilhelm der Grosse* by the *Highflier* was attributable almost entirely to the fact that the British Navy had free and unfettered use of wireless telegraphy, while the German stations at Togoland and Dar-es-Salaam had been destroyed. The part played by wireless telegraphy in the present European struggle has been most important from the outset, and our superiority in this respect is likely to make itself felt with still greater effect before the war is over, particularly in connection with the strategic movement of the troops.

West Indies.—An agreement dated August 10th has been concluded by the Imperial and Canadian Governments and the Crown Agents of the West Indian Colonies and the West India and Panama Telegraph Co., Ltd., whereby, in return for a subsidy of £16,000 per annum for ten years, payable in equal shares by the Imperial and Canadian Governments, and the continuance for the same period of subsidies amounting to £10,300 per annum already paid by the West Indian Colonies, the company undertake largely to reduce the cable rates at present in force. There will be a flat rate for messages between any of the Colonies and the United Kingdom of 2s. 6d. per word, and 1s. 6d. per word in the case of Canada, in place of rates varying from 3s. to 5s. 6d. and 2s. 2½d. to 4s. 9½d. Corresponding reductions are made for inter-Colonial messages.

If in any year after the first four the company's revenue exceeds £74,000, a sum equal to one-half of such excess (up to a revenue of £106,000) is to be deducted from the Imperial and Canadian subsidy payable in respect of the next year; while if it exceeds £106,000, a sum equal to one-half of such excess (up to a revenue of £126,600) is to be deducted *pro rata* from the Colonial subsidies. Furthermore, if in any year after the first four the revenue exceeds £126,600, reductions in the current rates of charge are to be made.

Provision is made for the effectual working of the company's existing system; for a reduction of 50 per cent. in the charges for Government and Press telegrams and for priority for Government telegrams; for the acceptance of deferred telegrams at a reduced rate; for the maintenance of the British character of the company; for the supply to the Colonies free of charge of daily news bulletins—especially as to matters chiefly affecting British and Colonial interests; and for penalties in the case of interruptions.—*Daily Telegraph.*

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CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—September 9th. Electrical goods, for the Powell Duffryn Steam Coal Co., Ltd. Stores Manager.

Australia. — SYDNEY. — September 30th. Telephone instruments and parts, for the Postmaster-General. See "Official Notices" August 21st.

October 7th. Telegraph instruments, measuring instruments, incandescent electric lamps, switchboard parts, for the Postmaster-General. See "Official Notices" August 28th.

MELBOURNE.—Victorian Railways Department. October 7th. Motors and switchgear, and motor-driven air compressors for the Ballarat and Bendigo workshops.

September 22nd. P.M.G.'s Department. Ten tons twisted-pair wire.

October 12th. Three-phase motors for workshop machinery, for Melbourne Suburban Railways. See "Official Notices" to-day.

BRISBANE.—December 15th. C.B. multiple switchboard, automatic or semi-automatic.—*Aus. Mining Standard.*

KALGOORLIE.—Five-ton electric wagon, for Municipal Council. Specifications, &c., may be seen at the Commercial Intelligence Branch of the Board of Trade.

Birmingham.—September 7th. Coal (173,000 tons) for the Corporation Electric Supply Dept. Mr. R. A. Chattock, City Electrical Engineer and Manager, 14, Dale End.

Burnley. — September 21st. Guardians. Electrical goods and the performance of electrical work during the next half-year.

Clayton (Bradford).—September 7th. Electric lighting installation, for the Guardians of North Bierley Union. Specifications from Messrs. J. Harper Bakes & Sons, Calverley Chambers, Leeds.

Eccles.—September 21st. Coal elevator and conveyor at the electricity works, Cawdor Street, Patricroft. Specifications, &c. (£1 1s.), from the Borough Electrical Engineer.

Huddersfield.—September 9th. West Riding Asylums Board. Electric lighting, telephones, bells, &c., at the new chronic blocks, Storthes Hall Asylum, Kirkburton, near Huddersfield. Particulars from Mr. W. E. H. Burton, Engineer to the Board, West Riding Asylum, Wakefield.

Limerick.—September 18th. Corporation. One three-cylinder Diesel oil-engine coupled to a 160-KW. D.C. generator; one motor-driven air compressor. See "Official Notices" to-day.

London. — L.C.C. — September 8th. Cables, H.T. and L.T., and laying stoneware ducts (tramways). See "Official Notices" August 7th.

September 8th. Reconstruction of motor-generators in the tramway southern sub-stations. See "Official Notices" Aug. 14th.

September 22nd. Induced-draught fans, motors, spare parts and dampers, also alteration of flues and moving of dampers at the generating station, Greenwich. See "Official Notices" August 28th.

ST. PANCRAS.—September 21st. Electric lift for heavy vehicles, for the B.C. See "Official Notices" August 28th.

Manchester.—September 15th. Supply and erection of steel storage shelving in the Stores Dept., Hyde Road car depôt, Manchester. Mr. J. M. McElroy, General Manager, Corporation Tramways, 55, Piccadilly, Manchester.

September 15th. Uniform clothing and caps. Specifications from Mr. J. M. McElroy, as above.

Middlesbrough.—September 12th. Corporation. Three electric motor-driven sewage pumps, priming pumps, metering arrangement, pipework, overhead travelling crane. See "Official Notices" August 14th.

New Zealand. — WELLINGTON. — September 8th. (1) 3,000 wall telephones, (2) 50, or more, telegraph typewriters, (3) 6 tons of copper binding wire, (4) 5 tons of galvanised-iron binding wire. Specifications, &c., may be seen by United Kingdom manufacturers at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*B. of T. Journal.*

Spain.—JARAIZ (CACERES).—December 5th. Concession for the urban and suburban lighting of the town (594 lamps). The present contract with the Sociedad Electro Industrial Anton Martinez Herraiz expires on December 5th. Prospective tenderers are informed that within 6 or 8 kilometres' distance private waterfalls exist, which may be acquired for the provision of current for public and private lighting and industrial purposes.

Salford.—Steel rails, points, crossings and tie-bars, for the Tramways Department. General Manager, 32, Blackfriars Street.

South Africa.—JOHANNESBURG.—October 9th. Ten single-truck double-decked electric tramcars, for Municipal Council. Specifications, &c., may be seen at Commercial Intelligence Branch of Board of Trade.

Warrington.—September 11th. Education Committee Wiring, &c., at the Evelyn Street Council School. Mr. J. Moore Murray, Secretary and Director, Education Office, Sankey Street, Warrington.

September 15th. 12 months' supply of earthenware conduits for Tramways Committee. See "Official Notices" August 28th.

Whitby. — September 30th. U.D.C. Construction of cliff tramway or lift. Particulars from the Clerk to the Council.

Wolverhampton. — September 8th. Construction of tramway permanent-way, Bilston Road, for the T.C. Mr. George Green, Borough Engineer (returnable deposit of £1 1s.).

September 15th.—B. of G. Electrical fittings, &c., for the Board of Guardians. Forms of tender from Mr. F. Harrison, Clerk to the Guardians.

CLOSED.

Bradford.—The Electricity Committee on Tuesday cancelled the contract for the 5,000-KW. turbo-generator of the Bergmann Elektricitäts-Werke A.G., Berlin, and transferred the order to the British Westinghouse Electric & Manufacturing Co., from whom, the committee state, they have obtained very satisfactory terms. The amount of the original tender was £9,370 The Bergmann generator was almost completed in Berlin.

London.—The Edison & Swan United Electric Light Co., Ltd., have received a contract for 12 months' supply of Standard-type "Royal Ediswan" drawn wire, and also carbon and special-type lamps, for H.M. Office of Works.

Manchester.—Messrs. Chamberlain & Hookham, Ltd. have received the contract for the supply of meters to Manchester.

Salford.—The following tenders are recommended to the Town Council for acceptance :—

Babcock & Wilcox.—Steel steam-pipes for 5,000-KW. turbo-alternator, £88.
J. Wolstenholme & Son.—Cast-iron pipes for 5,000-KW. turbo-alternator £160.
British Westinghouse Electric and Mfg. Co.—Switchgear equipment to two 750-KW. rotary converters, £275.
G. & J. Weir, Ltd.—One steam turbine-driven boiler feed pump, £285.

Stalybridge. — The Joint Tramways and Electricity Board has accepted the tender of Messrs. S. Robinson & Sons, Hyde, for new offices and stores at the generating station.

Warrington.—The Electricity and Tramways Committee is recommending the Council to accept the following tenders :—

St. Helens Cable and Rubber Co., Ltd.—Cable, £1,658.
British Thomson-Houston Co., Ltd.—Extra-high-tension feeder pane £113.
Drake & Gorham, Ltd.—Low-tension feeder panel, £42.
Scottish Tube Co., Ltd.—Steel tramway poles, £83.
W. & J. Richardson.—5,000 tons of coal.

FORTHCOMING EVENTS.

Association of Mining Electrical Engineers (North of England Branch).—Saturday, September 5th. Visit to Felling Colliery and Garden Party at Wardley Hall.

London Association of Foremen Engineers.—Saturday, September 5th. At 7 p.m. At Cannon Street Hotel. Paper on "Railless Electric Traction," by Mr. W. E. Ireland.

Salford Technical and Engineering Association.—Saturday, September 5th. At 7 p.m. At Royal Technical Institute, Peel Park. Paper on "Centrifugal Pumps for Salvage, Sewage and Gravel," by Mr. A. W. Taylor.

Institution of Mining Engineers.—Wednesday, September 9th. At 10.30 a.m. At the Central School of Science and Technology, Stoke-on-Trent. Annual General Meeting. (Dinner, visits to works, &c., are cancelled.)

Institute of Metals.—Thursday, September 10th. At 4.30 p.m. At Caxton House, Westminster. Annual General Meeting.

NOTES.

A Siemens Resignation.—Mr. C. Koettgen has tendered his resignation, which has been accepted, as a director and as managing director of Siemens Bros. Dynamo Works, Ltd., and has no further connection with the company.

Electrical Destruction of Pests.—A recent article in the *Electrical World* describing a device adopted by the employés of a Fort Wayne, Ind., electric light station for disposing of rats by making them auto-electrocutionists, recalls a patent issued a few years ago for destroying smaller pests. In the Fort Wayne invention the rodents are lured upon a metallic base by a piece of cheese suspended above it on an iron prong, the two being connected with opposite poles of a 110-volt circuit; the result to a hungry and enterprising rat is obviously disastrous. In the patent referred to the "bugs" were supposed to be lured (bait not stated) upon a grill or network of wires of alternate polarity, which put the said bugs out of commission in short order. These inventions are being recommended to all American up-to-date central station managers as worthy of consideration in increasing their off-peak load!

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Patents of Enemy Subjects.—Mr. Runciman, in moving the second reading of the Patents, Designs and Trade Marks (Temporary Rules) Act (1914) Amendment Bill, explained that the Bill would not confiscate the property of alien patent owners. The object was to suspend and not to destroy. If, at the end of the war, Germany and Austria agreed to keep alive patents held by British subjects in those countries, we, on our part, would be prepared to keep alive patents in this country of German and Austrian subjects. Power, however, was taken to issue licences to British subjects to exercise alien patents not only for the period of the war, but for the full period of the patent. The Bill passed through Committee, and was read a third time.—The *Times*.

Late Correspondence.—Since our "Correspondence" pages went to press, we have received a number of other communications, which, owing to the immediate interest of the matter with which they deal, we insert notwithstanding our usual rule:—

ELECTRIC COOKING APPARATUS.

Mr. Ptah is evidently a reincarnation of one of those Egyptians whose internal arrangements he so graphically describes.

It would be immensely interesting to learn why they injected a fluid into the oil chamber which, I presume, in those old days, was the progenitor of the modern stomach.

I feel confident, however, that the Egyptian must have been greatly relieved when he lost his oil chamber and dissolved element, unless he happened to have been casually sucked out through the vent with them, and unless he had gone before in this manner it must have been a great relief to him to be dead.

Doesn't Mr. Ptah's Egyptian oil experience confirm the preservative effects of oil? We coat metals with oil to prevent oxidisation, because oil contains no free oxygen. Rapid convection prevents excessive temperature. Over three years' trial no element has failed, and there isn't the slightest reason why the elements shouldn't last as long as the mummies.

R. F. S. VENNER.

THE CRISIS AND PROVISIONAL ORDER NOTICES.

Would it not be advisable under the present crisis to request the Board of Trade to waive the necessary notices, other than the formal notices already given for Provisional Orders, for the supply of electricity in the different areas?

This would not only make work for English manufacturers, but would make work in other directions, as well as putting more money in circulation; even if the capital had to be raised at a larger rate of interest, it would still be more economical, as the poor rate in the districts would not suffer so greatly.

I should be very pleased to give my services to any such movement, but would suggest that it should be done through the Institution of Electrical Engineers.

R. W. ROWLAND-HILL.

Pinner, *September 2nd*, 1914.

WHAT CONSTITUTES A BRITISH FIRM?

May I be allowed to express in the strongest possible manner my complete disagreement with what is said by a member of a well-known firm of consulting engineers, under the above heading, in your issue for the 28th ult.? Your correspondent is anonymous, but I, at any rate, have sufficient belief in my opinions to write over my own name.

Your correspondent—and I fancy I know who he is, and believe him to be actuated by the best intentions—has no sense of proportion. He would put personal feelings and gratitude for past scientific services before patriotism, and this at a moment when this country, and, indeed, our whole European civilisation, is in the direst danger. This is certainly not a time to discuss the merits of the Siemens family, which all who know will readily admit; but to talk of "malicious tongues" when we declaim against our barbarous enemy is surely monstrous.

What are the facts? I append a list of the shareholders in Siemens Brothers & Co., Ltd., which I have obtained from Somerset House. As will be seen, 60 per cent. of the shares are actually held by Germans in Berlin, while of the remainder much the greater portion are in the hands of two Germans who are only English by naturalisation, in one case acquired, as I am informed, only a week or two ago.

The position of a foreigner made English by naturalisation must always be a dubious one, and I have sufficient respect for Mr. Alexander Siemens to believe that he must retain considerable sympathy for the land of his birth.

The board of directors of Siemens Brothers & Co., Ltd., is also preponderatingly German. The chairman is of that nationality, as also two other of the directors, while the board contains only one born Englishman.

In the case of the Siemens Brothers Dynamo Works, Ltd., the position is probably similar, though, owing to the fact that 19,993 of the 20,000 £10 shares which have been issued appear to be in the hands of trustees, it is impossible to say how the shareholding is split up.

Under these conditions, I say unhesitatingly that any Englishman who gives new work to either of these two companies is acting in an unpatriotic way. Nay, more, as it seems to me under the Royal Proclamation of August 5th, he is acting illegally, as this Proclamation contains a clause to the following effect:—

"Nor to enter into any new commercial, financial, or other contract or obligation with, or for the benefit of, any person resident, carrying on business, or being in the said (German) empire."

This description covers the whole of those members of the Siemens family who live in Berlin and own 60 per cent. of the company's share capital.

Quite apart, however, from the commercial and legal points of view, there remains the outstanding fact that the bulk of the shares in these Siemens companies are owned by our German enemies, citizens of a country which has apparently relapsed into the most atrocious barbarism, whose army is a horde of marauding murderers, whose most eminent professors teach doctrines of undiluted non-morality, whose Chancellor tears up as a matter of no concern a solemn treaty entered into by his country, which he sneers at as a mere scrap of paper, laying down the appalling doctrine that necessity knows no law, and whose Emperor has publicly inculcated wholesale massacre in the giving of no quarter to prisoners of war.

It is impossible for any Englishman to defend doing business with companies which are controlled by, and whose shares are principally owned by, citizens of a nation of criminal savages—very devils who are only restrained by the silver sea and by our own naval preponderance from wreaking on us here in England the unparalleled atrocities they have been perpetrating on the unfortunate and entirely innocent people of Belgium.

A. A. CAMPBELL SWINTON.

London, S.W., *September 2nd*, 1914.

SIEMENS BROTHERS & CO., LTD.

Capital, £600,000 in £5 shares.	Shares.	
Antill, B. H., London	100	
Von Chauvin, G., Bromley...	19,210	
Dieselhorst, Wilhelm, Charlton	200	
Easton, J. J., Sutton	200	
Grimston, G. S, Blackheath	100	
Hager, Carl, Charlton	200	
Hird, Frances, Charlton	120	
Huddleston, J. S., Blackheath	200	
Jacob, Frank, Blackheath	300	
Lauckert, Edward, Charlton	200	
Lawrence, Sir W. Roper, Eaton Square ...	8,045	
Loeffler, H., Kensington	20	
Siemens, Alexander, Westminster... ...	19,783	
Von Siemens, A. W. & G. W., Berlin ...	23,282	
" " " ...	33,034	
" Carl F. & A. W. " ...	13,249	
" A. W. " ...	300	70,782
" G. W. " ...	300	
" Carl F. " ...	300	
Exors. of Von Siemens, Carl H., Berlin ...	317	
Straube, Albert, Hampstead	140	
Wheeler, W., Westminster	400	
	120,000	

As will be seen, 60 per cent. of the shares are actually held in Berlin, while of the remainder the greater portion are in the hands of two Germans, who are only English by naturalisation.

A. A. C. S.

America and the War.—In an editorial in the American *Electrical Review*, dated August 15th, entitled "Some Principles of Foreign Trade," our contemporary says:—

"During the past two weeks, while the war cloud thickens abroad, economists on both sides of the water have had a good deal to say with regard to the possibilities of the manufacturer in the United States participating to a greater degree in the commerce and trade of those countries heretofore almost entirely dependent upon either England, Germany, Italy, France or Russia for their larger supplies of fabricated material. It seems reasonable to presume that if the foreign workshops are shut down for any considerable period, and with practically all of the sea-going nations abroad in a belligerent attitude, the exports of those countries must shrink very materially. With no selfish spirit then, it would seem to be the opportunity and the right of the manufacturers in the United States to see to it that if such a market be available, information of a most accurate nature respecting requirements and methods of doing business be secured as expeditiously as possible. In this contingency the records of the Bureau of Foreign and Domestic Commerce are available to our manufacturers, and the Chamber of Commerce of the United States of America is also in a position to help materially. While spasmodic efforts have been made by some manufacturers to develop business with the Latin-American countries, China, Japan and Asia, comparatively little is known in the aggregate either with regard to the requirements of the people there or their methods of doing business. It is a fact that in these places the American manufacturer has done a good deal to discourage dealing with this country because of an inequitable and vacillating policy with respect to his handling of orders and his desire to secure this business. When conditions in the United States have been depressed there has been a mild stampede to the other countries and orders have been booked enthusiastically. When, however, conditions have improved so that the factories are busy, it has not been the exception in the past to find the business so ardently solicited one year, scorned the next, and the contractor or builder or promoter in those countries has consequently sometimes been left in the lurch when refitting, rehabilitation or extension became necessary.

"Where United States manufacturers have made a study of conditions in Asia and in countries similarly situated, with regard to our possible trade extension, they have met with considerable success. A knowledge of the way to do business in those countries, however, is not easily secured and not at all in a single season. The Government departments are organised for team

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work and co-operation with the Chambers of Commerce of the progressive cities of the United States. It is a well-known contention among the officers of the Bureau that the manufacturers of the United States do not utilise their organisation to anything like the extent that they should. Here, then, is a possibility for trade expansion that should have attracted the intelligent attention of manufacturers, even in a time of keen competition with the manufacturers abroad. Now, when because of the unfortunate unsettlement of industry abroad the opportunity of the manufacturer in this country seems forced to his attention, will it not be well to begin at once to realise upon the latent possibilities?

"Out of strife and struggle has always come the period of greatest development in this country. During the awful days of the Civil War, when the ports of the South were closed to the industries of the Northland, an entire readjustment of facilities and business became necessary. The commerce of the country was changed about, and in a miraculously short time native genius blossomed, and invention had its greatest opportunity. Chicago's supremacy as a grain centre of the world, her leadership in the packing industry, are the direct results of the courageous efforts of brave commercial captains to live up to the opportunities forced upon them through the closing of the ports of the South, and the city of Saginaw and other populous places now along the river came into being because of the increased industrial opportunities due to the development of the new business centres. Dispatches from Paris contain the report that the French Government has placed an order with Armour & Co. for 2,000,000 lb. of canned beef for army rations. Without considering now just how these supplies are to be shipped and delivered, in view of a close adherence to the neutrality laws, if such requirements as this are magnified many times, can anyone conjecture the expansion that should come to this country in its hour of peace, while the other nations of the world are at war with each other?"

Inquiries.—A correspondent asks for names and addresses of firms able to make machines for spirally covering asbestos cores with resistance wires.

Another inquirer asks to be put in touch with the manufacturers of papier-maché or similar bobbins for electrical coils, supplies of which have previously been obtained from Germany.

A further inquiry is for any British-made substitute for "Stabilit."

British makers of small primary cells for pocket lamps are asked for.

Institution and Lecture Notes.—THE SOCIETY FOR ELECTRICAL DEVELOPMENT.—The report of this American Society, recently issued, states that specimen wiring specifications have been distributed to architects, to show them how such specifications should be drawn up. Machine-tool builders are being urged to show their tools in the catalogues motor-driven, and to build the tools with motors as integral parts where such practice is desirable. The extension of facilities for charging electric vehicles, the improvement of electric heating and cooking appliances, the employment of small electrical refrigerating machines and electrical ventilation, and the development of the use of domestic electrical apparatus, are other directions in which the Society is working. A prize story competition has been organised, with a Committee of Award of high qualifications, the prizes offered ranging from £2 to £50, and a large amount of work is being done in connection with a publicity campaign, special booklets, &c. The education of window trimmers in the matter of effective lighting of show windows and shop interiors occupies a prominent place in the activities of the Society. A booklet recently published, is entitled "Vacation Comforts," and shows in how many and various ways the use of electricity conduces to the comfort and happiness of holiday-makers and others.

THE ILLUMINATING ENGINEERING SOCIETY (U.S.A.) holds its convention at The Hollenden, Cleveland, from September 21st to 26th.

THE ELECTRICAL VEHICLE ASSOCIATION OF AMERICA.—The annual convention of the Association is to be held in Philadelphia from October 19th to 21st. Among the papers to be read are one by Mr. J. H. McGraw on "The Progress of the Electrical Vehicle," one by Mr. W. P. Kennedy on "Electrical Vehicles in Parcels Post Service," one by Mr. F. C. Henderschott on "Educating the Public to the Field and Use of the Electrical Vehicle," and one by Mr. Walker, the chief of the Philadelphia Fire Brigade, on "Electric Fire Apparatus."

INSTITUTE OF METALS.—In consequence of the war it has been found impossible to hold the proposed Portsmouth meeting of the Institute of Metals on September 10th and 11th next. This meeting is, therefore, indefinitely postponed. In its place, however, a statutory meeting of the Institute will be held at Caxton House, Westminster, S.W., at 4.30 p.m. on Thursday, September 10th, when, beside the transaction of official business (which will include the nomination of officers for 1915, and the election of members), there will be formally presented the nine papers that would have been read and discussed at the Portsmouth meeting.

Barcelona Exhibition.—It has been definitely decided to hold this Exhibition in 1917. The Spanish Cortes has voted 10,000,000 pesetas, and the Ayuntamiento of Barcelona a similar sum in aid of the undertaking, which, however, it is expected, will require a sum of 70,000,000 pesetas for its realisation. The organising committee are now considering the means of raising the balance.

Lamp Carbons Dispute.—A motion in an action of the Beck Engineering Co., Ltd., and Billington v. the Foster Engineering Co., Ltd., and Sloan Electrical Co., was before Mr. Justice Shearman in the Vacation Court on Wednesday. It related to a quantity of lamp carbons which were the subject of an agreement between the parties and Mr. C. Conradty, the manufacturer. A reference to these carbons appeared in our "Legal" section last week.

Mr. Collingwood appeared for the plaintiffs and Mr. Colefax, K.C., and Mr. Julian Fuller for the respondents.

At the outset Mr. Colefax explained that the plaintiffs had obtained an injunction *ex parte* relating to 10,000 of the carbons, part, it was said, of 180,000 or 200,000 in this country, and he should ask that that injunction should be dissolved, though he was willing to make the plaintiffs an offer in respect of the carbons they required.

Mr. Collingwood, however, said that he could not accept the offer. His present motion was that a Receiver should be appointed of the carbons in dispute, but he should ask for an adjournment to file evidence in reply. The motion was before the Court the previous week, when it stood over for the defendants to file evidence, and the evidence for the defence was not handed to the plaintiffs until after 4 o'clock the previous evening. He had had no opportunity of seeing it.

His Lordship asked what was the plaintiffs' title to the carbons. After a full hearing, his Lordship said that he could not see that the plaintiffs had made out that these carbons were their property earmarked to them, and he would dissolve the injunction as to the 10,000 and the rest of the motion, and all questions as to costs would stand over for a week to answer the affidavits. The defendants had expressed their willingness to execute any orders they might receive at current prices, and any dispute as to price could be determined later.

Appointments Vacant.—Junior switchboard attendant (£70) for Swansea Corporation; meter superintendent for Hull Corporation (£150); overhead lineman for Colombo (age, 30) for Colombo Electric Tramways and Lighting Co., Ltd.; shift engineer for A.C. and D.C. (30s.), for Ayr Corporation; temporary sub-station attendants are wanted for Sunderland to take the place of men serving with the forces. Particulars are given in our advertisement pages.

German Firm in Court.—In the City of London Court, on Wednesday, Hagen Accumulator Works, 15, Holborn Viaduct, sued F. L. Mitchell & Co., Ltd., electrical engineers, 188, Rye Lane, Peckham, for £3 16s. 4d., for accumulators and batteries supplied. The defendants' representative said they admitted having the goods from Germany, but their trade had been diminished by 75 per cent., and, even if they were liable, they said they ought not to pay, because the plaintiffs were a German firm. Judge Rentoul, K.C., wanted to know how he was to find out if the plaintiffs were a German firm. The defendants' representative said the plaintiffs advertised to that effect in the trade journals. The plaintiffs' representative said they were a German concern right enough, and he was only proceeding with the case to save the Court's issuing fees. Judge Rentoul said the case would be adjourned until the end of the moratorium, whenever that might be.

Ceiling Roses.—The British Standard specification, No. 67, for two and three-plate ceiling roses, has been issued by the Engineering Standards Committee. The preface to the report explains that the standardisation of two and three-pin plugs and other accessories is being proceeded with, but it was felt that the convenience of those concerned would best be met by issuing separate specifications so as to bring the standardisation into force as soon as possible, rather than by waiting until the whole of the work was accomplished and then publishing simultaneously a complete set of specifications. The Committee has had the cordial co-operation of the British Electrical and Allied Manufacturers' Association, so that these standards are likely to be generally adopted by the industry, with considerable benefit to both makers and users. The report contains particulars of the material to be used, the dimensions of all the essential parts, the sizes and shape of the holes for the wires and all other necessary details. The Committee has specified that each terminal plate in the standard ceiling rose shall be of a different shape, the reason for distinguishing the different terminal plates by form rather than by colour being given in a note to the specification. Drawings showing the gauges necessary for both the two and the three-plate ceiling roses, and a diagram illustrating the relative positions of the terminal plates in a three-plate ceiling rose, are included. The price of this report is 5s. 2d., post free. It is published for the Committee by Messrs. Crosby Lockwood & Son.

Educational Notes.—We have received the prospectus of the South-Western Polytechnic Institute, Manresa Road, S.W., for the session 1914-15.

UNIVERSITY COLLEGE, London.—A course of 12 lectures on "The Theory and Practice of Radiotelegraphy" will be delivered by Prof. J. A. Fleming, F.R.S., on Wednesdays, at 5 p.m., beginning October 28th, 1914. The course will be in two parts, six lectures before Christmas and six between Christmas and Easter. It is open to both members and non-members of the University. Application for tickets of admission should be made to the Secretary.

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Electrical Canal Tow-Boat.—In order to do away with "legging"—men pushing with their feet against the roof and sides—of the Harecastle Tunnel on the North Staffordshire Canal between the Potteries and Runcorn, the North Staffs. Railway Co. has installed an electric towing boat to tow the canal barges. As the water is too shallow for a propeller, and the roof too low for a trolley wire, four steel ropes have been laid through the tunnel, and these pass through the bottom of the boat and round two electrically-driven grooved wheels. The power is provided from a special barge, holding 150 cells, and capable of discharging sufficient current to meet the demands of several journeys. The cells are charged by a special plant at one end of the tunnel—which is 2,900 yards long—and while one accumulator barge is in use another is being charged. By this means, 17 boats, each carrying 20 tons, can be towed through in about 40 minutes, whereas the journey used to take each boat from two to four hours. The boats have been constructed by Messrs. Bullivant & Co., Ltd., of Millwall, and the scheme has been carried out under the direction of Mr. A. F. Rock (chief electrical engineer to the N.S. Railway), Mr. F. A. L. Barnwell and other officials.

Fatalities.—Indian Shock Fatality.—An inquiry was recently held into the death of a Brahmin from contact with a broken telephone wire which fell across the Bombay Electric Supply Co.'s overhead lines. The latter consisted of five wires arranged one over the other, the top and bottom ones being earthed guard wires. The telephone wire was suspended between a bungalow and a tree, crossing above the power lines, and snapped at both ends of the span; one end apparently dangling over a small branch, which prevented its falling on the guard wire, touched the live power lines, while the other end fell into the road and killed the man. The tree branch from which the wire was suspended was 9 in. thick, and the jury came to the conclusion that the wire broke owing to the tree swaying in a high wind.

Salford.—Last week an inquest was held on James Wm. Hacking (16) who had been employed as an apprentice by Messrs. Eckstein, Heap & Co., electrical engineers, of Caroline Street, Lower Broughton. From the evidence it appeared that on July 10th the deceased got on a stool to fit brushes on to the switches, and the stool gave way. Hacking caught hold of a switch, which gave way, and he fell to the ground with the switch on top of him. He told a fellow workman that he had not hurt himself beyond bursting his thumb, but he was seen to be limping. He went on working, but two days later became ill, and a doctor who was sent for said he was suffering from blood poisoning. He died on August 20th at the Salford Royal Hospital. The medical evidence was that death was due to a state of septic poisoning brought about by an injury to the leg. "Accidental death" was the verdict.

Electric Heater for Oil Wells.—In the oilfields of the Whittier district, California, experiments are being made with an electric heater with a view to increasing the output of flowing oil wells. The heater consists of a long brass cylinder containing numerous coils, which is lowered to the bottom of the oil well, and the resulting increase of flow is considered as due to the expansion of gas causing a greater upward pressure. The heater, which is loaded with 9 kw., will, if successful, be a source of considerable income to electric companies in the locality.—*Electrical World.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. S. Seal, of Hull, has been appointed meter and electrical testing superintendent to the Salford Corporation, at a commencing salary of £150, rising to £200 per annum, Mr. E. F. Kent, of Sunderland (see Elec. Rev., August 7th), having withdrawn his application for this post.

The Cleckheaton Electricity Committee has decided to advance the wages of Mr. H. Atherton, of the engineer's staff, to £2 5s. per week and to pay him £5 in respect of overtime.

Tramway Officials.—At St. Paul's Church, Leyton, on August 22nd, the marriage took place of Mr. John Fayle, traffic superintendent of the Leyton tramways, and Miss Ethel Jessie Trace, daughter of Mr. J. Trace, of Leyton. The presents included gifts from the tramway staff.

General.—Mr. H. Clifford Palmer (manager, publication department, General Electric Co., Ltd.), has recovered from the effects of a serious operation, and, as a lieutenant in the London Scottish Regiment, is now actively engaged in military duties.

Mr. T. A. Fraser has resigned his position as manager of the cable and metals departments of the Electrical Co., Ltd., and will terminate his engagement at the end of November, after being associated with the firm for 13 years.

Mr. Herbert Wolstenholme, formerly of Pendlebury, who is in the London office of the Chloride Electrical Storage Co., Ltd., was married to Miss Amy Scott, daughter of Mr. and Mrs. R. C. Scott, of Tynemouth, on August 26th. The wedding took place at Christ Church, North Shields.

Mr. W. Vincent Edwards has been appointed engineer and general manager of the Hastings and District Electric Tramway Co., Ltd., as from the 1st inst. He has for some months past been in charge of the system as deputy manager during the illness of Mr. Thos. B. Holliday. Mr. Edwards was one of the first to join the electric traction branch of Messrs. Dick, Kerr & Co., and saw a good deal of service with them in various English and Continental towns. Subsequently he was in their London office for several years before moving down to the Hastings Co.

Mr. Ernest E. Sharp has joined the board of the Jackson Electric Stove Co., Ltd., and will act with Mr. Williams in the direction of the business. Though the company has hitherto devoted itself to large cooking equipments, it is now ready to go ahead with kettles, toasters, flat-irons, &c. Mr. Sharp's connection with the C. & H. meter and Venner time-switch business will not be interfered with in any way.

The *Times* states that the Postmaster-General has appointed Mr. E. Raven to be an Assistant Secretary to the Post Office, in place of Mr. H. S. Carey, C.B., promoted.

Mr. D. N. Scott will shortly be severing his connection with the Reason Manufacturing Co., Ltd., of Brighton, as secretary and accountant, which position he has held for the past seven years.

Obituary.—Mr. Herbert R. Hudson.—On Sunday, August 30th, at his residence, Penn Fields, Wolverhampton, the death took place of Mr. Herbert R. Hudson, A.M.I.E.E., A.C.G.I., chief designer to the Electric Construction Co., Ltd. Mr. Hudson joined the E.C.C. staff in 1907, and a little more than 12 months ago was offered, and accepted, the position of chief designer. Although an exceptionally young man for so responsible a post, his performance of its important duties has more than justified the confidence placed in him. A man of much personal charm, unassuming, a wise counsellor and an ever-ready helper, he was a great favourite throughout the works. Of fine physique, an athlete, excellent company and a wonderful singer, he was heart and soul in the recreative and festive sides of the E.C.C. affairs, and did much to foster that spirit of comradeship which is so valuable an asset in any large business concern. For some years he was a member of the Executive Committee of the Wolverhampton Engineering Society. The increasing pressure of his duties at the works led him to tender his resignation from that Committee, whereupon the Society paid him the compliment of electing him a vice-president. By his untimely end the electrical engineering profession has lost a man of fine achievement and finer promise; the Electric Construction Co. a loyal and highly-valuable servant; the E.C.C. staff and workmen a comrade and friend.

Lord Merthyr.—We regret to record the death, which occurred on August 27th, of Lord Merthyr, who, as Sir W. T. Lewis, in the course of a lengthy and successful career, was at different times president of the South Wales Institute of Engineers, the Mining Association of Great Britain, and the Iron and Steel Institute. He was born in 1837, the son of an engineer, and he rose from comparatively humble circumstances to a position of great power in the industrial world, among his other attainments being that of an authority on industrial arbitration.

Mr. Frederick Smith.—We very much regret to learn of the death, which occurred at Swinford Old Manor, Ashford (Kent), on August 27th, of Mr. Frederick Smith, managing director of Messrs. Frederick Smith & Co., Ltd., wire manufacturers, of Caledonia Works, Halifax, and of Manchester, also director of the London Electric Wire Co., Ltd. He was in his 66th year.

NEW COMPANIES REGISTERED.

Harvac, Ltd. (137,523).—This company was registered August 27th, with a capital of £1,000 in £10 shares, to carry on the business of manufacturers of household appliances, vacuum or pneumatic or other dusting and cleaning machines and motors to drive the same, &c. The subscribers (with one share each) are:—C. J. Harvey, Haverbrae, Bewdley Hill, Kidderminster, manufacturer; J. H. Heynes, The Hursles, Torton, near Kidderminster, secretary. Private company. The first directors are C. J. Harvey and J. H. Heynes; solicitor, H. G. Ivens, High Street, Kidderminster.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Allen West & Co., Ltd.—Deb., dated August 10th, 1914, to secure £8,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: London County and Westminster Bank, Ltd., Lothbury, E.C.

Electrolite, Ltd.—Particulars of £1,500 debs., created August 5th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1903, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Compagnie Des Cables Sud Americains (1,408).—Particulars filed August 25th. Registered in France. British address:—22, Royal Exchange, E.C., where E. L. Byng is authorised to accept service. No memorandum or articles of association filed yet.

John Davis & Son (Derby), Ltd. (66,606).—Capital, £35,000 in £1 shares (20,000 ord. and 15,000 pref). Return dated July 8th, 1914. 15,000 ord. and 11,000 pref. shares taken up. £1 per share called up. £26,000 paid. Mortgages and charges: Nil.

Central Wireless Co., Ltd.—Charge on company's undertaking and property, including uncalled capital, dated July 31st, 1914, to secure £150. Holder: Mrs. G. Scudamore, Mayford, Surrey.

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Chesham Electric Light and Power Co., Ltd.—A memorandum of satisfaction in full on August 18th, 1914, of debs. dated January 27th, 1908, and September 25th, 1912, securing £10,000, has been filed.

Spanish Telephone Co., Ltd.—Capital, £81,000 in 5,600 ord. shares of £10 each and 1,250 pref. shares of £20 each. Return dated August 14th, 1914; 5,600 ord. and 671 pref. shares taken up; £20 per share called up on 671 pref. and £10 per share on 4,000 ord.; £53,420 paid; £16,000 considered as paid on 1,600 ord. shares. Mortgages and charges: Nil.

Dartmoor Electric Supply Co., Ltd.—A memorandum of satisfaction in full on August 13th, 1914, (*a*) of debs. dated March 15th, 1911, securing £500; (*b*) of "B" deb. dated August 22nd, 1913, securing £800; and (*c*) of debs. also dated August 22nd, 1913, securing £700, has been filed.

Particulars of £4,000 debs. created August 13th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

James Keith & Blackman Co., Ltd.—Issue on August 13th, 1914, of £700, part of a series of which particulars have already been filed.

Indian Electric Supply and Traction Co., Ltd. (84,233).—Capital, £547,986 in £1 shares; return dated April 30th, 1914, 78,021 shares taken up, £8,021 paid, £95,000 considered as paid. Mortgages and charges: £65,000.

D.P. Battery Co., Ltd. (44,084).—Capital, £10,000 in 4,996 "A," 4,996 "B" and eight other shares of £1 each, return dated July 8th, 1914; all shares taken up, £10,000 paid. Mortgages and charges: £12,000.

Harrow Electric Light and Power Co., Ltd. (44,529).—Capital, £50,000 in £5 shares (6,667 ord. and 3,333 pref.). Return dated March 19th, 1914; all shares taken up; £50,000 paid. Mortgages and charges: £26,325.

Evershed & Vignoles, Ltd. (43,206 C).—Capital, £30,000 in £10 shares. Return dated July 9th, 1914; 3,000 shares taken up; £30,000 paid. Mortgages and charges: £15,000.

CITY NOTES.

Manaos Tramways and Light Co., Ltd.

THE annual meeting was held on August 26th, at the offices, 9, Cloak Lane, E.C., Mr. G. M. Booth presiding.

The CHAIRMAN, in moving the adoption of the report, said they were holding the meeting under extraordinary and overshadowing circumstances. The world of finance and commerce was completely disorganised, and the future of all companies somewhat obscure. With them the obscurity was deepened by the problem of Brazilian exchange. As regarded the State debt for public lighting, their efforts to collect this had not met with any success, and, beyond a small payment in December last of less than £1,000, no payment had been made, and the amount of this debt to them at April 30th, 1914, was £33,898, and he feared present conditions would further postpone a settlement. The accounts for the year under review showed tramway receipts amounting to £87,029, against £106,148 for the previous year, a decrease of £19,119. The lighting receipts amounted to £44,395, as against £44,148 for the previous year, an increase of £247, the total gross income decreasing from £151,741 to £132,877. The total operating expenses decreased from £101,942 to £96,848 (the ratio of operating expenses to gross receipts had increased from 67·2 per cent. to 72·9 per cent.), and the net surplus had decreased from £28,107 to £14,426, or over 48 per cent. It was satisfactory to note that the lighting department was holding its own, and that it had not been necessary to write off anything from either of the company's reserves. The directors recommended the transfer of £8,000 to the contingencies and accident reserve account, making a total to the credit of the account of £23,725, and to the renewals reserve £6,000, making a total to the credit of the account of £27,000; the balance of £3,862 to be carried forward to next year's account. In the three months expired since the close of the year under review, the net earnings had decreased from £11,920 in 1913 to £5,764.

MR. G. WATSON seconded the resolution.

MR. HENSLEY asked whether the ordinary reserve was invested in the business or separately. He also asked how the moneys which were owing by the State Government were treated in the accounts.

The CHAIRMAN said that with regard to the reserve fund, it was invested in the business. The amount owing by the Government appeared under the head of book debts and payments in advance in Manaos, £43,431. That included £33,000 due to them from the State. In addition, there was about £1,700 odd, which the municipality owed them, and there was something owing by the Federal War Department, on which sum small payments were being made on account. With regard to the future prospects of the Manaos rubber trade, on which the success of the company was almost entirely dependent, that was a very difficult question to answer, and it was one which the directors had been asking themselves for the past two years. It was very complicated, because they had the general problem of the success of producing rubber in the East cheaply, and the second problem which chemists differed upon was as to whether the quality of the fine, hard Para rubber was essentially superior to the Eastern rubber. At present there was a difference of about 9d. in the two prices. At anywhere near 3s. it was his own opinion that the Amazon would recover its own balance. He was also inclined to hope that the difficulties in the Amazon would lead to the production of more rubber and not less. That, again, was a speculation on his part, and the difficulty was that they were dealing with a very uncivilised part of Brazil, the population of which was entirely different to the population which gathered Eastern rubber. After the people had succeeded in getting what they required in the way of luxuries they would cease to gather in more rubber. The idea of railway developments in the country, which, if proceeded with, would have made the labour problem more difficult had now been abandoned, and he hoped that the rubber gatherers would remain in the Amazon, and that they would be encouraged to tap more rubber. Their chief troubles arose from the fact that the revenues of the State had fallen so considerably that they, in their turn, could not pay the company what they owed them. He need hardly say that the directors regarded the position very seriously. If they could collect the £35,000 from the State they would be in an excellent position. They were doing their very best to come to some arrangement whereby the ultimate payment could be secured to them, but he could give them no information about it, and it was no use his holding out any hope except to say that they were working hard to try and secure the payment of the debt.

Replying to other shareholders, the CHAIRMAN said that their contract with the State Government was such that they could not cut off the public lighting without cancelling the concession. It was an abominable arrangement, but there it was. There was also this point to be remembered—that any high-handed action of that sort might result in very great damage to their property. Therefore, after giving the matter the most careful consideration, the board had determined that they would serve the town as well as they could, and rely on the final pressure of public opinion being brought upon the Brazilian Government to ultimately secure their legitimate claim.

The report was then adopted.

British L. M. Ericsson Manufacturing Co., Ltd.—The 6 per cent. preference dividend for the half-year ending June 30th, 1914, will be paid on the 16th inst., and the transfer books are closed until 16th inst., both days inclusive.

Marconi's Wireless Telegraph Co., Ltd.—The directors announce, with regret, that owing to the present impossibility of obtaining repayment of money lent by the company on short loan against securities prior to the moratorium, they are compelled to postpone paying the dividend warrants, which otherwise would have been issued on Monday last.

Buenos Ayres Port and City Tramways, Ltd.—The directors have decided, in view of the present financial position of the company, that the coupon of the extension first mortgage debenture cannot be paid.

Metropolitan Electric Supply Co., Ltd.—The directors state that, owing to the unprecedented financial position, they have decided to defer the payment of any dividend on the ordinary shares for the present.

Crossley Brothers, Ltd.—According to the *Financial Times*, the directors report that the working results for the half-year ended June are satisfactory, but, owing to the abnormal monetary conditions, payment of the usual dividend on the preference shares, due on September 1st, is to be postponed. Warrants will be posted as soon as the directors are satisfied that the financial situation has sufficiently improved. No interim dividend will be declared on the ordinary shares.

South Metropolitan Electric Light and Power Co., Ltd.—Warrants for interim dividends, due on August 31st, on the 7 per cent. cumulative first preference shares and 6 per cent. cumulative second preference shares, for the half-year ended June 30th, 1914, have been posted as usual.

Continental.—SPAIN.—The amalgamation is announced of the Sociedad Electrica de Chamberi with the Co-operativa Electra.

STOCKS AND SHARES.

Tuesday Evening.

EXTENSION of the general moratorium was practically inevitable, and the announcement from the Chancellor of the Exchequer that it would be continued until October 4th met public anticipation. That it would be on a more limited scale than its predecessor had been expected, but its full rigour remains in force for at least some time to come. Accordingly, such good people as are evading payment of their just debts, on the ground that to discharge them while a national moratorium was in progress would be an act supremely unpatriotic, will be able, if they wish, to deprive their creditors of the money for another month.

Moratorium or not, the opening of the Stock Exchange would be impossible at the present time, although there are many who think an unofficial market might be established, to be held in some City hall, or in the settling rooms of the Stock Exchange itself. It has been pointed out here that the grave danger lies in the possibility of selling being forced were an official market to be re-created, and that the Committee of the House, in deciding to keep the doors closed, are adopting the least of various evils, which all, in their way, recoil upon the community just as much as they do upon Stock Exchange members.

Dealings for cash are going on in a quiet sort of way, and it is interesting to notice that many of the principal issues amongst electric supply and power companies are saleable at present

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although at prices considerably depreciated from those of a month ago. This, for instance, is a selection of some of the shares and bonds which can be sold to-day; of course, the demand is limited in each case, and it may be that at the end of the week the buyers will have got what they wanted. This being distinctly improbable, however, we set out the list as follows:—

	Bid, July 30th.	Price bid.	Fall.
Electric Lighting—			
Bournemouth and Poole 4½ per cent. Deb. ..	93	90	3
Charing Cross 4½ per cent. Deb.	100½	96	4½
Westminster Electric 4½ per cent. Pref.	5	4¾	¼
Melbourne Elec. Cons. Deb...	104	99½	4½
Tramways—			
Anglo-Argentine 4 per cent. Deb.	90	85	5
,, ,, 4½ per cent. Deb.	97	92	5
Bombay Second Debs...	99	94	5
Brisbane Investment Deb.	100	92	8
Brit. Columbia Elec. Rly. 4½ per cent. Deb. ..	95	90	5
Calcutta Tramways 4½ per cent. Deb.	98	92	6
Mexico Trams First Bonds	82	75 c.d.	7
Para Elec. Railway 5 per cent. Deb.	88	84	4
Sao Paulo Trams 5 per cent Deb...	98	92	6
Utd. Elec. Trams of Monte Video 5 per cent. Deb.	95	90	5
Miscellaneous—			
Cons. Gas. Elec. Light and Power of Baltimore 5 per cent. Deb.	99	97	2
General Electric (New York) 5 per cent. Deb...	108	103	5
Mexican Light and Power 5 per cent. Bonds ..	79	73	6
Mexican Electric Light Bonds	61	55	6
Mexican Northern Power Bonds	22	18	4
Underground Elec. Income	82	80	2
,, ,, 1s. shares	5s. 6d.	5s.	6d.

It must not be supposed from the figures quoted in the second column that these represent the utmost values to be obtained. By dint of negotiation—to give it a polite name—a seller could probably obtain more. It is to be understood that all the bids are for cash, and the money would be available upon delivery of the securities.

On the other side of the sheet, there are sellers of a hundred times as many stocks and shares as those set out above. The Stock Exchange policy throughout the crisis has been to maintain quotations so far as possible, in order to prevent any avoidable disturbance in the public mind. That is to say, in principle, the bargain-hunter has been discouraged, because it is felt that he might be able to buy stock from a desperate holder at a knock-out level, which, being quoted in the papers, would have an unsettling effect upon proprietors of the same and similar securities.

At the same time, if an investor wants to pick up cheap stock, he need have no hesitation in making a bid for it—which, again, must be for money; and his broker would no doubt do the best possible in order to fulfil the order. In days such as these, clients need have no scruple in asking their brokers to take up stock through the agency of their bankers, although, as a matter of fact, with the moratorium over everything, and with all bargains being done for cash, any risks in dealing with members of the Stock Exchange at the present time are reduced to a minimum.

Not a few of the companies which declared dividends, and then postponed payment of them, have by this time distributed the money. But many more are announcing their decision to pass the usual distributions at this time of the year and to carry forward the amounts, having regard to the existing state of affairs abroad. Both inconvenience and suffering are hereby entailed; and in the case of the Alabama Traction Company, for example, protests have become vocal at the Company's withholding payment of the interest on the bonds, due on September 1st. Reassuring statements to the effect that this or the other company is able to meet its obligations, but considers it prudent to suspend temporarily the discharge of them, savour of affront rather than assurance to the people who look for regular distributions in order to pay their way.

Boards of directors, of course, are in the best position to judge whether such course of action is essential; but even where it would be straining a point to make the payments, such effort would seem to be justified in most circumstances. Needless to say, we have always been the last to suggest that companies ought to strain their resources by payment of dividends, and in the past we have ventured to criticise distribution of money which not only austerity, but common prudence, demanded should have been husbanded. But with the times so out of joint as they are now, the more elasticity there can be imported into financial relations, the better for the common weal.

The cry for the capturing of German trade has already led to developments in electrical, as in other, industries. Negotiations are on foot for the acquisition of a property in England, through the formation of a company, to annex the tungsten and the tungsten acid business. Efforts are being made in the City to obtain sufficient money to erect a plant for the treatment of wolfram, with a view to winning the tungsten. Another development, of course, is that of some of the electric supply companies in the matter of providing electrically-propelled vans for the delivery of goods within a comparatively short radius, as to which particulars were given here last week, and which, we understand, has aroused a good deal of interest. Rubber companies, too, are looking out for fresh military uses to which they can put their produce, so that in various directions efforts are afoot to wrest good out of the prevailing evil.

The Buenos Ayres Port and City Tramways announces that it cannot pay the coupon on the Extension First Mortgage Debentures which became due on September 1st. This is only what had been looked for, but the suspension comes at an unlucky time, because the reorganisation scheme which was to have been put forward, but which has not yet been forthcoming, would, no doubt, include the raising of fresh capital, and, with things as they are now, the hope of getting more money for ventures of this kind must, indeed, be dim. The Marconi Company is another of those which withholds payment of its dividend.

The report of the Puebla Tramway, Light and Power Company shows a debit balance of £18,350, which is due simply to the heavy loss in exchange. The Company's various properties have not suffered materially, except for some slight damage done from time to time by bandits.

Brazil Traction shares have been weaker at 50 sellers, but, at the time of writing, there is a small buyer at that price. With regard to the dividend on the Ordinary shares of this Company, this is usually paid at the rate of 4s. 0½d. per dollar to shareholders who have not had the shares registered into their own names, but who allow them to stand in the names of big firms, in order to save the registration and stamp charges. Owing to the international situation, the rate of exchange is now quite nominal, and some of the registered holders have intimated to the proprietors that they are willing to give a dollar cheque on Toronto at $1½ per share in settlement of the amount claimed, or to withhold payment until such time as the exchange rate may again become normal.

MARKET QUOTATIONS.

OWING to the war, the prices given below are, of course, only nominal.

Wednesday, September 2nd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	Nom.	..
a ,, Nitric	,,	,,	..
a ,, Oxalic	per lb.	,,	..
a ,, Sulphuric	per cwt.	,,	..
a Ammoniac Sal	,,	,,	..
a Ammonia, Muriate (large crystal)	per ton	,,	..
a Bleaching powder	,,	,,	..
a Bisulphide of Carbon	,,	,,	..
a Borax	,,	,,	..
a Copper Sulphate	,,	,,	..
a Lead, Nitrate	,,	,,	..
a ,, White Sugar	,,	,,	..
a ,, Peroxide	,,	,,	..
a Methylated Spirit	per gal.	,,	..
a Potassium, Bichromate, in casks	per lb.	,,	..
a Potash, Caustic (88/90 %) ..	per ton	,,	..
a ,, Chlorate	per lb.	,,	..
a ,, Perchlorate	,,	,,	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	,,	,,	..
a Shellac	per cwt.	,,	..
a Sulphate of Magnesia	per ton	,,	..
a Sulphur, Sublimed Flowers ..	,,	,,	..
a ,, Recovered	,,	,,	..
a ,, Lump	,,	,,	..
a Soda, Caustic (white 70/73 %) ..	,,	,,	..
a ,, Chlorate	per lb.	,,	..
a ,, Crystals	per ton	,,	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£86	..
b ,, Wire, in ton lots (1 to 14 S.W.G.)	,,	£107 6 8	..
b ,, Sheet, in ton lots ..	,,	£112	..
a Babbitt's metal ingots	,,	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8½d.	½d. dec.
c ,, Tube (brazed)	,,	10d.	..
c ,, ,, (solid drawn) ..	,,	8¾d.	½d. dec.
c ,, Wire, basis	,,	8¾d.	½d. dec.
c Copper Tubes (brazed)	,,	10d.	..
c ,, ,, (solid drawn) ..	,,	10d.	..
g ,, Bars (best selected) ..	per ton	£78	..
g ,, Sheet	,,	£76	..
g ,, Rod	,,	£78	..
d ,, (Electrolytic) Bars ..	,,	£65	£7 dec.
d ,, ,, Sheets ..	,,	£83	£7 dec.
d ,, ,, Rods ..	,,	£71	£7 dec.
d ,, ,, H.C. Wire	per lb.	8¾d.	¾d. dec.
f Ebonite Rod	,,	3/6	1/- dec.
f ,, Sheet	,,	3/-	1/- dec.
a German Silver Wire	,,	1/7	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	2/10	3d. dec.
l Iron Pig (Cleveland warrants) ..	per ton	62/11	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£16	..
g Lead, English Pig	,,	Nom.	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7	..
e Mica (in original cases) small ..	per lb.	4d. to 2/6	..
e ,, ,, ,, medium	,,	3/- to 5/-	..
e ,, ,, ,, large ..	,,	6/6 to 10 6 & up.	..
o Nickel, sheet, wire, &c.	,,	Nom.	..
p Phosphor Bronze, plain castings	,,	1/1 to 1/3½	..
p ,, ,, rolled bars & rods	,,	1/0½ to 1/3	..
p ,, ,, rolled strip & sheet	,,	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	£141	..
g Tin, Block (English)	,,	Nom.	..
n ,, Wire, Nos. 1 to 16	per lb.	2/3	..
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
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k Morris Ashby, Ltd.
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n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

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REVIEWS.

The Principles of Automatic Telephony. By Walter Atkins (Engineer, Post Office Telephones). London: *Electrician* Printing and Publishing Co., Ltd. Price 2s. net.

The continuous and rapid growth of telegraph and telephone engineering has rendered it quite impossible for anyone to keep up to date with the details of the developments in all its branches. At best, an outline knowledge only can be acquired of the work which is being done in departments other than those in which one may be particularly engaged. In the telegraph service, however, at least in this country, a man may at any time be called upon to take up any branch of the work at short notice, and it is very desirable, therefore, that he should have some idea of what is being done throughout the whole field.

The little book under review meets this need as far as automatic telephony is concerned. A sketch is given of the Strowger and Lorimer systems, sufficient to give a good fundamental knowledge of their operation and to provide a foundation for more detailed study if the reader should subsequently find such necessary. The book is well provided with diagrams and photographs, there is an entire absence of padding, and we can recommend it to all whose duties are likely to bring them into touch with automatic telephone installations.

X-Rays. By G. W. C. Kaye, D.Sc. London: Longmans, Green and Co., Ltd. Price 5s.net.

The study of X-rays, since their discovery by Röntgen in 1895, has been continuous and persistent, and although their nature cannot be said to be established beyond all doubt, yet enough is now known of them to make us fairly certain that they consist of ether waves of extremely short amplitude and great frequency, with a velocity equal to that of light. The book under review is valuable in that it gives us an account of all the most novel and original discoveries with regard to these rays; it describes present-day methods and apparatus, a complete acount of which can only be found scattered throughout many journals; it is concerned to some extent with the development of theory as well as of experiment; and it brings tne whole subject right down to the end of the year 1913.

The author—who is head of the radium department of the National Physical Laboratory—considers first the phenomena of a discharge tube and deals with the production of cathode rays—rays which can cause fluorescence, affect photographic plates, be disturbed by electric and magnetic fields, and so on. The existence of the cathode rays has been known for a long time, although their nature was entirely unsuspected until recently. Modern research has shown that they consist of particles, each about 1-1800th the mass of a hydrogen atom and each possessing a negative charge of electricity. They issue in great quantities from the cathode of the discharge tube, and striking the glass of the tube, cause the production of X-rays—rays of quite a different order, inasmuch as they can penetrate solid matter to a considerable distance.

From the scientific standpoint generally, an efficient X-ray bulb is of the first importance, and the author devotes a chapter to the consideration of this. It was soon found that the X-rays produced by allowing the cathode rays to strike the glass of the tube were unsatisfactory in that they scattered too much and therefore gave insufficient definition; accordingly, in a modern bulb the rays are produced by introducing an "anticathode," and allowing the cathode rays to impinge on this at an angle of about 45°. The anticathode is usually made of platinum because of its high melting point and high atomic weight, for experiment has shown that the metals of high atomic weight are the best "radiators." High melting point is necessary because of the intense heating effect of the cathode ray bombardment. Other metals that have been used for the anticathode are osmium, iridium, tungsten, and tantalum. The cheaper bulbs have nickel anticathodes faced with very thin platinum sheet. A photomicrograph is given of one of the last showing the fusing effects of the discharge. Various devices have been introduced for cooling the anticathode, including circulating currents of air and water, magnetic, and other means.

In order to produce a discharge current three methods may be employed: (1) influence machines, (2) induction coils, and (3) step-up transformers. The first is now obsolete, at any rate in this country; the second is generally used for ordinary work; and the third is in use where special circumstances prevail, such as where instantaneous photography is required or where for some reason a comparatively large current is necessary in the tube. The author describes the varying types of these machines, and with regard to induction coils, goes pretty fully into the question of design. Photographs of the wave-forms of the primary and secondary currents are given, and in this connection it may be of interest to note that a primary current showing superimposed high-frequency oscillations is the best for X-ray work.

An interesting chapter is on the "blackening of an X-ray bulb," that annoying phenomenon which accompanies continuous work. There are two main causes for this:—(1) The disintegration or "sputtering" of the anticathode while acting as cathode during the inverse current, and also the cathode during the direct phase; and (2) the volatilisation of the anticathode due to its high temperature under reduced pressure.

The chapter on the measurement of the rays is important and comprehensive. The British Radium standard, consisting of 21.10 milligrammes of pure radium chloride, has been certified in terms of the International standard, and is now deposited at the National Physical Laboratory. The standard serves as a means of standardising radioactive preparations as well as the energy output of X-ray bulbs. The intensity of the X-rays at a particular point is defined as the energy falling on one sq. cm. of a receiving surface passing through the point and placed at right angles to the rays, and there are several methods in practical use for determining this:—(1) By measuring the current passing through the tube; (2) by measuring the heat produced when the X-rays are completely absorbed by a metal; (3) by measuring the ionisation effects of the rays; (4) by a comparison of photographic and fluorescent effects. Of these, perhaps, the most satisfactory and exact is the ionisation method.

The author devotes some space to the practical application of the rays, and this portion of the work is illustrated by interesting photographs. Micro-radiographs are now quite commonly taken, one of the pictures in this connection showing the legs of a tiny lizard with every bone completely defined. Another remarkable photograph is a radiograph of the intestines of man, the alimentary system being rendered temporarily opaque through the administration of bismuth salts or emulsions with the food. Stereoscopic radiography is now possible, and the method is useful in ascertaining the depth of a foreign substance in the body. Instantaneous photographs can quite readily be taken, and snapshots through any part of the body and of almost any of the moving organs are common; a bullet leaving the muzzle of a revolver has been radiographed.

Chapter XII, on the interference and reflection of the rays, is a wonderful record of the wit and ingenuity of man when confronted with problems of unusual difficulty. We have space only to notice one of the examples recorded. In 1912, Prof. Laue, of

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Munich, believing that X-rays were short light rays with wave-lengths of an atomic order of magnitude, conceived the notion that the regular grouping of the atoms in a crystal, which modern crystallography affirms, should be capable of producing interference effects with the X-rays, in a way analagous to that in which diffraction gratings deal with light waves. Friedrich and Knipping at once put Laue's theory to the test. They arranged that a parallel beam of X-rays should, after traversing a crystal, be received on a photographic plate, so that any directions showing "interference maxima" would be registered as spots. The first crystal that was tried gave the result anticipated from the theory.

One of the last chapters is on the nature of the rays. When they were first discovered the most diverse suggestions were made as to what they were. Röntgen himself believed them to be longitudinal ether-vibrations of short period and great wave-length. Other theories represented them to be short transverse ether-waves akin to ultra-violet light, internal vibrations of the electrons within the atom, a manifestation of the breaking up of molecules into atoms, ether vortices, irregular pulses in the ether, and flights of material particles strongly resembling the parent cathode rays. Only with the last few years has the controversy been stilled by the discovery that the rays can be reflected and diffracted by crystals, and there is now practically no doubt that they are identical with ultra-violet light of extremely short wave-lengths—wave-lengths of the order of the diameter of the atom.

Dr. Kaye's book is a good one, and is sure to be much used. It brings together in connected form all that is most interesting and important with regard to its subject; and while it contains a great quantity of matter for the serious student, it nevertheless lightens the touch here and there, as witness Mr. Robb's three verses to the Revolution of a Corpuscle, given by way of introduction. The first verse, to be sung to the air "The Interfering Parrot," from the *Geisha*, is as follows:—

A Corpuscle once did oscillate so quickly to and fro,
He always raised disturbances wherever he did go;
He struggled hard for freedom against a powerful foe—
An atom—who would not let him go.
The aether trembled at his agitations
In a manner so familiar that I only need to say,
In accordance with Clerk Maxwell's six equations
It tickled people's optics far away,
You can feel the way it's done
You may trace them as they run
$d\gamma$ by dy less $d\beta$ by dz is equal K. dx/dt,
. . . . . .
. . . . . .

while the curl of (x, y, z) is the minus d/dt of the vector (a, b, c).

W. J. C.

Continuous and Alternating Current Machinery. By J. H. Morecroft. London: Chapman and Hall, Ltd. Price 7s. 6d. net.

"Many of the students in engineering schools do not have the time for an exhaustive study of the subject of Electrical Machinery, but every engineering graduate should have some knowledge of the different kinds of generators and motors in every-day use." The author, who is Assistant Professor of Electrical Engineering at the Columbia University, makes the above statement in his preface, and most engineers will be inclined to agree with him, in spite of the fact that a little knowledge is sometimes a dangerous thing.

The first five chapters in the book deal with the elementary principles of continuous currents and their application to continuous-current generators and motors. The treatment is quite on ordinary lines, the only essential difference between this book and many English elementary text-books being that the author uses circular mils for wire areas and the whole of his practical illustrations are for American machines.

Alternating currents and their application are next dealt with in a similar fashion. A good and concise account is given of the mercury arc and other rectifying devices. The operation and care of electrical machinery is briefly dealt with in the final chapter.

Like so many American books, the work is marred by the large number of catalogue illustrations included. There are nearly ninety altogether, and some are so poor that it is difficult to see what educative value they can possibly have.

The reviewer cannot recommend the book to English students, since it is paralleled by as good, or better, works at a cheaper price.

H. G. S.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, AUSTRALIA, 1914.—II.

Irrigation Dams and Hydro-Electric Power.

By E. Kilburn Scott, M.I.E.E., A.M.Inst.C.E.

Read in Section G (Engineering).

(*Concluded from page* 319.)

Uses for Power.—The question may be asked, what is the best use to make of electric power which is developed by water for irrigation? Seeing that irrigation dams are usually situated at considerable distances from cities and other centres where electric current is wanted for lighting, tramways, and motive power, the matter requires careful consideration.

Although electric transmission of power is efficient, a long-distance transmission line is expensive to construct and maintain, and even in countries where there is no trouble with ice and snow, there are the risks of stoppage due to wind and dust storms, bush fires, etc.

The supply of electric lighting, tramways and motive power may, for the purpose of the present argument, be called a "domestic" supply, and it is important to remember that when once such a supply is undertaken, it must be kept up at all seasons and in all years. On the other hand, the primary object of an irrigation dam is always to have a supply of water available for the farmers, and more especially so during dry seasons.

When estimating the supply available from a given source for domestic purposes, only the minimum flow can be reckoned upon, if risk of shortage is to be obviated. Therefore for a domestic supply of electricity all surplus between the minimum and the maximum flow is wasted so far as power is concerned, and expensive spill-weirs and channels have to be provided.

Clearly it is wise to make use of the electric power as near to where it is generated as possible, also for operations which use the same power right through the 24 hours, but which can be temporarily suspended if need be. The supply of light and power to a city 50 or so miles away sounds well, but it is not necessarily commercially advisable, because of the difficulty of ensuring continuous supply, because of the low load factor, and, finally, because the supply must be at a standard pressure and periodicity, which, as we have seen, are difficult to get where the head of water varies.

The first use which suggests itself is the utilisation of the power for pumping purposes. By this means the irrigation area can be extended beyond that which can be reached by gravitation channels. In some cases in the United States, electric energy is used to pump water out of the same river which develops the power. Hydroelectric pumping is being largely utilised in connection with Chilean irrigation work.

When the Assuan dam comes to be harnessed a part of the power is to be transmitted about 30 miles and used for pumping. It may be mentioned that Assuan presents considerable difficulties because, in the first place, it is not easy to select an industry to be pursued which could utilise power that varies between 100,000 H.P. and 10,000 H.P.; also during the greater part of the year the climate at Assuan is extremely hot, and it is therefore difficult to develop large manufacturing industries in such a climate.

When the Trawool dam scheme was being considered a suitable use for the power appeared to be to transmit it to the cities of Ballarat, Bendigo and Melbourne for a domestic supply. The great advances in the last few years of electro-chemistry and metallurgy have, however, changed the situation considerably.

During this brief period of eight years, many new industries which utilise large quantities of cheap electrical energy have safely passed the experimental stage, and a single factory making fertilisers could now easily utilise the entire output of the water power, and with an absolute certainty of selling the product without disturbing prices.

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The tendency is now to establish electrochemical and metallurgical factories close to the power and so dispense with transmission lines; also to work the water power and the factory together, arranging the output of the one to meet the demand of the other so that the utmost use can be made of the water available. When that is done surplus water need not be wasted, and under certain conditions the whole mean annual rainfall may be reckoned upon after allowing for evaporation.

The following are some of the new electrical industries which require large quantities of electrical power at low cost:—

1. Manufacture of nitric acid from atmospheric nitrogen in electric furnaces by the direct method.
2. Making nitrogenous and phosphate nitrogenous fertilisers by the direct process.
3. Manufacture of calcium carbide for acetylene lighting.
4. Manufacture of calcium cyanamide fertiliser from calcium carbide.
5. Electric reduction of iron and steel.
6. Making alkali from salt by electrolysis.
7. Making aluminium from bauxite.
8. Making carborundum for use as an abrasive.
9. Making graphite in the electric furnace.
10. Melting concentrates.
11. Treating refractory zinc ores, etc.

Some of these industries have to be carried on continuously, as, for example, the manufacture of calcium carbide and calcium cyanamide, the reduction of iron and steel, and the making of aluminium, etc. The cost of stoppage and restarting is excessive in all smelting and allied operations. On the other hand some of the industries, such as fixation of atmospheric nitrogen by the direct process, can be worked intermittently. The manufacture of graphite can also be carried on intermittently.

Fixation of Nitrogen.—Where the water can only be used for a portion of the year, the problem is to fix upon some particular industry which can utilise power intermittently, and will permit of changes in the amount of labour employed, without undue additional expense. Also, the product must be such that it has a very widespread market, so that when it is turned out in considerable quantities it does not upset prices. At the same time it should be capable of being conveniently stored at times when the output may temporarily exceed the demand.

The manufacture of fertilisers from atmospheric nitrogen by the direct furnace process meets all these conditions, and is therefore ideal. Not only can the process be carried out intermittently, but the demand is practically unlimited, for to be continuously productive all soil requires plant foods.

Virgin soils have such foods accumulated in them and for the first few years they give good crops, but sooner or later there comes a time when fertilisers must be added. If wheat and other similar crops are grown year after year from the same ground the natural plant foods accumulated therein become exhausted. Of these nitrogen takes first rank.

The best policy is to utilise the power of irrigation water for the manufacture of such commodities as will be of direct use to the farmers. Fertilisers are undoubtedly the right commodities to make, and it is very fortunate that the manufacture of some of these fertilisers can be carried on intermittently.

At the Portsmouth meeting of the British Association I read a paper in which were described the various methods and the furnaces in use for fixing atmospheric nitrogen. It will therefore be sufficient to state here that the most *direct* and simple method to make fertiliser is to blow air through an electric arc flame so as to form nitric oxide gas. In the presence of oxygen this changes to nitrogen peroxide, which, when brought into contact with water, produces nitric acid.

If lime is acted on by this dilute nitric acid a nitrogenous fertiliser called calcium nitrate, containing 12¾ per cent. of nitrogen, is produced. Large quantities of this fertiliser are made in Norway, and it is finding its way to the fruit lands of California and to other parts of the Pacific in competition with sodium nitrate and sulphate of ammonia.

Phosphate Nitrogenous Fertiliser.—A valuable fertiliser can be made by grinding up phosphate rock and mixing it with water to the consistency of cream. When the gas from the furnace is passed through this it changes the phosphate into the citric soluble state, so making it valuable as phosphate fertiliser. At the same time the lime is acted upon and takes up nitrogen, so that the fertiliser contains two out of the three principal plant foods.

For some time I have been interested in a scheme to utilise waste basic slags from steel furnaces, which at present cannot be used by agriculturists. The phosphate of basic Bessemer slag is in the soluble condition and is very largely used as a phosphorus fertiliser, but the slag from some open-hearth steel furnaces is largely insoluble, and so the phosphorus is not in a form in which it is immediately available for agriculture.

This waste basic slag is being produced in Middlesbrough alone at the rate of 150,000 tons a year. With the aid of the electric furnace it may be possible in the future to turn it to good account.

It may be mentioned that the direct method of making fertilisers has reached enormous proportions in Norway. One factory utilises 140,000 H.P., which is generated by a water power at Rjukan, whilst another factory to utilise 120,000 H.P. is also being equipped. About eight millions sterling is invested in the business in Norway alone, this money having been principally found by Scandinavian and French investors.

Calcium Cyanamide.—During the last year a good deal has been heard of the *indirect* method of fixing atmospheric nitrogen.

This method commences with the manufacturing of calcium carbide for which limestone and coke or anthracite are treated in the electric furnace. After the carbide has cooled down it is ground to a fine powder in closed chambers in an atmosphere of nitrogen so as to prevent formation of acetylene gas.

The powdered carbide is then changed into calcium cyanamide by being electrically heated, whilst pure nitrogen is forced through it. For this purpose the powdered carbide is run into a large number of barrel-like retorts, crinkled paper being put in with it so as to provide passages for nitrogen gas. The retorts are comparatively small and each has a rod of carbon down the centre for the electric current to pass through to start the reaction.

It is of the utmost importance that the nitrogen be absolutely pure, and it is usually made by the liquid air process. A meter on each retort registers the amount of nitrogen which passes in, and when all that is possible has been absorbed the retorts are given time to cool down. The contents are tipped out and ground up ready for market.

It will be noted that this indirect method requires a great deal of plant and makes use of electric power for several operations. If, as in the case of Assuan, manufacture can only be carried on for eight months of the year it means that a great deal of very expensive plant is going to stand idle for a third of the year.

The writer is, therefore, of opinion that the *direct* method is the best to adopt for such water powers as are being considered in this paper, because it is so very simple and the raw materials are only air and water. Also, the process can be carried on to suit the exigencies of the power supply, and the voltage periodicity may be varied. The plant required is a minimum and it needs very little attention.

Thus far all the furnaces which have been used in Norway and elsewhere have worked with single-phase alternating current, and as the power is usually generated as three-phase the furnaces have to be used in sets of three.

Three-Phase Furnace.—I have been at work on this problem for the last few years and have made an efficient three-phase furnace. I claim that for a given power the first cost is much less than it would be for three separate single-phase furnaces; also, the space occupied is less and attendance and maintenance costs are lowered. By combining the three arc flames together a balanced load is given on all the phases, also continuity of working is assured because current is always flowing in one or other of the phases and the arcs thus maintain each other.

The combined flame takes the form of an inverted cone, and thus a large portion of the air passing through the furnace is enabled to come into intimate contact with the flame. Further, a combined flame is naturally hotter than if the same energy were expended in three separate furnaces because the latter have greater radiation losses, etc. High temperature is all-important. Professor Nernst has shown that the yield of nitric oxide depends partly on the temperature, and it goes up very rapidly indeed at the highest temperatures.

By projecting a stream of high-voltage high-frequency sparks into the space between the electrodes where they are nearest together the air dielectric is broken down without any adjustment of the main electrodes, and it is thus possible to control a powerful furnace by means of quite a small switch. Also, the quantity of air is in no way restricted by the position of the electrodes.

A boiler forms an integral part of the furnace, and this not only effectively cools the gases, but at the same time heat that would otherwise be wasted is utilised for raising steam. None of the furnaces in use abroad has a boiler applied directly. The steam raised in the boiler may be used to generate electric energy, which if passed back into the furnace enables the combination to work regeneratively.

Where there is plenty of water power, as in Norway, there may not be much advantage in regenerative working, but where the power is limited, as it would naturally be at an irrigation dam, then there is something to be said for it. The advantage, however, is most apparent where the electricity is obtained from power plants using steam turbines.

The Migration Towards Power.—The evolution of power from primitive water wheels to steam engines, then to steam turbines, and again back to water, has had a considerable effect on the geographical distribution of manufacturing. The factories of the olden times were placed on the banks of the rivers because the prime movers were water wheels, and the power was directly transmitted from the water wheel through shafting to the machine. Later came the utilisation of the potential energy in coal by means of steam engines, and factories began to centre on the coal-fields of the world. This phase is still going on, but along with it there is a distinct trend of new industries towards districts and countries where hydro-electric power is available.

In new countries manufacturing centres are apt to be located somewhat haphazard, and by such accidents as the location of the first factory of a given industry; but as economic law and consuming necessities begin to operate there is always a movement towards productive soil and a consuming population.

Those who have their interests bound up in agriculture in Australia should see to it that all power which is generated

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by means of irrigation dams is kept for service in their neighbourhood for the manufacture of commodities which they themselves specially require. As Australia becomes more and more a wheat-growing country, more nitrogenous fertiliser will be required, and it should be obtained from the air by electric power.

The question of making ammonium nitrate (from the dilute acid) for making safety explosives and also concentrating the nitric acid to make high explosives is also of interest. Independently of the importance of each country making its own explosive materials for defence and mining purposes, there is going to be a large outlet for explosives to break up soil instead of ploughing it; also for making holes for planting fruit trees, etc. The latter method is very much superior to digging the holes, as the soil is loosened all round and it is much cheaper and quicker.

The Limiting Conditions for the Safe Use of Electricity in Coal Mining.

By Prof. W. M. Thornton, D.Sc., D.Eng.

(*Section G. Abstract.*)

The paper is a summary of recent researches on the limits of electrical ignition of inflammable mine-gases and coal-dust. The lower limit of inflammability is 5.6 per cent. of methane in air by volume; a temperature of 200° C. lowers this to 5.1 per cent. The most inflammable mixtures are at 8 per cent. for continuous-current break-sparks, 10.2 per cent. for alternating-current breaks. Excess of nitrogen appears markedly to increase the necessary igniting current. With non-inductive circuits 1 ampere at 100 continuous volts is a typical value; the corresponding values with alternating current are 7 amperes at 40 periods a second, 16 at 20, 20 at 80, and 29 at 100. By varying the inductance the energy of an igniting break-spark is found to be constant at about 0.1 joule. Electric signalling bells have inductance up to 0.5 henry and ignite gases at the trembler spark or signalling point. All electric lamps and fuses, however small, must be enclosed. Oscillations on a cable sheath caused by short circuits on the conductor will not ignite gas, but maintained leakage arcs from armouring are only slightly more active than break-sparks. Static discharges from 6-inch high-speed belting could not be made to ignite gas, nor the blue brush discharge from high-pressure conductors. Movements of clouds of dust have been shown to give electrification and to cause sparks, but the energy must be much greater than can be obtained experimentally in order that this should become dangerous. Wireless telegraph operations on the surface do not induce sparking potentials underground. Capacity sparks in general from cables left insulated after being charged are very active, 0.002 to 0.005 joule causing ignition. The influence of gas in forwarding coal-dust explosions begins to be felt when ½ per cent. of gas is present. At 2 per cent. full ignitions are obtained at every trial. Coal-dust alone can be ignited by both continuous-current and alternating-current break-flashes, the former requiring 3.5 to 6 amperes at 480 volts in non-inductive circuits, the latter 14 amperes at 40 periods and on a power factor of 0.8. Continuous-current faults on the negative cable develop rapidly in the presence of moisture and the cable is disintegrated. Alternating-current faults are self-healing, and a mechanical fault does not increase electrically on an alternating-current cable.

Armouring is necessary under modern power conditions; lighting and signalling circuits must be equally well protected to prevent open sparking. The limits of safety are electrically low, but the risks of ignition are even now no greater than those attending the use of flame safety lamps, and they can be entirely prevented.

BRITISH TRADE IN AUSTRALIA.

The following are extracts from a report on the trade of Australia by H.M. Trade Commissioner which has been published by the Board of Trade; the report itself may be obtained from Messrs. Wyman & Sons, Ltd., Fetter Lane, E.C., the price being 2½d.

The following table shows the total imports into the Commonwealth for the six years ending 31st December, 1913, with the shares of the United Kingdom, Germany and the United States:—

Year.	Total Imports. Thousand £.	Percentage of Total Imports from U.K.	Germany.	U.S.A.
1908	49,799	50.75	9.00	13.22
1909	51,172	50.54	8.87	11.60
1910	60,014	50.68	8.69	12.76
1911	66,968	48.88	9.52	13.45
1912	78,158	50.06	9.15	13.77
*1913	77,248	50.27	9.09	14.12

* Subject to revision.

That preference is of material benefit to British trade there can be no doubt whatever, and importers are emphatic in stating that this is so. The extent to which it is of benefit, however, is a matter which it is somewhat difficult to determine.

With regard to metals and machinery, notwithstanding the preference, our foreign competitors have materially increased their relative and actual positions. In the metals, etc., group, lower prices, due to highly organised methods of production and distribution, more rapid filling of orders, as well as lower rates of land and sea freight, sometimes enable foreign manufacturers to neutralize the benefits derivable by the Mother Country from preference. Of the total value of the trade in 1912 in the metals section, about 55 per cent. was affected by preference. While the British proportion marked a decline of over 2 per cent. between 1908 and 1912, that of foreign countries showed a corresponding advance. Notwithstanding the presumptive adverse effect of preference on foreign trade, the increase in value of the latter in the metal group amounted to over 97 per cent. in the five years, as against an increase of about 76 per cent. in the trade of the United Kingdom under preferential conditions.

In the section of metals, etc., not affected by preference little change is apparent in the relative positions of the United Kingdom and foreign countries in 1908 and 1912. The increase in value of the trade from the United Kingdom in the five years amounted to about 52 per cent., and that from foreign countries to about 54 per cent.

Machinery.—Competition in machinery is chiefly with the United States, which has nearly one-third of the trade. In electrical machinery (dynamos and starting and regulating apparatus) the effects of both American and German competition are felt—chiefly the former. The British percentage shows a decline in the three years reviewed, but it is most marked in the trade in dynamos over 200 h.p. (17½ per cent.-12½ per cent.) and in starting and regulating machinery (20 per cent.). The imports under these two sub-divisions combined are far less in value, however, than the imports of dynamos of lower horse power (25 per cent.-20 per cent.), in which the United Kingdom has about half of the trade. The imports of locomotives (25 per cent.-20 per cent.) fluctuate considerably, but amounted to over £468,000 in 1912, the average share of the United Kingdom for the three years 1910-12 being over 77 per cent. The United States is practically our only competitor. American firms have sometimes secured orders by guaranteeing quick delivery. Local engineering shops turn out considerable numbers of locomotives, one finely equipped establishment in Queensland having a capacity of one engine per week. It is always fully occupied with orders from different parts of the Commonwealth; but establishments such as that referred to are often not in a position to guarantee rapid delivery, while their prices are higher than those for imported locomotives, notwithstanding the handicap of Customs duty on the latter. In mining machinery the British position is weakest in that for coalcutting (5 per cent.—free), in which the United States has about 90 per cent., but the trade is unimportant, having averaged only about £15,000 during the three years reviewed. In rotary percussive drills (5 per cent.—free) the United Kingdom has about one-fifth of the trade only, notwithstanding the preference, the remainder being with the United States. The total trade is comparatively small, however, averaging under £33,000 per annum. In other mining machinery, viz., that for earth and rock cutting, dredging, etc. (25 per cent.-20 per cent.) the position of the United Kingdom is stronger, having averaged over 60 per cent. in the three years under review, out of an annual average total of about £51,000. Both Germany and the United States participate in this trade.

In machine tools (free) there is considerable competition from the United States and to a less extent from Germany, the average share of the United Kingdom being about 51 per cent. of an annual average of about £120,000.

In machinery not particularly specified, on which a duty of 25 per cent. under the general tariff and 20 per cent. under United Kingdom preferential tariff is charged, the average annual value of the imports was about £850,000, and of this the United Kingdom had nearly two-thirds, the most serious competition being that from the United States, which improved its percentage by over 2 per cent. in three years, while the United Kingdom's share remained stationary. In the much less important trade in machinery not particularly described, on which a general tariff duty of 15 per cent. is charged, with no preference, the British position improved by 5½ per cent., while imports from the United States showed only a slight advance, and imports from Germany declined.

Metal manufactures.—This forms one of the most important groups of imports, and naturally embraces a very wide range of items. From the point of view of foreign competition the item in which the position of British trade is most unsatisfactory, not only in this group but throughout the whole range of imports, is iron and steel wire (free), being chiefly that used for fencing. In the three years reviewed in the table to which reference has been made, the total value of this trade increased from about £700,000 in 1910 to about £724,000 in 1912. The following figures show the value of the shares of the three principal countries interested:—

	Imports from U.K. Thousand £.	Germany. Thousand £.	U.S.A. Thousand £.
1910	115	381	180
1911	111	320	266
1912	113	298	304

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Canada and Belgium both participate to a small extent in this trade, but their shares have declined since 1910. Apart from the unsatisfactory position of the United Kingdom, the most remarkable feature of the foregoing figures is the great decline in German trade and the corresponding increase in that of the United States. The German position is stated to have improved in 1913, but detailed figures on this point are not yet available. The demand for galvanised wire appears to be greater than for black wire. The success of the German manufacturer in this important staple has been explained as being due to:—

1. Syndicated methods of production and distribution, under which the German wire Verband pays an export bounty;
2. Lower freight rates;
3. Cheaper manufacturing processes;
4. The readiness to meet the demand for lower quality of wire in some instances.

As regards American wire, lower freights are also a factor, while there seems to be little doubt that this wire is sold in the Australian market at a lower rate than in the home market. All these factors combined make for lower prices, with which our manufacturers apparently are unable to compete.

Tools of trade (free).—The value of the tools imported increased from about £533,000 in 1910 to £695,000 in 1912, on an average the British share being just about half. The most serious competition met with is with the United States, the imports from that country having increased in the period mentioned from £215,000 to £305,000. The competition from Germany in this line is not serious, her average trade having been under £35,000 per year. There is slight competition from Canada, Sweden and France. The success of American manufacturers of tools is explained by importers as being due to various factors. The American tool makers are stated to be readier to take up a novelty than the British; they put up their tools for the shelf in a more attractive way, and also in such a manner as gives a minimum of trouble to the man behind the counter. They not only advertise them more extensively themselves, but provide the retailer with abundant advertising matter, show cards, etc., for use in the shop. Moreover, they spare no pains to demonstrate the utility of their goods by entrusting the business of making a market to men thoroughly conversant with the article offered. Importers claim that the British manufacturer is in some of these respects behind the times, and while admitting that he maintains his position in some lines of the tool trade, it is urged that his share of the trade would be larger if more attention were paid to detailed study of the Australian market. Tool-making firms in the United Kingdom are probably familiar with criticism of this kind, and in some instances they have adapted themselves to meet the conditions of the Australian market, but, if the importer may be believed, there is still room for closer study of local conditions on the part of our home manufacturers. In this as in other branches of trade the importance of studying both the manufacturing and distributing methods of our competitors is apparent. The problem for the manufacturer is not so much the sale of goods he already makes as what is the exact article required in a given market.

Electrical and gas appliances, not elsewhere included (17½ per cent.-10 per cent.).—Notwithstanding the substantial tariff preference to goods from the United Kingdom its share in this trade has only averaged a little under 52 per cent. of the total, which increased from about £153,000 in 1910 to over £245,000 in 1912. The trade of the United States in goods of this class shows a more rapid increase than that of Germany, although the latter is still slightly ahead of the former. This appears to be an instance where factors are operative which tend to minimise the effect of preference.

In telephone switchboards and appliances (free) the British share has declined from nearly 44 per cent. to about 35½ per cent. in three years, in relation to an increase in the trade from £105,000 to £164,000. The greater part of the imports are from Sweden, but it is noteworthy that in the three years under review the United States increased her sales of goods of this class from £3,000 to £30,000.

Rails, fishplates, etc. (15 per cent.-10 per cent.).—This trade has increased from about £820,000 in 1910 to £1,300,000 in 1912, the share of the United Kingdom being about 48½ per cent in the former year and close on 65 per cent. in the latter. A consideration of the detailed figures suggests that factors of greater moment than tariff preference have been operative in determining the position. Up to the present steel rails have not been manufactured to any great extent in the Commonwealth, but when the steel works at Newcastle, New South Wales, now under construction by the Broken Hill Co., are in operation, the local output should be considerably augmented, and may eventually meet the demand for the whole of Australia. It is anticipated that the rolling mills at Newcastle will be turning out rails in the course of next year.

Trade Inquiries.

The Trade Commissioner will be glad to furnish information regarding the nature and extent of foreign competition in respect of any of the items. It will assist him in replying to inquiries if these are made in the form of a series of specific questions, instead of in a general way.

Catalogues.—Although there is on file in the Trade Commissioner's office a large number of catalogues of British manufacturers of various kinds, it is felt that the collection is by no means as representative as it might be. British firms who have not already done so are invited by the Trade Commissioner to forward issues of their catalogues. These should show the full export discounts, and should state whether packing is included in the price or discount, whether quotations are f.o.b. at a British port, and whether the firm is prepared to quote c.i.f. at an Australian port. They would also do well to furnish the names and addresses of their agents, if any, in the Commonwealth in order that these may be incorporated in the existing lists of agencies before mentioned, if such be necessary.

It is hoped that the principals or travelling representatives of British firms visiting Melbourne or Sydney will make use of the Trade Commissioner's Office to a greater extent than hitherto. The Commissioner trusts that business men will regard his offices as a bureau where information likely to be useful to them is available in convenient form.

ELECTRIC FURNACES AND ELECTRIC STEEL PRODUCTION.*

In the first electric furnace of practical value (Stassano, 1898) heat was conveyed to the charge simply by radiation from an electric arc. Furnaces of this type are now usually confined to melting weights up to 2 tons of metal for casting. Almost simultaneously with the Stassano furnace the Héroult furnace was invented, and this type is now the most extensively employed. It is equally applicable to melting cold scrap and to refining molten metal, and a number of Héroult furnaces accommodating 25 tons' charge are in regular service. The Girod furnace (1906) is applicable to the same class of work as the Héroult furnace, but has so far not been built for more than 15 tons' charge. The Keller furnace is similar to the Girod type, but has found limited application, and that chiefly in France. The Nathusius furnace, invented in 1908 and since built in sizes up to 10 or 20 tons, is applicable to the same duties as the Girod furnace and is specially suitable for melting ferro-manganese. The Nathusius furnace is characterised by current flow between the electrodes in the floor of the furnace; the total heating can be distributed at will between the upper and lower electrodes. Many as are the patents which have been granted, no other really distinctive types of arc furnace have yet been evolved.

Late in the nineties the Kjellin and Frick induction furnaces were introduced. These types differ only in the form and arrangement of the primary coils. The Kjellin furnace can be used instead of crucible furnaces, but is not, says Dr. Guggenheim in *E.T.Z.*, very suitable for refining processes, and is subject to metallurgical and electrical defects. The latest Frick furnaces are free from these defects, and satisfactorily applicable to refining processes. Two Frick furnaces of 20 tons' capacity are used in America to make high-grade steel from molten charge; more extensive use of this type is to be anticipated. The Röchling-Rodenhauser induction furnace was the first to find extensive application; it is now used chiefly to refine molten metal and to melt ferro-manganese. The largest furnace of this type yet built has 12 tons' capacity.

The statistics presented in Table I (wherein doubtful figures are marked ?) show that arc furnaces find most favour, the greater number used, as compared with induction furnaces, increasing year by year. The 1913-14 data relating to Héroult, Girod, Nathusius, Kjellin, Röchling-Rodenhauser and Frick furnaces are derived from firms licensed to build these types. The number of Stassano, Keller, Chaplet and other arc furnaces has increased but slowly or has decreased, and, among the induction furnaces, only the Röchling-Rodenhauser and Frick types have made important advance since 1908.

TABLE I.—Electric Steel Furnaces, 1908—1913-14.

Type.	In Use. 1908.	1910.	1913-14.	Under construction. 1908.	1910.	1913-14.
Arc:—						
Héroult	12	22	47	7	17	20
Girod	2	9	21	8	8	6
Nathusius	—	2	5	—	—	4
Stassano	8	5	10 ?	3	1	?
Keller	1	4	6 ?	—	2	?
Chaplet	2	4	8 ?	—	1	?
Miscellaneous	—	5	11 ?	—	2	?
Total	25	51	108 ?	18	31	30
Induction:—						
Kjellin	10	10	10	2	2	—
Röchling-Rodenhauser	3	6	12	7	8	5
Frick	2	1	2	—	—	4
Miscellaneous	3	4	2 ?	3	—	?
Total	18	21	26 ?	12	10	9
Total—Arc and induction	43	72	134 ?	30	41	39

During the first years of its practical development, the electric steel industry made rapid headway. The first practical electric melting furnace was set to work in 1903-4, yet in 1908 there were 43 arc and 30 induction; in 1910, 82 arc and 31 induction; and in 1913, 138 arc and 35 induction furnaces in service. Though

* Abstract from the *Elektrotechnische Zeitschrift.*

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the number of induction furnaces now in use compares unfavourably with the number of arc furnaces, comparison on a tonnage production basis is more favourable to the former type. Both arc and induction furnaces have their own spheres of utility. The hopes engendered by the rapid development of electric furnaces ten years ago have not since been realised, the data presented in Table II being by no means so favourable as would be expected for new apparatus and processes of proven merit.

TABLE II.—Electric Steel Production, 1908-13.

Tons per annum.	1908.	1909.	1910.	1911.	1912.	1913.
Germany and Luxembourg ...	19,536	17,773	36,188	60,654	79,190	88,881
France	2,289	6,456	11,759	13,850	15,922	*
Austria-Hungary	4,533	9,084	20,028	22,867	21,556	26,837
America... ...	6,112	13,762	52,141	29,105	18,602	*
Total ...	32,590	47,039	120,116	126,476	135,270	*Not yet avail'ble

The decrease in the American figures is due to reversion to experimental work in the States. Patent records show that finality in electric furnace design is by no means achieved; indirectly these records expose many defects of existing furnaces. No electric furnace has yet been devised which combines the special and undoubtedly important advantages of all the types at present in practical use. This fact alone would explain the slow progress made recently in electric steel manufacture, but there are also two other unfavourable factors to be considered. The quantity of electrical energy consumed in an electrical furnace is so considerable, that the latter can only compete with other types in the manufacture of high-grade steels, so long as electric tariffs stand at their present level. In melting low and medium grade steel, other furnaces are cheaper and more applicable. The second obstacle to the development of electric furnaces is the difficulty of building furnaces for charges exceeding 15 tons; few, if any, furnaces have been built for over 25 tons' charge, and it is not yet certain that even such sizes give permanent satisfaction. Of 67 Héroult furnaces now in use or under construction, one is of 30 tons, two of 25 tons, and five of 15 tons' capacity. There are in use one 15-ton, two 12-ton, and one 10-ton Girod furnaces; and one 12-ton and one 10-ton Nathusius furnaces.

With the exception of Röhling-Rodenhauser furnaces up to 4 tons' capacity, no furnace can be connected directly to a high-pressure 50-cycle three-phase circuit without the intervention of converters or transformers. Large R.-R. furnaces and all other induction furnaces must be supplied at 5 to 25 cycles per second if a reasonable power factor is to be secured. The cost of special generators or rotary converters is serious. Arc furnaces usually require pressure-reducing transformers, and the melting current (some thousands of amperes) must be carried into the furnace instead of being induced in the charge. About 15,000 amperes at 100 volts is required in a 15-ton arc furnace, and in larger furnaces satisfactory electrode construction is most difficult. Not more than 6 or 7 amperes can be carried per sq. cm. section, hence 20,000 amperes requires an electrode 63 cm. in diameter. This is difficult to make homogeneous, and breaks easily. Difficulties are yet greater in 25 or 30-ton furnaces. The floor heating practised in the Nathusius furnace permits fully 20 per cent. greater heating with given top electrode dimensions. Escaping flames cause rapid oxidation of electrodes above the point where they enter the furnace roof: as the reduced section descends, the clearance becomes larger and the trouble is accentuated. Attempts have been made to water-cool electrodes at this point; to protect them by refractory rings or by netting covered with refractory cement; and to prevent combustion by delivering inert gas on the electrodes through ring-pipe nozzles.

The satisfactory development of electric furnaces has been much hindered by the mistaken policy of ironmasters building home-designed furnaces to which they apply electrical apparatus bought ready made. Naturally, the most elementary principles of electrical engineering are frequently contravened; the performance of the furnace is unsatisfactory, its power factor is low, and depreciation is rapid. On the other hand, it cannot be denied that electrical manufacturers have often, in the past, overlooked the requirements of steel workers.

Many endeavours have been made to improve the power factor of induction furnaces and to use with the latter a form of bath or hearth suitable for refining purposes. Not much success has attended efforts to melt cold charges in induction furnaces, and those arrangements which have given the best form and position of hearth have involved carrying the heavy melting current through a sufficiently heavy secondary winding, thus introducing one of the chief defects of arc furnaces and making the furnaces no longer of the true induction type, in which melting current is generated solely in the charge itself. A fluid slag at higher temperature than the charge is produced automatically in arc furnaces, but in induction furnaces it can only be secured by superheating the molten metal.

The interests of the electrical industry would be better served by the great increase in consumption of electrical energy which would follow the perfecting of a simple and economical electric furnace, than by the existing and probable future demand for the special generators, transformers and conductors necessary under existing conditions. For some years past satisfactory electric blast furnaces have been in operation in Scandinavia and California, and their further development and application would be of immense importance to the electrical industry. To smelt a ton of pig-iron requires about 2,500 KW.-hours, hence commercial success is only to be expected in countries where cheap hydro-electric power is available near iron mines, and coal supplies sufficient for purely metallurgical requirements

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co. Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,737. "Dynamo-battery electric systems." G. E. Mortley. August 17th. (Complete.)

18,738. "Electrically-actuated tools." W. J. Mellersh-Jackson. (Commonwealth Electric Tool Co., United States.) August 17th. (Complete.)

18,747. "Automatic current cut-off for electrical appliances." Ulysses Schuyler Smith. August 17th. (Complete.)

18,751. "Coherers." British Thomson-Houston Co., Ltd. (General Electric Co., United States.)

18,761. "Terminal-boxes for electric cables." W. B. Woodhouse and Callender's Cable & Construction Co., Ltd. August 17th.

18,775. "Electric lamp-holders." F. C. Lyster. August 18th.

18,809. "Pocket flash-lights." W. J. Mellersh-Jackson. August 18th. (Samuel Isaac Posen, United States. Complete.)

18,810. "Electric primers." C. F. Lindsay. August 18th. (Convention date, September 8th, 1913, United States. Complete.)

18,823. "Electric light, to illuminate the music for brass or reed instruments." J. E. Wood. August 19th.

18,829. "Electrical starting-mechanism for internal-combustion engines." F. H. Royce and Rolls-Royce, Ltd. August 19th. Complete.

18,869. "Spring terminal for electric batteries." G. Pearson. August 20th.

18,870. "Combined lamp-holder and contacts for electric portable lamps." G. Pearson. August 20th.

18,873. "Mercury switches." G. Jacobus van Haersma Buma. August 20th. (Complete.)

18,882. "Systems of electric distribution." British Thomson-Houston Co., Ltd. (General Electric Co., United States). August 20th.

18,887. "Variable-pole dynamo-electric and like machines." F. Creedy. August 20th.

18,930. "Means of overcoming electrical disturbances." E. S. Heurtley. August 21st.

18,942. "Electric switches." J. H. Tucker and J. A. Crabtree. August 22nd.

18,954. "Electric railway signalling." J. Gardner. August 22nd.

18,960. "Electrolytic process for the production of iron tubes, sheets, and the like with an incorrodible surface." S. O. Cowper-Coles. August 22nd.

18,961. "Process for the electro deposition of lead." S. O. Cowper-Coles. August 22nd.

18,962. "Process for the electro deposition of iron." S. O. Cowper-Coles. August 22nd.

18,963. "Process for banding projectiles." S. O. Cowper-Coles. August 22nd.

18,964. "Process for coating metallic surfaces with brass." S. O. Cowper-Coles. August 22nd.

18,965. "Process for coating metallic articles with lead." S. O. Cowper-Coles. August 22nd.

18,966. "Electrolytes for the electro deposition of zinc." S. O. Cowper-Coles. August 22nd.

18,967. "Electrolytic process for the production of rustless iron." S. O. Cowper-Coles. August 22nd.

18,968. "Electrolytic process for the production of rustless iron alloys." S. O. Cowper-Coles. August 22nd.

18,971. "Electric distribution systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 22nd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

5,088. Electric Safety Lamps. G. A. Dicker. February 28th. (August 28th, 1913.)

15,463. Galvanic Cell. P. Burger. July 4th. (July 6th, 1912.)

17,733. Galvanometers, Voltmeters, Ammeters, and like Instruments. A. Onwood. August 1st.

17,926. Electrically-controlled Valve. H. J. Read and W. J. Bransom. August 6th.

18,000. Liquid Resistances. Akt.-Ges. Brown, Boveri, et Cie. August 7th. (August 8th, 1912.)

18,072. Electric Furnaces. W. N. Crafts. August 8th.

18,103. Apparatus for Measuring the Magnetic Potential between any two points of a Magnetic Circuit. W. Rogowski. August 8th. (August 9th, 1912.)

18,122. Telephone Exchange Systems. Western Electric Co. (Woodward, acting for Western Electric Co.) August 8th.

18,321. Telegraphy. United Telegraph & Cable Co., and W. M. Bruce, Jnr. August 12th.

18,326. Wireless Telegraph Receivers. Marconi's Wireless Telegraph Co. and H. J. Round. August 12th.

18,447. Incandescent Electric Lamps. British Thomson-Houston Co. (General Electric Co.) August 13th.

18,479. Electric Contact Device for use with Semaphores, Small Lifts, and the like. A. Schalch. August 14th.

19,220. Telephone Call-recorders. D. J. McGauran. August 25th.

19,271. Electric Devices for Calling any one of several Stations connected to the same line. Siemens & Halske Akt.-Ges. August 25th. (August 24th, 1912.)

19,475. Automatic Retrieving Devices for Trolley Collectors of Electric Traction Systems. C. Kodderitzsch. August 28th.

20,008. Electrometers. B. Szilard. September 4th. (October 15th, 1912.)

20,216. Unspillable Electric Accumulator Cells. W. Thomson. September 8th.

20,773. Automatic Telegraph Systems. D. H. Cameron. September 15th.

21,480. Electrical Connection Devices for Railway and like Vehicles. L. Boirault. September 23rd. (Addition to 13,820/13.)

22,223. Manufacture of Carbon Electrodes for Electric Arc Lamps. C. Conradty (firm of). October 2nd. (July 2nd, 1913.)

26,338. Interrupter for Electro-Magnetic Ignition Devices. E. Rogalski. November 17th.

26,733. Electric Controlling Mechanism for Marine and like Engines. S. Rumolino. November 20th. (Patent of Addition not granted.)

27,148. Electric Lighting Apparatus. Cold Light (Dussaud Processes), Ltd. (Soc. Internationale de Lumiere Froide (Procédés Dussaud)). November 25th.

27,409. Earthenware Troughs for Electric Cables. H. L. Doulton and C. E. Morris. November 28th.

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Vol. LXXV.] CONTENTS: September 11, 1914. [No. 1,920.

	Page
Looking Ahead	353
Wages or Dividends?	355
The New Trade-Mark and Patent Rules	355
Copper	355
Repenting at Leisure	356
The Moratorium—and After	356
The Decline of the Self-Synchronising Motor, by E. P. Hollis	357
Reviews	357
Correspondence—	
Half-Watt Lamp Patents	359
America and Export Trade	359
Deterioration of Red Cable	359
British Association—	
Radiotelegraphic Investigations	359
Gaseous Explosions (*illus.*)	360
Imperial College of Science and Technology	360
War Items	361
Legal	366
Our Legal Query Column	366
Business Notes	367
Notes	371
City Notes	375
Stocks and Shares	376
Electric Tramway and Railway Traffic Returns	376
American Exports of Electrical Goods	377
Large Electrical Smelting Furnaces (*illus.*)	378
Costing, by "Surplus"	381
"Poochees," by C. S. Jeffrey	383
New Patents Applied For, 1914	384
Abstracts of Published Specifications	384
Contractors' Column	Advertisement page xviii

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THE UNIVERSAL ELECTRICAL DIRECTORY

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1914 EDITION

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LOOKING AHEAD.

IT has required nothing less than the most terrible war that Europe has ever witnessed to lead some of our contemporaries, lay and technical, to worry their heads about the extent and character of Germany's foreign trade connections and the need for strong British action in order to deal properly with the menace. Suddenly it has dawned upon the various writers that there is a chance to capture Germany's export trade, and when writers who know everything in general and nothing in particular adopt such a view, they are apt to become obsessed with the idea that this capturing is no sooner said than done, or that, at any rate, it is comparatively easy to wrest from our Teutonic enemies the many millions of pounds' worth of business that they have by their own methods, and with most careful nursing, secured from different markets.

It will be a matter for everlasting regret if we are going to be satisfied with airy utterances from men who are overwhelmed by the sight of figures in millions, and whose only qualification to write on things in general lies in their lack of specialised knowledge. We venture also to suggest that it will be to our discredit if we thoughtlessly imagine that we are going to succeed in capturing German trade by giving vent to feelings of anger and malice. The electrical and engineering manufacturer or trader will be able to deal more effectively with the position by freeing himself both from the excessive optimism of the uninitiated and from the erratic policies of men in haste and anger.

Every man of the "Bull-Dog Breed" has felt his blood boil as he has heard of the barbaric practices which have been adopted by the so-called "cultured" nation in its war upon higher civilisation. It has been staggering all humanity by its onward downhill course of militarism. Our outraged feelings refuse to be silenced, and they justify a demand for vengeance upon the perpetrators; so far, all of us are to be excused if we express in anger our determination to stop at nothing in order to bring about the utter confusion of our adversaries. But we do well to inquire whether in our discussions on capturing trade we are quite maintaining that reputation for coolness and stolidity that our representative, Mr. T. Atkins, is displaying on the field of battle. When we get actually down to the details of the trade war, and proceed with the execution of the very well thought-out plan of campaign that is essential, we shall probably talk less and *do* more. No doubt, talk of the order that we have so far witnessed has formed one of the preliminaries to the adoption of a proper plan of campaign. Perhaps now it will be as well if we set about the very deep thinking and planning and organisation that have to follow before any plan of campaign can be proceeded with, with reasonable hope of either immediate or ultimate successful execution.

First of all we may safely accept it that the present revulsion of feeling against manufactures made in Germany

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will continue in the British Empire and in many other countries long after the sound of cannon has ceased to be heard. Sentiment will, in this case, very largely affect the course of business. This will be a most valuable power inevitably working in our favour as manufacturers for the home market, and as exporters, too. The question of price, instead of being a prime factor, will become a consideration of secondary importance, and will continue so for some time. But there may be lines into which the question of price cannot enter. For some things German that we have depended upon in the past we shall, where possible, substitute other things British. Ultimately, however, it may happen that necessity will influence the direction of orders for specialities, and price will have again to be reckoned with.

Further, scientific achievement is superior to military conquest, for, as has been pointed out again and again, science is international, though scientists individually have to take arms nationally against each other. It is both sad and ludicrous to observe the cordial fraternisation of scientists internationally the while they are as nationalists doing their utmost to invent means whereby they may the more effectually annihilate each other. The pen indeed *is* mightier than the sword! We take it that British electrical engineers and scientists are prepared now, as ever, to give credit to the men and firms of Germany who have produced inventions and made discoveries which have advanced the science and applications of electricity.

In addition to the very helpful influence that British trade must most assuredly receive from the new Home sentiment, and the improved business relations that as far as we can see are bound to follow between ourselves and other countries as the result of comradeship in arms, we are justified in accepting the statement that Germany by her own deliberate attack has, as stated in one of the daily papers, "smashed her own trade to atoms." It may be true that those engaged in the peaceful occupations of commerce and industry were not responsible for the madness of German militarism; but there has long been a suspicion of very close relationship between some leading German industries and the powers in authority, and our own pages have repeatedly borne witness to the fact that in her commercial competitive methods, whether here or in foreign parts, there has been an unscrupulousness and a hitting below the belt which have not much more to commend them than have overhead attacks on defenceless non-combatants or under-water mine-laying for the dispersal of those whom you are not plucky enough to come and fight fairly in the open. The subsidising of Press world-wide agencies and newspapers to sway public opinion in favour of German national policy is only a reminder of some of the deeply-laid Press schemes with which, as revealed in our pages at the time, it was sought by German firms to create opinion favourable to German manufactures and trading schemes.

We published not a great while ago a copy of a letter sent privately by one of the huge German electrical organisations to an electric central-station engineer in China, which showed the inducements that they were willing to offer in order to secure a footing. British engineering and electrical firms will have a very real sympathy with the intentions of our gallant Japanese allies to allow themselves no rest until they have completely extirpated German commercial influence from China. Clearly wherever German commercialism has been displaying itself in the markets abroad, it has been marked with the same overbearing "Will-to-power," over-weening ambition to remove, by hook or by crook, all others from its path. But its present attempt to get all Europe under its heel with its toe ultimately reaching across the broad Atlantic to the States and Canada, will be its own undoing in the Far East as well for many a day.

Yet in our deprecation of all that is so unworthy in German methods we shall be foolish indeed if we pretend that there have not been some very good and commendable reasons why success has practically everywhere attended our enemies' efforts at commercial expansion. We shall do well if we calmly, and as dispassionately as may be in the present atmosphere, analyse the reasons for that success, and take advantage of the advice and criticism that have being so freely offered by our own representatives. We forbear at this moment reiterating all those old and almost musty criticisms—British firms know them only too well. Yet, while in a trading sense, at any rate, our rivals lie *hors de combat*, we ought to rise to the occasion. What steps are we taking to do so? Many firms have, no doubt, been turning over in their own minds whether they can manufacture this or that new line, for which hitherto we have placed too great a dependence on foreign sources. We hope that they will not too easily dismiss such lines as impossible. Of course, much must depend upon the time the war is to last, but whether it end soon or late, the fact remains that disorganised German and Austrian electrical factories, when they try to get to work again, gathering together such parts as remain of their broken staffs, will find themselves in a very different position from that which obtained when the war broke out. We need not labour this point; German industry cannot pull itself together and get into its stride again for many a year to come, and as to German credit and finance, who can predict the position in this connection, and what the effect upon industry may be? We cannot help feeling that fear of an early resumption of German cut-throat electrical competition should not deter from enterprising action any manufacturers who are considering whether they will embark upon new ventures, extend existing departments and open new ones, laying out capital expenditure, and undertaking the manufacture of articles which will be needed by the United Kingdom and the Colonies, by France, by Belgium, by Russia, and by the other great purchasing nations now at war.

A financial daily prints the fears of a Mr. Faintheart, who hesitates to lay out new capital in capturing German trade. He fears to install the necessary machinery, because to compete with Germany he would have to make cheap and inferior goods, would have Germany strongly up against him after the war, because she can manufacture so cheaply, &c., rendering his capital outlay useless. Well, to him who hesitates in this connection the opportunity is lost. We sincerely hope that this attitude will not be assumed by electrical firms, for we are profoundly convinced that in many cases when the position is properly understood the venture will be found worth making.

Let it be remembered that this storming of the citadel of German trade by the guns of German militarism has come at a very important juncture in the electrification of the world. Russia has done little more than scrape the surface

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of her soil, has but touched a thousandth part of her electrical possibilities. Where will she be likely to go after this for electrical requirements? Who said Germany? As has been said of late, perhaps we have so far known less of Russia than of our other Allies, but the last few weeks have led us to wonder whether when that great nation begins to move enterprisingly along electrification roads, the vast Empire will not make a most magnificent market. We merely use Russia here as one instance, among many which could be advanced, to support our suggestion of the timeliness of this German industrial *débâcle*, and how it may be made to redound to the mutual advantage of Britain and her Allies when the final issues on the field and on the sea are decided. In all these recent doings Germany has sown for her own commercial craft mines which she will find it difficult with all her manœuvring diplomacy to catch by trawling.

The moral of the situation, so far as we can deal with it just now, seems to us to be as follows:—There has been enough of general talking, and the time has arrived for British electrical firms and engineers both individually and in co-operation, to resolve to do something, in their own particular sections, to "capture" German electrical trade. We have done our best to put the facts of the position forward in several recent issues, and we have for years past stated the directions where our procedure has shown shortcomings and wherein our rivals have gained advantages. A willingness to take trouble, to adapt ourselves to the buyers' requirements instead of trying to compel him to change *his* ways for *our* benefit, to make cheaper as well as better quality lines in some goods, to organise our foreign service in the most efficient manner possible (a point on which German trade has notably won much success) and a determination to keep ourselves constantly in evidence—these are some of the essentials called for. At the base of all our new operations there lies of necessity the financial need. New capital will be required for industry. Will the banks help us more than they have done? We hear that they are considering the matter, taking different industries in turn. If that be so, we will hope that when the electrical trade position is studied the possibilities will be weighed in detail and that the question of assistance will not be dismissed after a merely general glance at the matter.

Wages or Dividends?

We publish elsewhere in this issue a collection of interesting letters on the subject of German shareholding in British electrical businesses. We commend the views expressed to the serious thought of all our readers, confident that when the matter has been considered in all its bearings, a conclusion will be arrived at favourable to the uninterrupted employment of British workmen and workwomen, adequate safeguards as to profits being adopted by the Government. In the past it has been a grievance that London financiers and investors found the money for German manufacturers to fulfil the Victoria Falls contract. We took the risks—Germany did the work. Now some of our correspondents are protesting against German capital coming into this country to keep manufactories in operation, paying many thousands of pounds in wages every year, perhaps ten or twenty times the amount earned in dividends or interest for those who hold the paper. Sometimes part of the capital involved in these works is even lent by British bankers, and is not German at all.

From the point of view of industrial activity, taking that alone at the moment, we cannot help feeling that some of the evening newspapers, led by certain politicians, have laid themselves open to a charge of excess of zeal, which is calculated to do harm to legitimate British industries. The Government has seen to it that profits shall not go out of the country during the war at any rate. Let us be careful lest, in attacking German capitalists and investors, we do not do untold harm to hundreds of thousands of Englishmen and their dependants. The national or public opinion in this connection is, we think, reflected in the letter from the Chief Constable of Stafford, which we reprint elsewhere to-day.

The New Trade-Mark and Patent Rules.

It was inevitable that upon the outbreak of a European war attention would have to be paid to the Patents and Trade-Marks Acts in so far as they affect the belligerent parties. Many Germans own patents and have registered trade-marks in England, and the question at once arose whether they should continue to enjoy the same rights as in the piping times of peace.

The first of the Patents, Designs and Trade Marks (Temporary) Rules, 1914, provides that the Board may on the application of any person, and subject to such terms and conditions, if any, as they may think fit, order the avoidance or suspension, in whole or in part, of any patent or licence granted to a subject of any State at war with His Majesty, and the Board, before granting any such application, may require to be satisfied on the following heads:—(*a*) That the patentee or licensee is the subject of a State at war with His Majesty; (*b*) That the person applying intends to manufacture, or cause to be manufactured, the patented article, or to carry on, or cause to be carried on, the patented process; (*c*) That it is in the general interests of the country, or of a section of the community, or of a trade, that such article should be manufactured, or such process carried on as aforesaid.

With the principle which underlies both these sets of rules, we have no reason to quarrel. We may be fairly sure that our German enemies have not been slow to take full advantage of all the patents owned by Englishmen in the happy Fatherland. The new patent rule is fairly easy to understand. It practically throws a German patent open to the British public. The effect of the new Trade-mark Rule is not so easy to comprehend. Does it not, in effect, legalise the use of a false trade-mark? Suppose, for instance, a subject of the Kaiser had registered a brand of metallic-filament lamps under the trade-mark "Teufel Lichte." Is it to be open to any subject of the King to make similar lamps and attach this trade-mark to them? If so, it may be that the public will be defrauded. Buying Teufel Lichte in the market, the ordinary purchaser who wants a German article, notwithstanding the war, might be misled. It seems as if we shall have to wait for some decision of the Courts before being able to say with certainty what the new rules really portend.

Copper.

The appearance of the copper statistics for the end of August was quite unexpected, and the figures as issued are manifestly incomplete, owing to the impossibility of ascertaining the position of stocks on the Continent. Meantime, however, the returns were appreciated, though they show hardly any change during the month. The stocks in Havre, Rotterdam, Hamburg, and Bremen, are recorded as nominally unaltered on the month, and the total visible supply in Europe on this basis amounts to 34,806 tons, compared with 33,612 tons at the end of July, and 34,045 tons a year ago. The stocks of standard copper were 16,081 tons, compared with 16,003 tons on July 31st. There was a very notable diminution in the supplies coming forward, which for the entire month only amounted to 26,623 tons, while there was an equally notable diminution in the deliveries, which stood at 25,429 tons. With trading on the Metal Exchange still in a state of suspension, there is practically a deadlock in the standard copper market, but a certain amount of business is being put through from day to day on private terms. The dealings are, however, very restricted, and business is exceedingly difficult, and, indeed, becomes more so. On the other hand, there is more doing in actual copper, refined and so forth, for which demands are

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manifesting themselves—not to any great extent certainly, but in a measure which seems to suggest that a gradual restoration of confidence is occurring amongst the consuming trades. That consumption has been checked by the war goes without saying. It is impossible for tens of thousands of men to be called to the colours without the available working forces in the industrial establishments suffering, and a restriction of consumption in this direction is, therefore, inevitable. On the other hand, there are one or two branches where special activity is to be observed, these being the brass and ammunition works. The former have taken large quantities of copper and spelter for the production of brass for cartridge strip, and the latter are working night and day in the endeavours to provide ample reserves for the destruction of the hordes of barbarians who are murdering non-combatant men and women and children and their own and our wounded, and who call this "war." It is in the destructive ends of the metal trades that the greatest animation is shown to-day, the arts of peace being temporarily relegated into the background. For the former there is no doubt that the present very greatly curtailed output of the world's mines and smelters is amply sufficient. Following upon the war, the United States mines and smelters have reduced their output by fully 50 per cent., and the process is being carried even further by a number of works, many of which have now closed down entirely. This restriction of the supply of copper is bound to have the effect later on of stimulating prices, but for the time being there is all the metal about which is wanted, and the tendency of prices within the last week or two has been towards a lower level. If a seller comes along and wants money for his copper, the sale resulting is made at what looks like being a very cheap figure. On the other hand, when a buyer wants a certain brand, or a certain description of copper which is scarce, he has, when he finds a seller, to pay up smartly for it. Under such conditions it is difficult to say exactly what the market price is, but probably from £58 to £60 for electrolytic covers most brands and specifications.

Repenting at Leisure.

Everybody is wanting to help in these days, and those who have no better way of occupying their time are writing "letters to the editor." Such an opening of the floodgates has there been—everybody's doing it! May good emerge as a result of some of the suggestions, criticisms, and so forth. We sympathise deeply with the editors of daily papers at this time, and in turn we invite our readers to extend their kindly sympathy to us in our own tribulations. No doubt there is much to be said in favour of an occasional outburst as a relief for our over-heated temperaments. Blood-letting was a good old remedy—would that we could apply it just now to some of our friends. It is a mistake to write an angry or unreasonable letter over-night, and hasten out to catch the midnight collection with it. It would be so much better to leave the posting until the morning. The writing of the letter has relieved somewhat, sleep has done the rest, and with the dawn has come repentance. How many are the missives that have been destroyed after further and calmer consideration! We never like rejecting correspondence when it bears on matters of interest to the electrical fraternity, but occasionally it devolves upon us to exercise the maturer thought that we are sure the writer would have exercised himself if he had still the opportunity. Sometimes he does use the opportunity, and after letters are in type we are asked to suppress them. It would be so much more convenient for us if the writer would send us a covering letter asking us to do so.

Associations, too, have occasionally been known to act with undue expedition, and inasmuch as associations are made up of individual members, and many individuals at the present time are affected by the war-like atmosphere so that urgency gets the better of the reasoning faculties, it is not perhaps a matter of surprise that some things are done over-night that might be better done if left until the morning.

THE MORATORIUM—AND AFTER.

[from a legal contributor.]

The lawyer returning from his holidays finds himself confronted with a new and extraordinary situation. Contracts innumerable, the sanctity of which has been instilled into him from his legal cradle, are being broken with impunity—nay, more, they are being broken by virtue of a Royal Proclamation under statutory authority. He reads that debts incurred prior to a certain time may not be enforced until after a certain time. Incidentally, he realises that his business, in so far as it consists of the gentle art of debt collecting, must be suspended for a considerable period.

This state of affairs is puzzling even to the lawyer; and if the legal fraternity find it difficult to comprehend, how much more must the layman fail to grasp its full meaning?

Reading the moratorium proclamation, together with the various amendments which have been made in it quite shortly, it amounts to this that all payments which became due before September 3rd, 1914, or which will become due on any day before October 4th in respect of any contract made before August 4th, shall be deemed to be due and payable on a day one calendar month after the day on which payment originally became due, or on October 4th, whichever is the later date, instead of on the day on which payment originally became due.

For the sake of simplicity, we have omitted references to bills of exchange and cheques.

Payments so postponed shall, if not otherwise carrying interest, and if specific demand is made for payment, and payment is refused, carry interest until payment as from August 4th, 1914, if they become due and payable before that day, and as from the date on which they become due and payable if they become due and payable on or after that day at the Bank of England rate.

Certain payments are excepted from the operation of the moratorium, viz. (1) any payment in respect of wages or salary; (2) any payment in respect of a liability which, when incurred, did not exceed £5 in amount; (3) rates and taxes; (4) any payment in respect of maritime freight; (5) any payment from a person or firm resident outside the British Islands, unless such person or firm has a branch business establishment in the British Islands; (6) any payment in respect of any dividend payable in respect of trustee stocks; (7) any liability of a bank of issue in respect of bank notes issued by that bank; (8) any payment by, or on behalf of, the Government; (9) any payment under the National Insurance Act; (10) any payment under the Workmen's Compensation Act; (11) any payment in respect of the withdrawal of a deposit by a depositor in a trustee savings bank.

Let us see what the effect of this delay in payments is in the commercial world so far as electrical people are concerned. In the first place, it clearly applies to *rent*. Rent due under a lease for any sum over £20 a year cannot be recovered until the moratorium expires. For instance, suppose £10 is due for rent at the Midsummer quarter day under a lease granted before August 4th cannot be claimed until October 30th. Distress, however, might be levied before that time. It is conceived, however, that when the lease was for £20 a year or under, payable by four quarterly instalments, such instalments are not affected by the moratorium. This view is put forward with some hesitation, because when a man takes a lease for years at £20, he incurs a liability *in futuro* for more than £5.

With regard to goods sold and delivered prior to August 4th, the price cannot be recovered until October 4th, if it is more than £5. Where, however, a customer has had a trading account with a firm which allows him credit, and his bill amounts to, say, £49 6s. 8d., made up of different items in respect of goods ordered and delivered on various dates prior to August 4th, it is conceived that while the items over £5 could be sued for and recovered notwithstanding the moratorium, those under that amount could not be recovered. Each purchase must be regarded as a different transaction.

It will be observed that gas and electric lighting charges are not excepted. They cannot be said to come under the

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head of rates and taxes. As such charges in so far as they relate to gas and electricity supplied before August 4th do not become due until October 4th, it is conceived that an authority could not cut off the supply, and by that means enforce payment, until after that date.

It is satisfactory to notice that payments by the Government are exempt.

Assuming that the moratorium be not extended beyond October 4th, writs will presumably appear like leaves in Vallombrosa after that date. Whether a further extension will be necessary no one can say. Other questions, of interest more to the lawyer than the layman, may arise hereafter. Thus, it may have to be decided what effect the moratorium has upon the Statute of Limitations.

THE DECLINE OF THE SELF-SYNCHRONISING MOTOR.

By ERNEST P. HOLLIS, A.M.I.E.E., A.Am.I.E.E., M.Assn.Mining E.E.

The synchronous motor possesses such valuable power-factor characteristics, that for a number of years endeavours have been made to overcome the disadvantages attendant upon the starting process in order to popularise the motor and to permit it to enter the much larger field which is now very much in the hands of the induction motor. Mainly on account of its simple starting characteristics the induction motor has been able to put up a stiff fight, and in consequence the self-synchronising motor has not made material headway. Its sponsors have mainly sought to push it as a substitute for the large low-speed induction motor, taking advantage of the very poor power factor that such induction motors possess.

With the design of the self-synchronising motor and its auxiliary squirrel-cage winding all electrical engineers are conversant, although, perhaps, the endeavours which have been made to design the self-starting synchronous motor with a high starting torque are not so widely appreciated, for it was recognised that the poor starting torque consequent upon the low starting voltage which had to be applied to the self-synchronising motor weighed heavily against it. For this purpose such expedients as magnetic end-rings to the squirrel-cage winding have been resorted to with a fair degree of success, and in the matter of starting torque the self-synchronising motor in some designs stands on an equality with the induction motor. The disadvantage of the inevitable employment of continuous current for excitation has, of course, never been overcome.

With the advent of the phase-advancer, however, the situation has vastly changed, and it is apparent that this device has entirely eliminated all necessity for the use of the self-synchronising motor, since the induction motor plus phase-advancer can do all that is wanted in regard to the improvement of power factor without in any way sacrificing the simple starting characteristics of the induction motor. At the same time, many of the little troubles which arise from time to time with the self-starting synchronous motor, such as breakdowns due to high pressures induced in the field windings at starting, and so forth, are eliminated.

With the exception of supply undertakings, and in large sub-stations, the orthodox synchronous motor has found very little scope for its services, and it cannot be said, reviewing the situation as a whole, that the self-synchronising motor has greatly improved its prospects. The starting of a self-synchronising motor, to say nothing of an ordinary synchronous motor, cannot in any way compare for simplicity with the starting of an induction motor. The phase-advancer does, of course, introduce a few more complications to the connections of the induction motor, but recent designs of phase-advancer switchgear include such perfect mistake-proof characteristics, that it is quite outside the ability of the operator to do any damage, or to insert any of the switches out of their proper sequence. Numbers of installations of induction motors with phase-advancers are now in operation, the starting of the motor being entrusted to non-technical persons, to whom it would be impossible to leave the starting of either an ordinary synchronous or a self-synchronising motor.

The change in the situation wrought by the more general application of the phase-advancer is worthy of consideration, and it would certainly seem that the promising future of the phase-advancer has set the seal upon the fate of the self-synchronising motor.

REVIEWS.

Practical Iron Founding. By Joseph G. Horner, A.M.I.Mech.E. London: Whittaker and Co. Price 5/- net.

Entirely in keeping with its title is this new and enlarged edition of Mr. Horner's work, a book which should be in the hands of all concerned with foundry practice. As compared with the last edition the present, with its 409 pages and 283 illustrations, has almost doubled in bulk, a fact explained by the very rapid progress in iron founding that has taken place in recent years. Particularly noticeable has been the increasing use of electricity in the foundry, a matter that is suitably dealt with by the author, who rightly holds that "electricity is the agent which, in foundries as in other shops, is the most flexible and the most mobile form of power." It enables the cranes to be worked to the best effect now that these are built with separate motors for each motion and for heavy and light loads, rated suitably for the different speeds and loads. Electricity, too, drives the blowers and other machinery used in the foundry, though we have not yet applied it to the moulding machine, many types of which invaluable modern device are fully described by Mr. Horner in his chapters on "The Elements of Machine Moulding" and "Examples of Moulding Machines." Gear-wheel moulding machines receive a chapter all to themselves, for, as the author rightly says, though these machines are now largely used there are still many shops in which they are unknown. They ought, of course, to be universal.

Unless it be that Mr. Horner has, in his endeavour to be strictly "practical," cut down rather severely his account of the raw material of the iron founder and omitted references that might be useful, we cannot suggest how this very useful handbook might further be amplified, for he describes very clearly, and with adequate photographic and diagrammatic illustrations, the caster's art from alpha to omega.

Researches on Irritability of Plants. By Jagadis Chunder Bose. London: Longmans, Green and Co. Price 7s. 6d. net.

The publication in 1902 of the author's first work, "Response in the Living and Non-living," excited very wide scientific interest, appealing as it did alike to the physicist and the physiologist. He there proved with great experimental skill and ingenuity that electrical excitation in plants, and also in inorganic substances, notably slightly warmed magnetic oxide of iron reduced to powder, and in a less degree, other metallic powders, gave rise to response curves, obtained by taking the galvanometer deflections as ordinates, and the times of exposure, or recovery, as abscissæ, closely resembling those obtained from animal nerves and muscles subjected to mechanical strain. The molecular strain excited in the powders by radiation replaced the mechanical strain in the animal fibres, and further researches in

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the author's works on *Plant Response*, and on *Comparative Electro-Physiology*, showed that in the case of both plant and animal tissues, the substitution of electrical methods of exciting strain for mechanical ones provided the physiologist with far more delicate methods of investigation, without changing the character of the phenomena. The similarity extended even to the modification brought about by the administration of stimulants and poisons. Plants and metallic powders, as well as animal tissues, could be excited or depressed, as shown by the variations in electric response, by the administration of drugs, and in each case a limiting critical condition could be produced corresponding to the death of the animal tissue. But the metal could be restored to its state of sensitiveness by purely molecular processes—*e.g.*, by heating to a sufficient temperature and again reducing to powder—but the living protoplasm, once killed, could be restored to sensitiveness only by absorption into living substance, by giving it as food to a living animal or plant.

In the researches described in this, the author's latest work, the methods of excitation are of the same character as employed before. In order to measure the amounts of excitation with the utmost attainable accuracy, the mechanical shocks and changes of temperature, as well as the direct electrical excitation, are all effected and measured by electrical methods, and the ingenuity shown in the design of the recording instruments, and the delicacy and accuracy of their indications, are in themselves such as to make them worth the close attention of every maker of delicate electrical recorders. The observed responses, however, although electrically recorded, are, for the most part, primarily mechanical, for the volume is devoted to the investigation of the movements, in response to excitation, of the leaves and leaflets of various types of what are known as *sensitive plants*—plants possessing very delicate mechanisms, which respond, by mechanical movements, to the various types of excitation.

A large part of the volume is occupied with the mass of experimental evidence tending to establish the conclusions that excitations are transmitted along the fibrovascular system of stalks and petioles (leaf stalks), not, as has hitherto been supposed, as mere hydromechanical impulses, but as true protoplasmic excitations, the fibrovascular system of the plant coresponding to the nerve system of the animal, from which it differs, not in kind, but only in degree. Our limits of space prevent the discussion of this evidence, for the correspondence is shown by similarity in the most minute details of an exceedingly complex system of closely inter-related phenomena. There appears, indeed, to be hardly any phenomenon of irritability observed in the animal which is not also found in the plant, and all the manifestations of irritability in the plant have been shown to be identical with those in the animal. This, as the author points out, should lead to many difficult points in animal physiology finding their solution in the experimental study of the corresponding problems under the simpler conditions of vegetable life. One fact may be mentioned which would in itself make the hydromechanical hypothesis highly improbable—mechanical motions have been shown to be excited in the leaflets of a sensitive plant by a current as low as 0.5 microampere, considerably less than can be detected by the most sensitive human tongue, and less than a tenth of what can be perceived through the tongue of the average person.

A very interesting phenomenon is what the author calls the death-spasm of a plant. If the temperature of a Mimosa leaf be raised gradually, there is a steady increase in the erection of the leaf until the temperature reaches a point in the neighbourhood of 60° C., when a spasmodic fall occurs, and after this no further response can be obtained to excitation. The tissue is dead. G. W. de T.

Electric Car Maintenance. By Walter Jackson. London: Hill Publishing Co., Ltd. Price 12/6 net.

This book is a selection of articles and paragraphs from the columns of the *Electric Railway Journal*, of New York, with some additions of braking and wiring diagrams, designed to serve as a kind of "Enquire Within upon Everything" for the repair and maintenance staffs of electric railway rolling stock. "Railway" must be understood in its American sense of street or interurban tramway, with a small admixture of third-rail lines. The articles have been sorted into thirteen chapters, and instruction prints and tables, mostly wiring diagrams, put into the last and fourteenth chapter.

For the greater part the articles are descriptions of methods, tools, and processes adopted in the repair shops and sheds of various railways in the United States, generously communicated to the Journal by their devisers for the benefit of their fellows in like circumstances. It is difficult to review a book of this character and origin, because, naturally enough, the devices described and recommended are of varying merit, and there is no internal evidence, in most cases, as to the success achieved by their adoption. The task of editing such a collection cannot have been light, and perhaps the success of the editor could only fairly be gauged by inspecting the rejected material.

In quite a number of cases there are several different ways described for doing the same thing—for example, the relining of bearings. A man coming new to the particular job and seeking guidance from the chapter in question would rise from its perusal without much help towards a choice. Curiously enough, a method much in use in this country, and one which has proved alike economical, speedy and efficient under widely varying circumstances, has not found its way into this chapter, viz., to dispense with bearing shells, casting the bearing on a mandril in a chill, solid. The resulting casting needs no machining, and the whole process of melting out and tinning shells is saved.

Whilst the collection of workshop dodges and methods is of somewhat mixed merit, they all bear on their face the suggestion that they are in use, and that they get over some difficulty. In a great many cases the difficulties surmounted are those due to inadequately equipped workshops; special tools and appliances for certain jobs not being forthcoming, ingenuity has utilised the things on hand, sometimes visiting the scrap heap to good purpose. The engineer who has to keep things going in foreign and other out of the way places will sympathise and may pick up many wrinkles from this book. A British criticism on it is that to a very large extent the dodges described are to do certain things to a particular (American) motor, controller, or other piece of apparatus, and are not directly applicable to British-made material. Nevertheless, they are frequently suggestive, and there is no lack of dimensioned figures illustrating the descriptions.

There is a good deal, in one way or another, about slotting commutators, a practice now very general in the States, but not so common here, though not unknown, and piecing together various bits of information, one gets a general notion of the *raison d'être* of the practice. Perhaps a good half of it is expressed in the experience of Mr. F. J. Foote, of the Ohio Electric Railway:—"Very little trouble will be experienced with flat (? flatted) commutators if a brush can be found that is just hard enough to keep the mica even with the copper. . . . This condition, however, will be very difficult to secure and maintain in all cases. . . . In regard to the kind of brushes used, we have never found any brush quite equal to the French brushes, although American brushes nearly as good are now on the market."

The articles on brush and brush-holder setting,

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adjustment, and maintenance are among the best in the collection, and are worthy of attention in every car shed, in spite of their special adaptation to American plant.

The collection of wiring diagrams in chapter XIV is very comprehensive, clear, and useful to the persons for whom it is intended and who are handling American equipment. It is the kind of thing every manufacturer of electrical car equipment should prepare and issue to his customers; some do it, some do not. Both will find something suggestive in those now mentioned. Mr. C. W. Squier's "circuit diagrams," showing the circuit through all apparatus for each controller notch, for a considerable number of equipments, can be warmly commended for imitation.

The book is quite a valuable one for men in charge of tramway rolling stock. If they have American equipments they will be able to apply the various dodges directly; if not, their own ingenuity will be much aided by these examples. Electric car maintenance touches so many trades that except in the largest systems it is impracticable to have all the best tools and appliances for every job. Such an equipment would in fact be that of a car and electrical equipment manufacturer. So that, especially in out of the way places, lots of things have to be done without the proper tools. Brains and ingenuity and "what we've got" have to take their place, and the examples from men "who have been there," will often be valuable in suggestion.

The table of contents gives the titles of each separate paragraph in each chapter, making it easy to find a particular note, and there is in addition a subject index. The book is well printed and bound, as one expects from the Hill Company, and the figures in general are self-explanatory and well produced.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Half-Watt Lamp Patents.

We shall be very much obliged if you can give us some information regarding the position of patents covering half-watt lamps.

From revelations recently made, not only are the patents of squirted filament lamps owned in Germany, but the greater part of the capital of one of the most important firms manufacturing these lamps is held in Germany, and we are wondering whether this state of affairs exists in connection with half-watt lamps. We should be very much obliged for any information you can give us on the subject.

The Electrical Engineering & Equipment Co., Ltd.

London, W.C., *September 4th*, 1914.

[We believe the principal patents covering the "half-watt" lamp in this country are owned by the British Thomson-Houston Co., Ltd., whose lamp-works are the subject of an article elsewhere in this issue.—Eds. Elec. Rev.]

America and Export Trade.

The letter signed "Innocens" in your current issue appears to me to be a most inappropriate and almost childish outpouring. As your correspondent seems unaware of the fact, let me inform him that at least 95 per cent. of the Americans in business are business men—not sloppy sentimentalists, and although they will not fill the needs of the abandoned German overseas trade this year, they will immediately set about adjusting the 1915 output, and will be up and at it. Moreover, they will easily secure about 85 per cent. of the acceptable business, leaving the long credit jobs in the East, Near East and possibly Russia. To anyone who has travelled a good deal on account of sales and business generally, it will be apparent that delivery of British goods is always unreliable and erratic, while literature and publicity is generally unsuitable, and often conveys nothing to countries like South and Central America. This, to my mind, is indescribably regrettable, as British goods are nearly always superior to foreign or American, with the exception, perhaps, of machine shop tools. The present, however, is not a time to be sentimental, but to face hard facts, one of these being that if British manufacturers are going to capture even 15 per cent. of Germany's late overseas trade, they will have to get busy on the job right now. Don't go and call meetings at home of people who know nothing about the business, but start on the present connection, however small, on the enemy's abandoned pitch abroad, and remember that while one of the two business nations of the world is temporarily out of the field, you are going to be right up against the only remaining one.

If you publish this letter, may I ask that no firm that has the enlarging of its export business seriously in mind should get offended at it? At the same time, however, I would impress it upon your readers that to ask, or even half-suggest, that America should wait until British firms should start even with them in respect to export trade, is a plea of a mental weakling, and although they would hardly take it that way, is an insulting conception of American business ability and intelligence.

Arthur Mallord Turner.

Wimbledon, S.W., *September 7th*, 1914.

Deterioration of Red Cable.

Referring to this subject mentioned in your issue of May 22nd, just to hand, I, for some 16 years, was with the Electric Sign Co., of London, and found out (using both red and black cable in the wiring of the signs) that the red cable was by far the best cable to use, both for cleaning ends and drawing into conduit, but the life was much shorter, as in some of the work taken down after five years the black cable was as good as when put in, but the red was bad, the braiding being loose and the rubber cracked and hard; for this reason I refused to use any red cable in any of the signs for six years before leaving England. I have had some hundred miles of small cable through my hands, and have found the same results out here, whether exposed or enclosed in conduit; it is something that cable manufacturers should look to.

W. Gibbs.

Barcaldine, Queensland, *July 24th*, 1914.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. AUSTRALIA, 1914.—III.

Radiotelegraphic Investigations.

Abstract of Interim Report of the Committee: Sir Oliver Lodge (*Chairman*), Dr. W. H. Eccles (*Secretary*).

Section A.

The past year was occupied mainly by the designing, printing, and distribution of books of forms for recording observations, by the enrolment of observers, and by the preliminary work in connection with the observations to be made during the solar eclipse.

For the collection of ordinary daily statistics, the Committee obtained the cordial support of many Government Departments of the British Empire and of other countries.

The following companies are taking a prominent part in the collection of statistics: The Marconi International Marine Communication Co., Ltd., have already twenty-three ships at work; the Marconi Co. of Canada have thirteen stations at work on the East Coast of Canada, in Newfoundland and on the Great Lakes; the American Marconi Co. have put fifteen land stations (between Alaska and the Gulf of Mexico) to work, and several ships; the Federal Wireless Telegraph Co. of America have started observations at their San Francisco station; the Gesellschaft für drahtlose Telegraphie will put a considerable number of stations to work as soon as forms have been translated. At the Slough station the Anglo-French Wireless Co. started observations which will be continued by the Galletti Co.; while the English Marconi Co. are doing the like at Chelmsford. The Société Russe de Telegraphes et Téléphones sans Fil have agreed that the forms, when translated, shall be used at a number of the stations under the control of the company in Russia.

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There are also a number of professors in the British Isles and in the Colonies helping, and about sixty-one amateurs.

As a member of the British Section of the International Commission the Secretary was made a delegate to the recent conference in Brussels, and there suggested that it might be to the advantage of both organisations, especially when requesting assistance from Government Departments or companies, or even private experimenters, that a public announcement should be made showing that the aims of the two bodies were different, and that there was room for both. The International Commission therefore passed a resolution to that effect, and at a meeting of the British Association Committee on May 8th, 1914, a resolution was adopted stating that the Radiotelegraphic Investigation Committee of the British Association was in full accord with the definitions, as expressed in the resolution, of the differences between the aims and methods of research promoted by the two organisations.

Gaseous Explosions.

Abstract of Seventh Report of the Committee: Dr. Dugald Clerk (*Chairman*), Professor Dalby (*Secretary*).

Section G.

The report is devoted partly to the special consideration of temperature measurements and subjects arising therefrom, and partly to the illustration of the use which can be made of the data obtained by the committee.

One of the problems requiring solution was the direct measurement of the temperature of the working agent in the gas-engine cylinder while the engine was running under ordinary working conditions. The difficulty of making this measurement rises from the fact that during the explosion of the charge in the engine cylinder the temperature is sometimes higher than that of the melting-point of platinum or of the couples which can be put in the cylinder to make the measurement.

A method devised by Professors Callendar and Dalby for the first time enabled direct observation of the suction temperature to be made while the engine was working not only under normal conditions but under special conditions, during which the richest possible mixture was used and the temperature reached at explosion was considerably higher than that occurring in practice. The thermometer itself consisted of a piece of platinum wire about 0.7 inch long and 1/1,000th of an inch in diameter, arranged with compensating leads. It is placed in a thermometer-valve which is inserted through the spindle of the admission valve.

During the explosion period the valve is closed, and the thermometer screened from the action of the gas. When the platinum thermometer is exposed in the cylinder and connected to the Wheatstone bridge and galvanometer on which the indications are received, the circuit is made by a contact-maker on the crank-shaft when the crank passes through an assigned crank-angle, and is broken by the contact-maker when the crank passes through a second assigned crank-angle a little greater than the first, so that the electrical measuring device is in operation during 5°, 10°, or 15° as the case may be.

The contact-maker (fig. 1) consists of a brass bush B, keyed to a lay shaft of the engine, and carrying two fibre washers

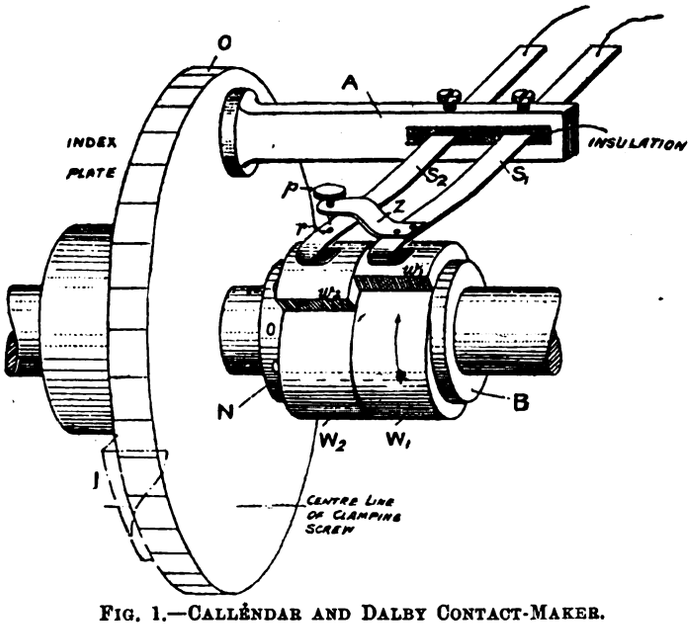

Fig. 1.—Callendar and Dalby Contact-Maker.

or cams W_1 and W_2, which can be clamped in any relative angular position against the flange of the bush by the nut N. A radial step, as w_1, is made in each washer, and the surface gradually rises from the bottom of the step to the normal circular surface of the washer. The reflexed ends of the stiff springs S_1 and S_2 rest on the fibre cams. A projection Z carrying a platinum-pointed screw p is riveted to one of the springs, and the screw p is adjusted so that its point is just clear of the platinum rivet r in the other spring when both springs are riding on the circular surfaces of their respective cams. Contact is made when the rotation of the lay shaft in the direction of the arrow brings the radial step w_1 of the cam W_1 under the spring S_1, thereby allowing it to fall down the step, thus bringing p and r together. Contact is broken when the radial step w_2 of the cam W_2 reaches the spring S_2, thereby allowing the second spring to fall down the step w_2. The epoch and duration of contact are readily adjusted by adjusting the angular positions of the cams relatively to the bush and also with regard to one another. The distances between the springs and the platinum contacts and the steps w are exaggerated in the diagram in order to make the principle of the apparatus clear. The percussion form of contact with platinum points is found to give definite and certain results. The contacts keep clean, and no trouble of any kind is experienced with them. The brushes are carried by an insulated arm A bolted to a divided disc O riding loosely on the lay shaft of the engine, and capable of being clamped in any position by a screw. The index I shows the crank-angle corresponding to the contact.

The temperature is measured, therefore, during a particular crank-angle determined by the setting of the contact-maker. This can be set, while the engine is running, to determine the make and break at any assigned crank-angle in the revolution. It was usually set so that the interval between the make and break was 5° or 10°. In this manner the mean temperature over a small crank-angle can be measured at any point in the cycle, except only during the period of the explosions when the thermometer is withdrawn from the cylinder.

Having found the temperature at one point in the cycle, the temperature at any other point can be calculated by using the charge itself as the thermometric agent. The characteristic equation of the charge is PV/T = a constant. If, therefore, from the indicator diagram taken at the time the temperature was measured, the corresponding pressure and volume are measured, then the temperature at any other point of the cycle can be calculated by the aid of this constant and the pressure and volume scaled from the indicator diagram, allowance being made for chemical contraction of the charge after explosion. It is necessary to have accurate indicator diagrams from which to measure the pressure and volume for this purpose, and this has led to the development of an optical indicator.

The second method of measuring the temperature of the charge in the cylinder is by means of a couple. This method has been developed by Dr. Coker and Mr. Scoble at the Technical College, Finsbury. It was found that alloys of platinum with rhodium and iridium respectively were able to withstand the temperature of explosion near the walls of the cylinder for some hours or even days when made into thermo-couples 5/10,000 to 8/10,000 of an inch thick, provided the engine was not overloaded. The actual temperature measurement is made by observing the change in the electromotive force produced in this couple by a change in temperature. The small changes in the electromotive force produced by a couple of this kind can be measured with great accuracy.

Dalby and Callendar's experiments have shown that when using rich mixtures the maximum temperature in the cylinder is probably about 2000° C., and these results have been confirmed by Coker and Scoble. For the mixtures used in ordinary working conditions the experiments of Dalby, Callendar, Coker, and Scoble show that the temperature is about 1800° C. It is hoped to continue the experiments on temperature measurements when engines of more modern construction have been installed in the new engine laboratory of the City and Guilds (Engineering) College.

The concentration of research on the accurate measurement of temperature is a necessary step towards a more certain knowledge of the specific heat of gases at high temperatures, a subject of vital importance.

Imperial College of Science and Technology.

The Goldsmiths' Company's extension of the City and Guilds (Engineering) College was dealt with in a paper read by Professor W. E. Dalby, F.R.S. After outlining the history of the Imperial College of Science and Technology, the author stated that at the end of 1909 he was instructed to prepare a scheme for the internal arrangements of the proposed engineering extension. Subsequently, he prepared a scheme for a large hydraulic laboratory, and then for a laboratory for structural engineering, motive power engineering and strength of materials, as well as for a laboratory for railway engineering.

These plans were approved by the governing body in 1910. Sir Aston Webb, R.A., was the architect for the whole of the extension, and building was commenced in the spring of 1911. The cost of the complete engineering extension, namely, £87,000, will be defrayed by the sum which the Goldsmiths' Company has generously allocated for the purpose. In addition to this Mr. Hawksley has promised the sum of £4,000 towards the equipment and endowment of the hydraulic laboratory. An additional sum of £30,000 is required in order that the laboratories may be suitably equipped with apparatus and machinery.

The object of the present paper is to describe the general arrangement of the laboratories and the principles on which they have been designed.

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The equipment of the motive power laboratory will include a plant of internal-combustion engines arranged specially for experimental purposes, a steam turbine plant, and several independent steam engines, as well as various testing machines. The laboratory has been designed especially with regard to flexibility and to adaptability to the changing conditions of engineering practice. The floor of the laboratory may be regarded as a test bed about 17,628 sq. ft. in area.

The railway laboratory is 106 ft. long and 30 ft. wide, and the total floor area is about 3,200 sq. ft. It is provided with a wind flume, constructed as a closed circuit with a motor-driven turbine fan, so that it is possible to produce a current of air of 60 miles an hour. It is proposed to equip this laboratory with apparatus and models specially suitable for the practical work of the post-graduate course of instruction in railway engineering.

The main object kept carefully in view in the design of the hydraulic laboratory was to give every facility for the study of problems connected with the supply and distribution of water, as well as problems in connection with hydraulic machinery, turbines, and reciprocating pumps. The total length of the laboratory is 166 ft., the width is about 48 ft., and the total area is about 8,000 sq. ft.

About seven years ago the author designed an electrically-driven and controlled turbine and pump plant for laboratory purposes, with the object of bringing together various considerations regarding the transformation of energy and of enabling measurements in connection with the performance of the plant to be obtained with accuracy. The pump and turbine were designed by Escher, Wyss & Co., of Zurich. The electrical equipment was supplied by the Lancashire Dynamo and Motor Co. With this plant it is possible to make all the measurements required to give an accurate knowledge of the performance of the pump and the turbine over the widest possible range of action.

It is not proposed to encourage any considerable increase in the number of undergraduates, but to devote the resources of the college chiefly to the development of courses of instruction of an advanced nature, and to the provision of every facility for research.

The first of such advanced courses at the City and Guilds (Engineering) College is the course in railway engineering which was initiated by the author in 1908. The instruction includes lectures on electric traction and railway electrification. The principal feature of the course is that the lecturers are, in general, engineers of eminence engaged in practice. Students are not admitted unless they have suitable qualifications, such as the Diploma of the City and Guilds (Engineering) College, the degree of B.Sc. in Engineering of the University of London, or a Whitworth Scholarship. Pending the completion of the engineering extension the course is limited to ten students.

Subsequently the author also initiated a post-graduate course in structural engineering to give advanced instruction in constructional work generally. This course is now under the direction of Professor Dixon.

There is also a post-graduate course on electrical machinery and transformers, under the supervision of Professor Mather, F.R.S., which deals with electro-magnetic machinery, rotary converters, the design, manufacture and testing of transformers and the organisation of electrical manufactories. There is also a series of advanced lectures on wireless telegraphy.

There has been no difficulty in obtaining the number of students that, owing to the restricted accommodation, it has hitherto been possible to admit to these courses; and it may be mentioned that, on leaving college, many of the men have obtained important positions for which they have been specially qualified by their post-graduate work.

Great developments are now taking place: the scope of the advanced courses is being largely extended; new departments are being created and additional professors and their staffs appointed; and the Imperial College of Science and Technology will shortly be able to offer every facility for post-graduate study and research to students from all the colleges and universities of Great and Greater Britain.

WAR ITEMS.

What Constitutes a British Firm?—The Chief Constable of Staffordshire intervened last week in the discussion respecting Messrs. Siemens Bros. in the interests of the inhabitants of Stafford. The following is a copy of his letter to the *Morning Post*:—

"Sir,—The letter from Mr. Joynson-Hicks which you published on Wednesday may have a most mischievous effect here and elsewhere. I do not love the Germans a bit better than does Mr. Joynson-Hicks. But, if I had to burn down a German's house, I should at least take the precaution of making sure that it was not full of English women and children.

"At the present time, something between 15 and 20 per cent. of the population of this, the county town of Staffordshire, are directly or indirectly dependent on wages earned at Messrs. Siemens's works here. Out of the total number of their employés there are now less than 20 Germans, of whom most have been for many years in the employment of the firm in this country, while some of them are absolutely essential to the continuance of work in the shops where they are employed. A small number out of those who were employed here are now fighting against this country. I am glad to feel that these will not come back. The works at the present time are entirely under English management, and, therefore, the question of employment of Germans now scarcely enters into the matter at all. I know nothing as to where the profits go to; all I know is that good English money is being paid over by thousands every week for the support of residents here, and if Mr. Joynson-Hicks's suggestion were adopted, and orders refused to Messrs. Siemens on the ground that they are alien enemies, there would come untold misery and distress to a very large number in this town.

"If the President of the Board of Trade likes to accept Mr. Joynson-Hicks's peremptory mandate to take over the management of Messrs. Siemens's works, it will cause no joy here; rather, I am afraid, the contrary, as a Receiver would hardly be able to pay out the very liberal allowance which Messrs. Siemens already some time ago undertook to give to those who went away to the war, and the total amount of which is already equal to the payment of £5,000 per annum. Mr. Joynson-Hicks has been quite misinformed in so far as his statement as to such payments may be taken to apply to the works here.

"By all means, if there is any reasonable and lawful ground for annexing Messrs. Siemens's cash and employing it as a contribution towards the expenses of the war into which we have been so unjustly forced, let us have the money. But that is a matter which comes a long time after the welfare of our own people; while Mr. Joynson-Hicks's perfervid patriotism, unless checked, may bring desolation to this town.—Yours, &c.,

"G. A. Anson,

"Chief Constable of Staffordshire.

"Stafford, *September 4th.*"

Mr. F. B. Sinclair, manager of the Electric Street Lighting Apparatus Co., 11, Victoria Street, Westminster, S.W., writes as follows:—"As an individual I hasten to put on record my protest against the disgusting exhibition of outrageous & unbalanced prejudice as is displayed in Mr. Campbell Swinton's letter & equally against yourself in descending to the uttermost depths of the yellow press in consenting to publish it. One can scarce permit oneself to contemplate the frightful atrocities which would attend the triumphal progress of an army toward Berlin if commanded by one so possessed.

"Is it conceivable that he can now meet his fellow-member of the Institute, Sir (*sic*) Alexander Siemens, without deliberately spitting in his face, for that, in effect, is what he is (*sic*) done through the connivance of yourself."

[We are glad that, as Mr. Sinclair points out in his first words, he is an individual; if he were a multitude we should seek safety in flight, for, judging by his ruthless slaughter of the King's English, he seems to be capable of blood-curdling atrocities to which the "disgusting exhibition" of Mr. Campbell Swinton would be but as the muted murmurings of a maiden's prayer.—Eds. Elec. Rev.]

Among other letters received on this subject, is one from Mr. E. J. Williams, resident engineer and manager of the North of Scotland Electric Light and Power Co., Ltd., in which he says: "If it true that 90 per cent. of the capital (in Siemens's) is German, that should be enough for any Britisher. All that Siemens have done during the past 50 years for the electrical trade in this country has been done for dividends—what else? We are all hoping that the hands now employed by such firms will soon be wanted by British concerns."

"Electrical Contractor" writes:—"As it is quite certain that there will be a number of electrical contractors throughout the country who will pledge themselves never to purchase anything of German or Austrian manufacture again, it would be as well in the interests of genuine English firms, if a list of these firms could be prepared. It is, of course, particularly well known that there are numerous firms masquerading under English names, whose capital is supplied from foreign sources, and some of them make a point of carrying on works both large and small for the purpose of masking their chief trade which is that of Continental manufacture. Through long association we have got to think of firms as thoroughly English, but when the matter is looked into closely in a time like this, we find that their capital is supplied from abroad, and the profits are returned to foreigners. Therefore, all such companies as these cannot by any stretch of imagination be called British. One particular case, for example, is that of Messrs. Siemens Bros., but there are numerous others, and it should be, in the interests of the country at large, that no contractors should purchase any articles at all of either German or Austrian make. I, for my part, will certainly pledge myself that so long as I remain in the trade nothing that is manufactured by either of these two countries shall knowingly come into my place.

"Tohill" writes:—"Mr. A. A. Campbell Swinton's letter regarding the Siemens companies in Great Britain is highly instructive, but if he will make a few further inquiries some additional interesting facts might be brought to light.

"In the first place, I believe it is not disputed that whilst the shares of Siemens Bros. Dynamo Works, Ltd., are nominally owned by Siemens Bros. & Co., Ltd., they are really the property of Siemens-Schuckertwerke. In the second place, when Siemens and Halske acquired the business of Siemens Bros. & Co., Ltd., some years ago, probably the effect of this deal on Government departments was considered, as the Woolwich company has always had a good customer in the Government. What more natural, therefore, than to add a British director to the board and to take other steps with the object stated. For instance, I should not be at all surprised if the three directors in England were (as regards a

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large part of their share-holdings) merely nominees, and also, if the annual dividend declared since the absorption (4 per cent. regularly) were guaranteed by Siemens & Halske in order to make it appear to the Government that Siemens Bros. & Co., Ltd., were standing, so to speak, on their own legs.

"The financial arrangements of the British and German Siemens companies seem complicated, but I believe it is a fact that virtually, and with the exception of a few small blocks of shares held by English employés, Siemens & Halske are the owners and masters of the whole situation."

We have also received the following letters on this matter :—

In his letter published in your issue of the 4th inst., Mr. A. A. Campbell-Swinton used language none too strong in describing German methods of diplomacy and warfare. No language, indeed, could adequately express our abhorrence of, and indignation at, such immoral and barbarous proceedings.

But I have been a little dubious as to the ultimate result of this boycotting campaign which is being so energetically prosecuted by the Press. This is a stone which may easily rebound in more than one direction. If we are to boycott every firm in which German capital is employed, it seems to me that we may easily do more harm to ourselves than to the Germans. We may, for example, prevent a few of the enemy getting dividends on their capital by throwing a few thousand British workmen out of employment. I should think that means could be devised by which we could make use of any German capital invested in this country without benefiting the German capitalist, as his dividends, if not his capital, might be confiscated by the British Government. If an enemy's ship lying in a British port can be confiscated in war time, why cannot enemy's capital be confiscated in British works, in which case the Government would become part-owner of those works which are now partly under German control?

Another difficulty which presents itself to me is that a British works may be associated in some way with German interests without this being known to the public.

For instance, it is currently reported, with what amount of truth I do not know, that the A.E.G., of Berlin, are transferring some of their British orders to the B.T.H. Co., who are connected with the G.E. Co., of New York, who in turn are allied with the A.E.G. In giving orders to the B.T.H., or any other company, we may, therefore, be dealing indirectly with the enemy—who knows?

Where are we to draw the line?

F. Broadbent.

London, E.C., *September 7th*, 1914.

I have read with much interest the letter from my friend, Mr. A. A. Campbell Swinton, which appears in your current issue, and am much struck with the fact which he has elicited that 60 per cent. of the shares of Messrs. Siemens Bros. & Co., Ltd., are held in Berlin. I note that, being at war with Germany, Mr. Campbell Swinton urges that no patriotic Englishman should give an order to this firm.

I think I may claim that my feelings of horror and loathing at the conduct of the Germans in having provoked this war, and having conducted it in so barbaric a manner, are as strong as those of Mr. Campbell Swinton, but after perusing his letter, I am wondering whether the advice which is given by him is sound.

Capitalists who invest money in a foreign country are, of course, subject to the risk of that capital, or the profits arising therefrom, being confiscated in the case of a war, but what Great Britain has to consider is what should be its policy in view of the future?

We are not at the present time occupied in winding-up the assets of the British Empire, and we Britishers are all confident that when this ghastly war is completed, the affairs of our Nation will go on as usual. It behoves us then to reflect that the material prosperity of this country has in the past been greatly enhanced by the advantages which it has presented to foreigners for the conduct within our borders of industrial concerns.

In this case, the founders of the firm of Siemens Bros. threw in their lot in England. They did so, doubtless, in the view that their talents and business ability would be best rewarded here, and accordingly this great concern has developed, entirely as it appears from Mr. Campbell Swinton's figures, by the aid of capital drawn from Germany.

In the past we have deemed it a matter of great national congratulation that the conditions of labour in this country and our general legislation should attract foreigners to invest their capital in the establishment of works giving employment to a large number of our countrymen.

Suppose Mr. Campbell Swinton's suggestion is carried out and no further orders are given to Siemens Bros., what will result? At a time when it is of the highest importance that unemployment should be avoided, the works at Stafford and Woolwich will be closed and a dislocation in the labour market caused. Possibly it may be said that the men thrown out of employment at Stafford and Woolwich will be able to obtain employment in the works of "all British" firms, to whom the orders are diverted; but such a transference of labour must take time; especially as it is probable that other electrical factories would not be in a position for a considerable period to make the necessary arrangements to execute the transferred orders.

The homes of the men at the present time are in Stafford and in Woolwich, and the natural clinging to home will cause a very slow removal of the workmen from one centre to the other, and in these times it is certainly desirable that the *status quo* should be preserved as much as possible.

Again, it is highly probable that during the 50 years' operations of the particular firm in question, certain requirements of the Government have been standardised by them, and such standard articles could not be made by other works for many months until they had designed and erected special tools. Such a delay at this juncture would be most undesirable in the national interest.

It would appear, however, that the object to be secured by the drastic action recommended by Mr. Campbell Swinton is to prevent profits going out of the country to aliens. Surely this can be better attained by directing that such profits shall be paid to the Public Trustee, or by the Government commandeering the works, and, possibly, handing back to the shareholders, alien and otherwise, at the end of the war, the £600,000 capital, or such amount of the same that may be intact.

Looking at the matter from the broadest point of view, I would urge that no action should be taken which, in future years, would interfere with the free flow of foreign capital to this country. Hasty action taken under the present terribly trying circumstances would have a very serious effect upon the England of the future.

I see one good result that may arise from the publication by Mr. Campbell Swinton of his striking figures. It may raise the question whether it would not be advisable to promote legislation under which no foreigners should be permitted to hold, indirectly or directly, more than 49 per cent. of capital in any English industrial company carrying on an industry of vital necessity to the State.

Robert Hammond.

London, S.W., *September 7th*, 1914.

The energy with which the Press campaign is being prosecuted to capture German trade must invoke the admiration of the whole of the commercial community, and will, without doubt, have the desired effect of rousing all trades to immediate action. There are, however, certain phases in the proposals of the daily Press which, I venture to suggest, are unsound and not in the best interests of this country.

The commercial community are urged to make war on German trade; quite proper, and, in the present circumstances, most necessary, but I am afraid that the Press confuse the issue as to what is, and what is not, German trade.

As I understand matters, the objectionable part of German trade is represented by imports. A certain section of the Press include in German trade industries established under the English flag and whose capital is partly or wholly in German hands. It has even been suggested that such firms should not be allowed to continue business during the period of the war, and notices have been sent out by a certain organisation in the electrical trade warning people not to do business with them.

Great Britain has always been a great manufacturing country, and her prosperity is largely due to the fact that she has been opposed to race prejudice and kept her doors open to foreign brains and foreign capital. It must therefore be to the country's advantage to continue this policy, and any tendency towards exclusion would be a retrograde step.

A few years ago, when a large amount of capital left England for foreign countries, there was a great outcry. We now find the Press advocating the driving out of this country of money which has helped to develop England's trade.

For what purpose was the Patents Act of 1907 designed? Surely to give better protection to British industries, and to attract foreign capital permanently into Great Britain? That this Act gave a great impetus to British industry cannot be denied.

How often have we heard about competition from Germany, complaints by the thousand against manufactured goods being dumped into England below cost? Yet, when German capital does find its way over here to be permanently invested in manufacturing industries, thus placing the British manufacturers on a level footing to compete, we find sane men advocating that the British industries with German capital should not only be boycotted, but should not be allowed to continue trading during the period of the war.

There are tens of thousands of workpeople employed in England, in companies in which German capital is invested. If the suggestions of the Press are carried into effect, it must inevitably result in a large amount of unemployment and consequent great suffering.

A glance at the register of British railway companies will reveal large holdings by the Germans. Is any embargo to be placed upon them? Does the Press intend to urge the Government to stop them from trading?

I instance the case of my company. It was established by me some 15 years ago as a branch of a German concern. Partly on account of the Patents Act of 1907, and in order to place the business on a sounder footing, an English company was formed in 1909 for the purpose of establishing a works in this country and to further develop the industry. Payment for the German company's assets was made in shares only, so that no money went back to Germany. Freehold land and buildings were secured, and nothing but English and American machinery was installed, and at the time war broke out some 400 English people were employed. We have never at any time employed more than three or four foreigners, all of whom have been in subordinate positions.

I can, with all modesty, claim that my company has been largely instrumental in popularising the telephone industry, and has proved itself a worthy addition to Great Britain's industries, and though it is true that a large number of the shares are held in Germany, this, in itself, should not militate against the welfare of England or interfere with the progress of my company's business.

It is hardly necessary for me to point out that, being an Englishman, as are all those who work under me, my sentiments are entirely British, and I refuse to believe that our Government, which is essentially a business Government, would lend itself to

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anything so insane as to interfere with the development of established British Industrials, even though they have been built up with the assistance of German capital. On the other hand, the publicity which has been given to the subject of war on German trade, and the strenuous efforts which are being made to boycott firms similarly constituted to my company, are calculated to do such damage that the Government should make its policy publicly known without delay.

THE STERLING TELEPHONE & ELECTRIC CO., LTD.,
GUY BURNEY, *Managing Director.*

London, W., *September 8th*, 1914.

The letter from Mr. Campbell Swinton in your last issue will be read by his friends with much regret, and I hope that you may be able to find room for at least one protest.

It would appear that it is not your correspondent of August 28th, but Mr. Swinton himself who has no sense of proportion, a deficiency which prompts him to combine great issues with small, to suggest the punishment of the innocent for the crimes of the guilty, and, unhappily, leads him to refer to individuals in a manner which, if not actually cruel is, at least, lacking in the generosity which we should confidently expect him to exercise if he allowed his reason to operate instead of being overborne by his feelings.

This may not be the time, as he says, to discuss the merits of the Siemens family, but it is certainly not the time to hint or suggest without a particle of evidence a lack of loyalty on the part of men whose public work and business dealing during a residence amongst us of almost a lifetime have shown them to be high-minded citizens and honourable men, whose judgment on excesses would be as severe as ours, and whose sorrow must, perforce, be greater.

As suggested by your first correspondent, there is no doubt that the effect of following Mr. Campbell Swinton's patriotic suggestion would involve a considerable sacrifice by some of our compatriots. You cannot interfere with a long-established industrial community without an infinitely greater loss to that community than would be inflicted upon the German shareholders. Of course we can and must make sacrifices in a just cause. The ethics of the matter are perhaps more involved than the economics, and I will not touch upon them now. But the case presented by Mr. Swinton is frankly prejudice. Prejudice is blind, and generally hits a friend with the shaft intended for a foe. Prejudice is also deaf, and so argument becomes useless.

It, however, may be asked, does not the proclamation provide for the retention of the Berliners' dividends, if any? And have not the authorities the necessary powers to prevent any other advantage accruing to the enemy which the continuance of work might give?

If, as your first correspondent rather suggested, this question has been raised as a part of a commercial campaign then, is it too much to hope that the chivalry which actuates our fighting forces shall not be absent from the commercial arena? If, amid all the excitement of a naval engagement, the gallant men of our glorious Navy can think more of rescuing the enemy's wounded than of their own safety, is it unreasonable to expect that we who sit at home at ease should carry out a commercial campaign with some regard to courtesy?

But I return to the personal question. I do not know any of the German shareholders, but I do know the "two Germans who are only English by naturalisation." The one I have met in public work, as Mr. Campbell Swinton has also. If there is any man of whom it might be said that he would prefer not to hurt a fly, it would be Alexander Siemens. The other I have met on business affairs. In my experience no "scrap of paper" was ever necessary to bind the word of G. von Chauvin, and never was there less of a Chauvinist than he.

It is because I know these men, that I resent so strongly Mr. Campbell Swinton mixing up the atrocities of a nation with the names of individuals, and pointing out as a patriotic duty, what, I fear, might turn out to be rank injustice. The proceeding seems to me to be entirely un-English. Hence my protest.

J. E. KINGSBURY.

7, Serjeants' Inn, Temple, E.C.
September 8th, 1914.

In your issue of September 4th, I notice a letter by one "X," attacking Messrs. Siemens.

Though we all, I hope, agree that an arrangement should be made to prevent the dividends resulting from British-placed orders going to an alien enemy, yet, on reading through the "X" letter, one cannot fail to notice a narrow-minded prejudice prevailing, which is to be greatly regretted and which is not in accordance with "fair play."

"X's" opening statement is that 90 per cent. of Siemens's capital is in Germany. In looking through their list of shares, I find that 70,782 shares out of 120,000 are German held, or 59 per cent., not 90 per cent.

The number of German employés has never, I am told on excellent authority, exceeded 10 per cent., and is usually about 2 per cent., and this is more than many so-called British firms can say.

It is disgusting, moreover, to think that any Englishman will stoop to an unfair and despicable interpretation of gifts made by the Siemens family, and that 20 or more years ago.

Again, in "X's" interpretation of this he is wrong. Sir (*sic*) Alexander Siemens did not present King's College Laboratory, it was Sir William; further, if the gift was made in such a spirit one cannot believe that the Governors would accept it if it would be detrimental to English prosperity or people.

Many of your correspondents and evening newspapers are so keen on finding and damaging the Germans in this country (at no risk to themselves), that they would willingly ruin hundreds of Englishmen to do so. 90 to 98 per cent. of Siemens's employés are Englishmen, and many, if not all, of these would be financially ruined if this firm were boycotted for the sake of the German-owned shares.

Certainly confiscate the profits accruing to Germans and apply them either to the country's needs or Siemens's English employés, but never boycott the firm and ruin our own people.

Many people and firms who have given large sums of money to relief funds, &c., and had their names very prominent in the Press, have, at the same time, cut down the salaries of their ill-paid staffs or dismissed them to meet this expenditure; such actions are to be strongly deprecated (and I know of five large manufacturing firms who have done this), and yet they call themselves patriots. Some have made use of this ruse to give competitive prices to obtain orders. These are the people to be boycotted.

I am sure that all true Englishmen can still see fair play, though, like myself, they can sign themselves

A COMPETITOR OF SIEMENS.

September 7th, 1914.

"Common Sense" writes:—"Whilst heartily agreeing with the war on German trade, is it not carrying things rather far to extend this war to German investments in England? As a nation, we have immense sums of money invested abroad, and, therefore, on principle, we cannot quarrel with German investments here, especially when they are employed in manufacturing, and, therefore, have the effect of curtailing the importation of manufactured articles from Germany. The success of an industry (especially a comparatively new industry) depends upon the capital which it is able to attract. The British public have never given any real support to the electrical trade, and, backward as we are, our position would have been a thousand times worse had it not been for the financial support and enterprise of the foreigner.

"Take the large electrical manufacturing concerns in this country, and you would find a very small proportion who have not in some stage of their history had to largely depend upon foreign support, either in the shape of capital or credit.

"Doubtless there are many manufacturing concerns in England to-day who are supported partly by German capital, which they would only be too pleased to replace with British money if the British capitalist would come forward and divert into his own pockets this pipe-line of gold in the form of dividends which, according to the daily Press, has been flowing to Germany.

"The Patents Act of 1907 was a direct discouragement to the importation of patented articles manufactured in Germany, and a direct encouragement to the employment of German capital in Great Britain, with the result that many articles which were previously imported are now being manufactured in British factories by British labour. Putting all party feeling on one side, the effect of this has been distinctly good, and if we are now going to turn round and drive foreign capital out, we are simply cutting off our nose to spite our face."

"Britisher" writes:—"I am in substantial agreement with the views put forward in Mr. Sydney S. Galsworthy's letter printed in your issue of September 4th. I note that you suggest that the B.E.A.M.A. should take up the task of classification. The B.E.A.M.A. certainly should be able to get first-hand information, but I should say it is very doubtful that they would do anything, as any publication such as Mr. Galsworthy suggests would bring out into the limelight facts which some of the most prominent members of the B.E.A.M.A. would rather the public did not know.

"The average man in the street would be astounded to learn how much German capital and control—either by alien or naturalised Germans—there is in our principal electrical manufacturing companies. Where German is not the predominant influence, one can say it is only substituted by American influence and capital.

"And this brings me to Mr. Campbell Swinton's remarks. While we agree with many of Mr. Swinton's remarks, and the spirit which prompts them, many of us who know Siemens and their staff can hardly go so far as he does. One cannot forget the many excellent Englishmen on their staff, and the very excellent example they set to the large electrical firms—some of whom are benefiting by the attack on Siemens—by the generous way they have treated their staff and workpeople who have gone to the front, or been called up in Territorial forces.

"In my early days of electrical engineering, Siemens were looked upon as one of the aristocrats of the industry, and certainly English influence, if not money, was predominant. There is little doubt, however, that in late years a strong German influence has been manifest, and large portions of the orders they have obtained have been manufactured in Berlin.

"But if Mr. Campbell Swinton is consistent, why should Siemens be his one special victim? Why does he not examine the list of shareholders of the British Thomson-Houston Co., Ltd., and the General Electric Co., Ltd. Anyone in the electrical manufacturing circles in this country can tell him there are very large German interests in these companies, and the major part of their control is in the hands of Germans—in the B.T.H. case American interests are also largely involved—though a great number of these are naturalised. Still they have German interests.

"In addition to the firms so far mentioned, there is, of course, a very large company which was originally entirely financed by American capital, and must be still influenced to some extent by American capital and brains—I refer, of course, to the British Westinghouse Co. Still, America is our friend and not a hostile nation, and that counts for a lot.

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"My plea is that every encouragement should be given to the medium-sized all-British electrical manufacturing firms who have bravely kept their end up against the fierce competition initiated by the large manufacturing firms mentioned, bolstered up by the immense amount of German and American capital introduced into these large firms.

"Now is time of reward for such firms as Dick, Kerr & Co., the Lancashire Dynamo and Motor Co., Mather & Platt, E.C.C., Bruce Peebles & Co., J. H. Holmes, Brush Co., Ferranti, and other smaller firms whom one cannot detail off-hand. These are the firms to encourage. They are British, and it must be also obvious to the clear-sighted buyer that it is greatly to his advantage that such firms should be encouraged and not crushed out by the very large concerns."

"A Compleat Englishman."—"Englishman" writes:—"Adverting to the letter from Justus Eck, Esq., in your 'Correspondence' column of last week's Review, it seems to me that his main object is to dissociate himself from most things German and to prove he is a true-born Englishman. On the face of it he has creditably succeeded, but I think he has overlooked the fact, or, perhaps, not had time to state that he is, or was until the present war broke out, also managing director of the English branch of Messrs. Voigt & Haeffner, Frankfort (now known as the Switchgear Construction, Ltd.). As he has gratuitously given us full details of the Union Electric Co., perhaps it is not too much to hope he will also furnish us with similar details of his connection with this 'Birmingham' firm. It is only at times like the present that we really know how many patriotic Englishmen we have amongst us, when all with financial interests at stake are ready and willing to publish a guaranteed correct list of their antecedents from the year 1."

In your issue of September 4th, Mr. Justus Eck makes a pathetic appeal to us on behalf of the Union Electric Co., Ltd. After making some interesting autobiographical statements, he tells us that "every employé of the Union Electric Co., Ltd., during the 14 years of its existence, has been, and is, a British-born subject, and the same applies to the majority of the board of directors." So the majority of directors of the company have been, during the past 14 years, British-born subjects; and are so now. Reference to the return filed at Somerset House shows the following changes in the board:—

Directors up to 1912:—Henri Garbe, of Aachen, Germany; Max Koerting, of Leipzig, Germany; Max Muller, of Aachen, Germany.

In 1912, upon the death of Mr. Max Muller, Mr. G. A. Knapton, of Clapham, joined the board, and in July, 1914, Mr. E. Marshall, of Chiswick, and Mr. H. E. Moul, of Herne Hill, were added to the board; presumably to strengthen it in view of the impending crisis, but it should be noted that they hold no shares in the company.

Now let us see in whose interest this British company is carried on. Here is the latest return of shareholders:—

Shareholders at July, 1914.

O. Baerwinkel, of Munich	1	share
H. Garbe, of Aachen...	1	"
Max Koerting, of Leipzig	1	"
Exors. of Max Muller, of Aachen	1	"
Victoria Garbe, of Aachen	1	"
Frances Eck, of Chiswick	1	"
L. Reincke, of London	166	"
Sarah Bolling, of Copenhagen	167	"
Justus Eck, of Chiswick	502	"
Koerting & Mathieson, of Leipzig	7,804	"
Deutsche Electrische Werke, of Aachen ...	15,605	"
	24,250	shares

With these figures before us are we to believe that the company is run in the interest of the British shareholders, who hold 669 shares against 23,414 held in Germany? And those three apparently British-born directors who don't hold any shares: What has Mr. Eck to tell us about them?

There is more than one way of explaining how essentially British we are. Mr. Eck has chosen one; a German baker in Islington chose another when, a few days after the declaration of war, he wrote across the front of his premises—

"This is an Engelische Shopp."

Doubtless your readers will prefer the method of the Islington baker. It has the merit of simplicity, and hides nothing.

Chiswick, *September 8th*, 1914. Sydney Evershed.

Mr. Evershed, in one of your contemporaries to-day,* accuses me of telling a lie by concealing facts in a letter similar to one from me, which was published in your last week's issue.

Mr. Evershed admits that the majority of the existing board are British. I never stated that they had always been so, the standard directories, manuals, and Board of Trade Register having given the particulars yearly.

Mr. Evershed gives false dates and then assumes that certain acts were done "in view of the impending crisis."

He gives the number of shares held correctly, but does not state that all the British-held ones are fully paid and the German-held are not; this makes a difference of £10,000.

The British directors were elected by the British shareholders to protect their interests, and are gentlemen well-known and respected in the electrical industry. Justus Eck.

London, S.E., *September 9th*, 1914.

* Mr. Evershed's letter referred to was also received by us, and appears above.

British Coil-Winding Business.—We have received the following letter:—"It has come to our knowledge that a certain competitor of ours in the winding business—a German—being now unable himself to make deliveries of German-made coils to his customers, has been spreading a report here, that as the Varley Magnet Co., Ltd., is dependent upon Germany for the supply of raw material, this company is also unable to deliver its manufactured goods.

"This statement is absolutely false, for we use British raw materials in our manufactures, and as we believe the report to be widely spread, we trust you may be able to publish this refutation.

"It is unfortunate for our German rival that whilst his business should be stopped, our own is now being carried on uninterruptedly, and is largely enhanced by a bulk of work which before the war came direct to this country from Germany. The Varley Magnet Co., Ltd., in their new factory equipped with the most modern winding plant, are in a position to carry out any orders entrusted to them, and particularly will they energetically handle work which has previously been manufactured outside this country. We are determined that this extra business which we are now experiencing, and which we hope to further experience, shall lead to a permanent increase in the employment of British labour, capital and materials, and we hope that manufacturers of other electrical specialities may be able to report similarly.

"As the coil-winding business in the past has largely been associated with German connections, may we, in conclusion, say that this company, without exception, is English—in capital, directors, managers, clerks and workpeople.

"The Varley Magnet Co., Ltd.,
"Charles Oliver, *Director*."

British Bulbs for Electric Lamps.—It is often stated, quite erroneously, that all glass lamp bulbs are imported from the Continent. There is no fear, however, of any stoppage in the lamp-making trade for want of bulbs. The Lemington Glass Works, Newcastle-on-Tyne, which were acquired by the General Electric Co., Ltd., 10 years ago, in order to make certain of an independent British supply of bulbs, have been gradually extended from two to six glass houses, employing 250 workpeople, and the G.E. Co. is willing to meet the needs of all lamp-makers who find difficulty in obtaining bulbs.

London Transport Companies.—Of the 30,000 men employed by the London Electric Railways and the omnibus and tramway companies associated with them, 4,000 have gone to serve their country, and others are still going. The companies have agreed to keep their places open, and have made an arrangement with the remaining employés to look after the families of the absentees. All the employés are contributing to a fund every week, and the companies are adding to it the same amount as the men.

Tramwaymen Enlisting.—About 80 employés of the Birmingham Tramway Department enlisted in the 88th Battalion Royal Warwickshire Regiment last week, bringing the battalion up to full war strength. About 200 tramwaymen also offered themselves, but could not be enrolled.

Board of Trade and Inquiries.—The Board points out to British manufacturers and merchants, who wish to obtain information in regard to trade matters in the Colonies or foreign countries, that it is desirable that applications should first be made to the Commercial Intelligence Branch, 73, Basinghall Street, London, E.C., before communications are addressed to the Board of Trade Correspondents or to H.M. Consular Officers abroad. By the adoption of this course, much delay will be avoided by the inquirer in cases in which the Commercial Intelligence Branch is already in possession of the required information. Communications addressed to the Board of Trade Correspondents or to H.M. Consular Officers should be sent direct and not through the Commercial Intelligence Branch. Catalogues, price lists, &c, should also be forwarded direct.

Institute of Commerce.—In order to deal effectively with German and Austrian trade and other matters affecting British trade, an Institute of Commerce is being formed, with temporary offices at Exhibition Building, Aldwych Site, Strand, W.C. The objects of the Institute are to place authoritative trade opinion in closer contact with the Government, and to enable all trade sections to assist one another in obtaining valuable foreign contracts and to take such combined action (financially or otherwise) as may be considered necessary for the purpose.

One of the departments will deal with the electrical industry, while another will consist of a representative committee of bankers to handle the question of commercial credits in conjunction with the Council of the Institute. Manufacturing firms interested in the proposal should communicate with Mr. J. Taylor Peddie, at the above address.

Relief Funds.—At a meeting of the employés of Messrs. Alfred Graham & Co, St. Andrew's Works, Crofton Park, S.E., it was decided to institute a local war fund, and periodically to contribute therefrom to the National Relief and other funds. The staff and employés have unanimously agreed to contribute 2½ per cent. of all salaries and wages paid, and the firm are including a substantial subscription. A number of employés have joined the colours, the firm granting allowances to dependants.

A Splendid Record.—No fewer than 900 members of the staff and various works of the British Thomson-Houston Co., Ltd., have joined the Colours, or more than 50 per cent. of the eligible male adult employés. It is the company's intention to pay half wages to those of its employés who have enlisted, and to reinstate them in their former positions on the cessation of hostilities. In those positions where fresh help has to be employed to keep the works

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going, no male candidates will be considered who are not over 35 years of age, or who cannot give proof that they are medically unfit to enlist. Reserve and Territorial Officers on the staff of the company have rejoined their respective units in the Navy, Lancashire Fusiliers, and the King's Horse, and it is noteworthy that one of the officers, not being able to obtain his former commission, has volunteered as a gunner in a Howitzer Battery.

Lord Kitchener has sent a letter, through Major-General Rawlinson, to the managing director, expressing his appreciation of the company's attitude.

NOT PAYING AT PRESENT.—We have received the following letter:—

We received this morning a statement from Messrs. H. Traun and Sons, London Agency, asking for payment. We enclose you copy of our reply to them in case you should consider it of interest to your readers.

Faithfully yours,
NALDER BROS. & THOMPSON, LTD.,
FRAS. H. NALDER, *Managing Director*.

[COPY.]

Messrs. H. Traun & Sons, London Agency,
25, Goswell Road, London, E.C.
September 8th, 1914.

Dear Sirs,—We beg to acknowledge receipt of your statement for goods supplied asking for payment. As you are alien enemies, we have no intention of paying you until after the war, excepting that you can satisfy our Courts that you should be paid now.

Faithfully yours,
NALDER BROS. & THOMPSON, LTD.

BRITISH DRILLS.—The Light Electric Motor Co., Ltd., of Seven Kings, Essex, ask us to state that the portable electric drilling machines supplied by them are of British manufacture throughout, being made at their works at Seven Kings.

PAYMENT FOR PUBLIC CONTRACTS.—The *Times* states that representations have been made to the Government Committee on the prevention and relief of distress that business would be facilitated if payments in respect of works under contract could be made at shorter intervals than has been customary. The Committee state that the War Office are willing to make interim payments fortnightly instead of monthly; the Admiralty have arranged for weekly payments; and the Office of Works for fortnightly or weekly payments when desired. The Post Office and the Office of Works have decided to expedite the payment of all accounts.

SHIFT WORKMEN!—Of the many extraordinary ideas which this war has conjured up in the brains of, at other times, presumably sensible people, the following extract from a letter addressed by Mr. J. M. Henderson, M.P., to the *Times* of September 2nd, is hard to beat. In speaking of German firms and companies conducting business in this country, he remarks:—"It is said that to put a stop to their trading would cause unemployment in this country. That, however, is not so. The goods they make can be, and are, made by other firms, and the workmen would merely shift to those who got the order for the goods."

Does Mr. Henderson express this pious opinion as an M.P., as a member of the B.E.A.M.A. Council, or as a director of an electrical engineering company, and, in any case, does he really believe it? Is it not a fact that some of the firms have reduced salaries and wages to their existing employés, and are quite unable to offer vacancies for either new staff or new workpeople? We commend the letter of the Chief Constable of Stafford to Mr. Henderson's serious consideration.

EDINBURGH.—The first of the public departments to contribute to the War Fund was the Corporation electricity department, who voluntarily agreed to contribute weekly till the close of the war amounts varying from 1 to 2 per cent. of their wages.

BLACKPOOL.—Some 70 of the season staff have sent a petition to Blackpool tramways manager (Mr. C. Furness) asking to be allowed to pay to the War Fund the same sum weekly as those whose living is assured. The season men are to be employed as long as ever it is possible.

ALL-BRITISH EXHIBITION.—What will happen by March, 1916? We may rest assured that the Germans will not then be in London, for the International Trade Exhibitions, Ltd., of Broad Street House, New Broad Street, E.C., announce that in connection with the war on German and Austrian trade they are organising for March-April of that year a "London Fair and Market," to be held at the Royal Agricultural Hall, London. The exhibition will be exclusively for manufacturers and wholesale houses, and every entering exhibitor will be required to sign a declaration, under a penalty, that no goods exhibited are of German or Austrian manufacture. The whole of the proceeds of the gate, and from the sale of tickets to trade houses, will be given to one of the existing Public Funds for the benefit of the dependants of the soldiers and sailors who fall in the war.

COMPETITION WITH GERMAN AND AUSTRIAN TRADE.—The Commercial Intelligence Branch of the Board of Trade, at 73, Basinghall Street, E.C., are desirous of hearing from firms who are prepared to send to them samples or catalogues of German and Austrian or Hungarian goods which have competed with British products at home or abroad. The Board of Trade propose to hold an exhibition of samples of this nature, and would welcome the co-operation of British manufacturers and traders.

Another of the Board of Trade's series of publications gives very full information respecting our enemies' exports of machine tools and some notes on the position in the different markets of the world for the use of firms interested in this branch of engineering industry. Yet another deals similarly with printing and lithographic machines. Pumps and pumping machinery are covered in a third pamphlet; and others received just as we go to press deal with tubes, pipes and fittings of iron and steel, and anchors, grapnels and chains.

In the machine tool pamphlet the following comparative figures of British and German exports of such manufactures are given:—

Country to which exported.	Exported from Germany, 1913.	Exported from United Kingdom, 1913.
United Kingdom	£236,850	—
Canada	52,650	£24,800
Australia	21,700	115,800
Norway...	57,600	6,600
Sweden...	83,950	10,400
Denmark	49,200	3,800
Netherlands	154,150	17,900
France	554,050	142,100
Switzerland	207,800	3,200
Spain	74,850	20,600
Portugal	15,950	6,500
Italy	408,350	68,500
Bulgaria	18,850	—
Greece	4,450	1,200
Roumania	63,800	800
Russia	595,550	85,000
Turkey	27,600	3,300
Dutch East Indies	23,100	3,400
Japan	51,950	118,100
Brazil	153,850	57,700
Uruguay	19,050	2,700
Argentina	114,300	30,600
Chile	23,250	17,100
United States	59,250	4,400
	£3,072,100	£744,500

"AS USUAL."—Mr. Harry Moss, of Bradford, reports that in spite of the war he is doing good business. During the last few days he has received orders for a turbo-alternator for mill lighting; several orders for considerable extensions to various installations at mills, hotels, factories, &c., and above the average in supplies. His hands are working full time, and are contributing to the Lord Mayor's Local War Fund.

MANCHESTER TRAMWAYMEN.—Mr. McElroy, general manager, reported, at a recent meeting of the Manchester Tramway Committee, that 369 employés in that department who were Reservists or Territorials had been called up for service.

NEVER BY CHOICE.—Mr. E. Stanley Fardon, electrical engineer, 67, Mosley Street, Manchester, has issued a notice to the effect that the tenth anniversary of the establishment of his business occurs next month, and that he is prepared to make rewards of £500 to anyone who can prove that he has ever used cables or wires other than British made in installation work, or sold lamps other than British made, unless specially requested to do so.

THE MINERVA BATTALION.—No fewer than 40 of Messrs. Pinchin Johnson's employés have left their work to serve the country. Some are Reservists who have rejoined the colours, some have volunteered for foreign service with the Regular Army, whilst others have entered the Territorial ranks for home defence. The firm are keeping every position open for the men when they return, and whilst away all those who are married receive half-pay.

E.P.S. AND THE WAR.—The Electrical Power Storage Co., Ltd., has posted up the following enlistment notice:—"The company has decided to pay the following allowances to the dependants of men who have left its service to enlist for the present war, or who have been called up as Reservists:—(1) To wives with children under 14 years of age—half pay. (2) To wives without children—10s. per week. (3) To the dependants of unmarried men—an allowance to be settled according to the circumstances of each case. The above allowances will be paid whilst the men are on active service, and all particulars of such dependants are to be given to the works superintendent.—MANAGER."

LANCASHIRE DYNAMO WORKS.—A large number of men employed by the Lancashire Dynamo and Motor Co., Ltd., of Trafford Park, have joined the colours, and the firm has decided to pay 5s. per week to the wives of the married men, and 1s. 3d. per week for each child, with a maximum of 10s. per week per family. Dependants of unmarried employés will also receive a weekly grant. The situations of all men who volunteer for service will be kept open for them. The staff and workpeople have agreed to a deduction of 2½ per cent. from their salaries or wages for the National Relief Fund.

NO "PLACE IN THE SUN" COMPANY FOR GERMAN GOODS.—The Sun Electrical Co., Ltd., writes as follows:—"In view of the fact that a large numbers of the firms engaged in our particular business are either German, or dealing almost exclusively in German goods, we would like to draw your attention to the fact that this company has, since its formation, been entirely run by English capital, with an English board of directors, under English management, and with a British staff. Right from the commencement, no foreigner has ever held any position whatsoever in the company. Furthermore, the whole of our specialties, without exception, have been exclusively British throughout, and so have the greater proportion of our factored goods." The writers enclose with their letter a list of all articles included in their various sectional catalogues, showing that the proportion of foreign goods has always been small, as it has also been the policy of the company to deal with British firms wherever possible. The firm add: "We would like to add that, in the future, this policy will be materially extended to exclude everything of German manufacture."

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Messrs. Booth Bros., Ltd., electrical engineers, of Rodley, Leeds, have decided to make a weekly allowance of 5s. for the wives and 2s. for each child dependent upon men in the firm's employ who have enlisted.

The employés at the Dewsbury Corporation electricity works have been assured that if any of them volunteer for service in the Army, they will have their places kept open, and provision will be made for their dependants.

Ten per cent. of the employés of the Yorkshire Electric Power Co. have offered their services to the country. As a result of this patriotic response by the men, the company is short-handed for the time being. A special staff war fund has been opened to which each remaining member of the staff is making a weekly contribution, the proceeds being devoted to assisting the dependants of the employés who are on active service. If there is any surplus it will be devoted to other funds.

Contributions to the Manchester fund announced on Saturday included the following from the electrical trades:—Messrs. Chas. Macintosh & Co., Ltd., £49 13s. 9d.; ditto (employés), £49 13s. 9d.; employés of Electromotors, Ltd. (first weekly contribution), £4 14s. 6d.; employés of Mr. Bertram Thomas, £3 13s. 1d.; employés of Messrs. Drake & Gorham, £3 11s. 11d.

The employés of the Tudor Accumulator Co., Ltd., Dukinfield Hall, are contributing 2½ per cent. of their gross earnings to the distress fund

The employés of the Doncaster Corporation Electricity Works, including the staff of the tramways departments, have held a meeting and resolved to give 4d. in the £ of their salaries and wages to the Mayor of Doncaster's War Relief Fund.

Laurence, Scott at the Front.—About 100 of the employés of Messrs. Laurence, Scott & Co., Ltd., manufacturing electrical engineers, of Norwich, have joined the Army, and the firm have agreed to reinstate them at the end of the war. Allowances will be made to all dependants, and in the case of married men from 6s. 6d. to 11s. 6d. per week will be paid, according to the number of children.

Sixty-four of the employés of the Hackney Borough Council volunteered to give up four hours each day for the special duty of guarding the Council's electricity station. They have been enrolled as special constables and are now engaged in guarding the Council's property.

It is stated that the full staff of the electricity department of the Marylebone Borough Council, numbering 200, have been sworn in as special constables.

Carels Freres. — The *Financial Times* has investigated a rumour that has lately been current, to the effect that the engineering works in Belgium of Carels Frères were either wholly or partially destroyed during the recent fighting. It finds, however, that, according to advices mailed from Ghent on 31st ult. all was well. The works had been closed down to manufacturing operations, and the upper portion was being used as a Red Cross establishment. Ghent, where the Carels establishment is situated, is a good way removed from the fighting area, and, moreover, the Germans have undertaken not to molest the town.

British Westinghouse Staff War Relief Fund.—The amount subscribed by the staff to the above fund has amounted up to date to £937, and it is anticipated that further amounts to be received will raise the total to over £1,000. Out of the amount already subscribed the Committee have decided to make the following donations:—National Relief Fund, £350; Stretford Civic Guild of Help, £100; British Red Cross Society, £200; Belgian Relief Fund, £200; total, £850; the distribution of the balance to be considered at a later date. The contribution made by the staff is entirely separate and distinct from the amounts which the company have already given or which they are contributing week by week to the Relief Committee. The total number of staff concerned is about 1,200. In addition to these contributions, it is the desire of the employés of the company generally to form a further fund by weekly contributions on a graduated scale, and a meeting is to be held on Monday next to consider a suitable basis. The total number of men who have gone to to the front from the company's works and offices up to date is 700.

Engineers' Club Battalion.—We learn from Mr. Hill, the hon. secretary of the Engineers' Club at Manchester, that at an extraordinary general meeting of the club members held on Tuesday, it was decided to form a "Pals" battalion for Kitchener's Army, such battalion to be recruited from those engaged in the works and offices of engineering concerns. A Special Committee was appointed, consisting of Messrs. Daniel Adamson, H. T. Wilkinson, J. H. Stubbs, E. Simon, S. L Pearce, G. Hughes, W. T. Anderson, E. T. Morland Johnson, E. L. Hill, and Colonel Hollingworth. Every member of the club is asked to induce his friends, staff, and employés to join, and to send their names as quickly as possible to me at the club. The particulars that should be given are:—Name in full, age, address, married or single, if married, number of children under 16 years of age, occupation, name of employer, previous training, if any, in the Forces of the Crown.

Hans Renold, Ltd.—Mr. Hans Renold, who was detained at his birthplace in Switzerland in the early days of the war, recently addressed meetings of his workpeople and urged the younger men to volunteer, but pointed out that others could also serve their country by keeping business going and contributing to the support of the dependants of those who were fighting. The firm has adopted a scheme under which married men receiving 50s. a week or less will be paid full wages for a month, and half-pay till the end of the war; if a man is killed the same allowance will be continued to his dependants until the end of the war or until they obtain a pension. Places will be kept open for the men. Those in receipt of more than 50s. a week will receive individual consideration. A very large proportion of the employés have joined the colours; and the firm is working full time.

Lessening Unemployment.—We notice your remarks in last week's Electrical Review, and wish to state that we are quite in sympathy with your remarks *re* the dismissal of men and the reduction of wages by firms who have largely contributed to the "Prince of Wales's" Fund.

Our firm, under the management of M. K. Cooper, A.M.I.E.E., instead of dismissing, have, since the war was declared, employed 20 extra men, and are still open to engage good wiremen. No wages have been reduced, and our people are contributing weekly to the "Prince of Wales's" Fund; last week our contribution amounted to £4 4s.

It might also be worth mentioning that on the day war was proclaimed we cancelled orders to the extent of £3,000 with German firms, and these orders have now all been placed with British firms. We are, therefore, in the happy position of feeling that, by employing as many men as we can, we are doing something to lessen unemployment amongst our own people.

T. C. Smith & Co.

M. K. Cooper,

Manager for Electrical Department.

Aberdeen, *September 7th*, 1914.

LEGAL.

Factory Act Prosecution.

At the Sunderland Borough Police Court on Friday, the North-Eastern Marine Engineering Co., Ltd., South Dock, Sunderland, were charged with an infringement of the Factory and Workshops Act, by having on their premises a switch not so constructed as to prevent danger.

Mr. W. B. Lauder, H.M. Inspector of Factories, in preferring the charge, said the defendant company had neglected to observe Regulation 3A of the Electrical Regulations instituted by the Home Secretary under Sec. 79 of the Factory and Workshops Act, 1901—a regulation which provided that every switch should be so protected as to prevent danger. In this case the switch concerned was quite open and without a covering of any description. On July 21st a young man named Peter Cornforth was killed in consequence. According to the evidence given at the inquest, Cornforth went to switch on the current in order to work a pneumatic hammer. His hand slipped and came in contact with the live terminals, and he received a fatal shock of 240 volts. Three other people had received shocks from the same switch. The maximum penalty for the offence with which the company were charged was a fine of £100.

Mr. D. B. Jackson, from the office of Messrs. Cooper & Goodger, Newcastle, solicitors, pleaded guilty on behalf of the defendants, but submitted at the same time that it was not a very serious case, although, unfortunately, there had been a serious termination. The switch had been in use nine or ten years, and no one had been injured prior to the fatality. If shocks had been sustained by other people the occurrences had not been reported. It never occurred to the firm that there was any danger, and the Factory Inspectors had never drawn attention to the danger. After the accident a new switch with proper covering was immediately installed.

The magistrates imposed a fine of £50 and costs.

OUR LEGAL QUERY COLUMN.

"Inquirer" writes:—"As you are aware, we are subscribers to your paper, and thought, therefore, you might be able to enlighten us upon the two following points:—

"(1) *Tenancy Agreement.*—Is a tenancy agreement between an English landlord and an alien tenant of a nation with whom England is now at war void, or can the landlord enforce the conditions and payment for the full term just the same as if there were no war?

"(2) *Employment Agreement.*—Is an agreement between a naturalised British employer resident in an enemy's country and a British employé resident in England valid, or is it cancelled by the war? If so, must notice of cancellation be given to the employé?"

*** As to (1), it is clear that the agreement still holds good. The rule that an Englishman may not contract with an alien enemy only holds good with reference to a contract with a person resident in the hostile belligerent country. As to (2), the fact that the employer is admittedly a British subject appears to make the agreement perfectly valid. A difficulty would appear to arise when an attempt is made to enforce the agreement.

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BUSINESS NOTES.

Consular Notes.—CHILE.—The American Consul at Valparaiso reports that during last year work progressed on the extension to the hydro-electric plant in connection with the Broden Copper Co., near Rancangua, and plans have been under consideration to develop the water power of the Aconcagua River, above Valparaiso, for the use of the cities in the valley as well as for Valparaiso, where the current is now generated by steam, with coal selling at 25s. to 33s. per ton. The current is sold in Valparaiso for lighting purposes at 7d. per KW.-hour. The country is full of fine water-power sites that await capital to turn the waste power into electric current for distribution to the cities and towns, where are located small plants now run by steam power with coal costing 37s. 6d. to 50s. per ton. It is generally understood that this would be a paying investment from the start, and would be much more profitable when the demands for electric power became greater.

During 1913 the chain of seven wireless stations along the coast of Chile, viz., Arica, Antofogasta, Coquimbo, Valparaiso, Talcahuano, Puerto Montt and Punta Arenas, were completed, save the station at Puerto Montt, which is under way, and good progress was made on the station on Juan Fernandez Islands, to the west of Valparaiso. The Chilian Government has taken steps to put this service at the disposition of the commercial world, and the Director-General of Telegraphs of the country has been authorised to prepare a tariff list, and such other regulations as seem best, to connect up for commercial purposes with the other stations of the world.

MONTENEGRO.—The Austrian Consul, in a recent report, states that since 1910 the electrical works at Cetinje have been operated by a Trieste firm with a capital of 400,000 kronen (krone = 10d.). The plant works with two Diesel motors, and the installation of a third was projected at the time of writing. Only night work is carried on, and the power produced (2,000 volts) is used exclusively for lighting. The works projected in Montenegro for subsequent execution include electric light plants for the towns of Podgorica and Niksic, and refrigerating plant for Antivari, where a small electric plant for lighting the docks is already operated by the Compagnia di Antivari.

COREA.—In a recent report dealing with the graphite deposits of Corea, the German Consul at Seoul observes that the number of concessions has decreased from 135 on January 1st, 1912, to 117 on January 1st, 1914, the area having decreased from 28,554,717 tsubo (tsubo = 3·3 sq. m.) to 22,545,886 tsubo. In 1913 241,973 piculs of graphite were exported, nearly the whole going to Japan. One of the chief exporters is a Japanese firm in Fusan, who has concessions in Toksuri, where he has recently built a narrow gauge railway about 12¼ miles long to the Hoangkan station on the Seoul-Fusan line, which enables him to ship the graphite cheaply. At the beginning of 1913 the first direct shipment to Europe (500 tons) was made in a French steamer from Fusan, and now when the above-mentioned railway is fully working, regular shipments are proposed.

Catalogues and Lists.—STERLING TELEPHONE AND ELECTRIC CO., LTD., 210-212, Tottenham Court Road, London, W.—Publication No. 236 (8 pages), containing illustrated descriptions and prices of various loud electric bells and sirens.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, S.E.—New edition of pamphlet C513, describing their mine signal indicator for use with electric or mechanically-operated bells or rappers.

MESSRS. KRUPKA & JACOBY, LTD., 39, Victoria Street, London, S.W.—Three illustrated price leaflets relating to indirect fittings, electric candlesticks, and vase-standards.

MESSRS. E. BROOK, LTD., Colne Road, Huddersfield.—September stock list of single, two and three-phase electric motors.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Price list No. 5,511, describes, and gives prices of, their float switches for A.C. or C.C. circuits.

THE EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., of Ponder's End, have issued some coloured advertising postcards, showing how the Ediswan drawn-wire lamp is a "saving light." The same design is also used for their new price cards.

THE "STANDARD" TRADING CO, 25, Victoria Street, London, S.W.—Leaflet giving particulars and prices of miniature arc lamp ornaments for the watch chain.

MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—Illustrated leaflet, giving prices of insulated lampholders and new Home Office patterns of hand lamps.

THE BRITISH THOMSON-HOUSTON CO., LTD., of Mazda House, 77, Upper Thames Street, E.C., have issued a striking poster relating to the Mazda drawn-wire lamps, of which the principal feature is the Union Jack. The admirable design and artistic choice of colours render this one of the most effective and pleasing posters that we have seen.

Trade Announcements.—THE GENERAL VEHICLE CO, LTD., have removed to Imperial House, Kingsway, London, W.C.

THE BRITISH PROMETHEUS CO., LTD., of Birmingham, announce that until further notice the 10 per cent. advance on list prices, which has been in operation for some time, is now dropped, and prices in all lists are now subject to the usual trade discount.

Market Quotations.—THE BRITISH ALUMINIUM CO., LTD., state that the rates of aluminium ingot and wire are £88 per ton and £112 per ton respectively.

Private Arrangements.—THE HAMBLE RIVER, LUKE AND CO., LTD, The Hamble River, Southampton, electric boat builders, &c.—Pursuant to the provisions of the Companies' (Consolidation) Act, a largely attended meeting of the creditors of the above was held on September 2nd at the Cannon Street Hotel, E.C. A statement of affairs was presented as at August 15th last, and this disclosed ranking liabilities of £16,818. The assets were estimated to realise £25,429, and the estate thus showed an apparent surplus of assets over liabilities of £8,611. Mr. Kemp, the liquidator, stated that it was clear that there was a substantial estate, and in normal times the company would be able to pay 20s. in the £. Under the present circumstances, however, the creditors might have to put up with something less, but, nevertheless, the dividend should be very substantial. The following are creditors:—

General E'ectric Co.	£105	Silent Elec. Clock Co.	£91
D.P. Battery Co.	82	Pritchetts & Gold, Ltd.	298
Henley's Teleg. Works Co. ..	34	Siemens Bros. & Co.	119
Coventry Chain Co.	29	Worthington Pump Co.	96
Vandervell, C. A., & Co. ..	17	Nalder Bros. & Thompson ..	15
Unbreakable Pulley Co.	26	National Gas Engine Co. ..	16
Elliott Bros.	59	Phosphor Bronze Co.	17

New Cell.—MESSRS. JOHN C. FULLER & SON, LTD., of Woodland Works, Wick Lane, Old Ford Road, Bow, London, E, have devised a new type of "Inert Cell," with special features, which has been purchased by the Admiralty and the War Office in very large quantities. Dry cells are always liable to deteriorate in stock, and in consequence when they are called upon for work after long storage, they may be found in a partially exhausted state. The inert cell becomes a dry cell by the addition of water only when it is required for use, and it, therefore, always starts work as a new battery. The cell which the company are now putting on the market, can be filled in a moment, without fear of spilling the water over the sides of the cell, owing to its great absorbent qualities. Another feature is that when the cell becomes exhausted, additional moisture can be absorbed, and the remaining quantity of oxygen in the manganese can be extracted. After the cell has been filled, it becomes in reality a "dry cell," and can be turned upside down, or left on its side without any fear of fluid exuding.

British Magnetos for British Motor-Cars.—In connection with our recent article under the above heading, we learn that MESSRS. C. A. VANDERVELL & CO., of Acton Vale, well known as makers of motor-car dynamo lighting sets, and who have been, on a more or less large scale, making magnetos for some years, are now concentrating their attention on this branch. According to the *Motor*, the number of different types of magnetos (*i.e.*, of different measurements, and for engines of varying numbers of cylinders) at present used in connection with motor-cars and cycles totals up to just over 60. It will readily be realised that for any one firm to set out to fill these requirements at short notice is practically an impossibility, and in view of this fact, Messrs. Vandervell are at present devoting their energies to the production of nine types of magnetos for motor-cycles, viz., three types for single-cylinder engines, three for opposed two-cylinder engines, and three for V-type twin cylinder engines. These types have been exhaustively tested under varying conditions and are now being constructed in large quantities. At the same time, the firm are proceeding with arrangements for the manufacture of reliable magnetos for four and six-cylinder engines for motor-cars.

Liquidations.—THE MORDEY-FRICKER ELECTRICITY METER CO., LTD.—A meeting of creditors is called for September 12th at 82, Victoria Street, S.W., by the liquidator, Mr. F. Miller, to whom particulars of claims should be sent by October 9th.

H. W. SAMBIDGE & SON, LTD.—A meeting of creditors will be held at 39, Waterloo Street, Birmingham, on October 8th, to hear an account of the winding up from the liquidator, Mr. A. H. Gibson.

RANKINE PATENT FEED WATER FILTER CO., LTD.—A meeting will be held at the offices of Messrs. T. Theodore Rogers Bowler & Co., 30, North John Street, Liverpool, on September 22nd, to hear an account of the winding up from the liquidator, Mr. T. B. Maccabe.

THE CANADIAN ELECTRIC TRACTION CO., LTD.—A meeting will be held at 119, Finsbury Pavement, E.C., on September 30th, to hear an account of the winding up from the liquidator, Mr. E. H. R. Trenow.

Bankruptcy Proceedings.—HERBERT JAMES GODFREY, electrical engineer, late of 188, Balham High Road, S.W.—Receiving order September 1st on debtor's own petition. First meeting, September 15th, at 132, York Road, S.E; public examination, October 8th, at Court House, Wandsworth, S.W.

J. D. NIXON (J. D. Nixon & Co.), electrical and mechanical engineer, 65, Mill Street, Crewe.—Trustee (F. T. Halcomb, Official Receiver, King Street, Newcastle, Staffs.), released May 21st.

For Sale.—The Corporation of Londonderry offers for sale a quantity of Conradty carbons for open-type arc lamps, particulars of which are given in our advertisement pages to-day.

Book Notice.—"Brown's Marine Electrician for Sea-Going Engineers." By A. E. & A. H. Larkman. Glasgow: James Brown & Son. Price 5s. net.

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LIGHTING and POWER NOTES.

Aberdeen.—Annual Accounts.—The accounts of the Corporation electricity department for the year ended July 31st show a net revenue of £4,960 after allotting £16,252 to the sinking fund. £56,809 was realised from the sale of energy, as against £52,875 for the previous year, and the hire of motors brought in £2,889, as against £2,461. On the expenditure side the generation of electricity cost £17,711, against £17,941; 11,693,994 units of electricity were generated, an increase of 889,558 units.

The Corporation Electricity Committee's estimate for the current year is £56,918. It is recommended that the charge for energy to the tramways should be 0·85d. for the first 2,000,000 units, and 0·80d. after 2,000,000.

Altrincham.—Street Lighting.—It has been decided to light Railway Street, Stamford New Road, Kingsway, George Street, The Downs and Ashley Road by electricity. The work is to be put in hand immediately, the L.G.B. having sanctioned a loan of £700.

Atherton.—Loans for Mains, &c.—The U.D.C. has decided to apply to the L.G.B. for sanction to borrow £3,040 for electric lighting purposes, viz., £2,300 for mains, and £740 for transformers and switchgear.

The following scale of charges for electrical energy for power purposes for quantities of 12,500 units and over, per quarter, has been approved of:—12,500 units, ·625d. per unit; 75,000, ·55d.; 125,000, ·50d.; 250,000, ·45d.; 375,000, ·4d.; 437,000, ·37d.; 500,000, ·36d.; 562,000, ·35d.; 625,000, ·34d.

Australia.—Junee. (N.S.W.).—The Municipal Council is considering the question of installing electric lighting.

The Broome (W.A.) Municipality has decided to borrow £8,000 for the purpose of installing electric plant.—*Tenders.*

Warrnambool (Victoria).—The Electricity Committee has recommended the Municipal Council to put in generators at the pumping station and utilise the boilers for generating electricity as well as pumping the town water supply. It is stated that a plant for supplying 95,000 units per annum could be installed for £1,200, and the energy sold at 4d. per unit. The total cost of the installation with mains would be £3,600.—*Tenders.*

Bundaberg (Queensland).—The rights and powers conferred by the Queensland Government on D. S. Finnemore for the supply of electricity at Bundaberg have been transferred to the Electric Light and Power Co. of the same town.—*Tenders.*

Tasmania.—The provisional agreement between the Hydro-Electric Power and Metallurgical Co. and the Government, for the purchase by the latter of the company's Great Lake hydro-electric scheme, has been ratified by the shareholders of the company and by the Legislative Assembly. The purchase price is £190,246. When the Bill came before the State Legislative Council, certain amendments were made, including the elimination of the obligation on the company to construct carbide and metallurgical works at North-West Bay, and the obligation on the Government to supply the company with current for the works, thus making it an agreement to purchase the hydro-electric scheme without hampering contracts.—*Australian Mining Standard.*

The St. Leonard's Council has decided to borrow £5,000 for an E.L. scheme for St. Leonard's, Invermay and Mowbray, for which Mr. A. H. Masters has been instructed to prepare plans.—*Tenders.*

Bacup.—The Electricity Committee considers that it is inadvisable to renew the agreement for the management of the undertaking by Rawtenstall Corporation, which expires on September 30th.

Bishop Stortford.—Plant Installation.—Generating plant is being installed here by the Bishop Stortford, Harlow and Epping Gas and Electricity Co.

Bolton.—New Power Station.—The Chairman of the Electricity Committee (Ald. Longworth) started the new 5,500-H.P. turbine at the new power station, Back-o'-th'-Bank, on September 3rd. The official opening will take place later.

Bradford.—Mains Extension.—Mains are to be extended in various parts of the city at a cost of £807. The Electricity Committee has authorised the laying of mains in five roads for railless trolley routes at a cost of £101.

Continental Notes.—Italy.—A limited company has just been formed at Brescia, Italy, under the style of the Società Anonima Vestonese Elettrotecnica, for the utilisation of local water power for the production of electrical and mechanical apparatus. Its capital is 60,000 lire in 600 shares of 100 lire each.

Crewe.—Street Lighting.—Owing to the shortage of carbons, the T.C. has discontinued the use of arc lamps.

Farnworth.—Loan Sanction.—The L.G.B. has sanctioned the D.C.'s application to borrow £1,900 for additional plant at the electricity works, and £1,500 for mains and services.

Grappenhall.—Prov. Order.—Provided that the proposed charges for electricity are reasonable, the P.C. has decided to support the application of the Warrington Corporation for an extended area of electric supply.

Guiseley.—The Guiseley D.C. has refused the application of the Yorkshire Electric Power Co. for the approval of the Council to the supply of electricity by the company for lighting the district.

Harlech.—The installation of electric lighting was formally inaugurated last week. The promoter of the scheme is Dr. Thomas, Menai Bridge, and the contractors are Messrs. Johnson and Phillips, Ltd., London.

Kirkburton.—Prov. Order.—The Council has decided to support the Yorkshire E.L. Power Co.'s application for lighting powers in the district.

Liverpool.—Proposed Loan.—For the provision of electric mains the Corporation proposes to borrow £40,000.

Llanidloes.—L.G.B. Inquiry.—An inquiry was held last week into the application of the T.C. for power to purchase the local E.L. undertaking for the sum of £400.

London.—Hackney.—The Emergency Committee of the B.C. reports that adequate arrangements have been made to avoid any shortage of the supply of coal to the electricity works, and also that the arrangements as to the supply of arc lamp carbons will cover the Council's requirements for a long time.

The Finance Committee recommends that £15,750, the amount of the loan sanctioned by the L.C.C. for the extension of the generating plant, be borrowed from the London City and Midland Bank, Ltd., at 4 per cent. per annum.

Maidstone.—L.G.B. Inquiry.—An inquiry was held on September 2nd into the application of the T.C. for a loan of £6,316 for new boiler and office accommodation at the electricity works, and mains and services.

Malvern.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £1,600 for extending the U.D.C.'s electrical plant.

Manchester.—Loan Sanction.—L.G.B. sanction has been received for the borrowing of £10,000 (repayable within 10 years), £28,000 (repayable within 15 years), and £29,400 (repayable within 15 years), for electricity purposes.

Mexico.—With the settlement of Mexico's internal troubles in sight and the resumption of operations in a number of mines in its vicinity, the 50,000-H.P. Santa Rosalia hydroelectric plant of the Mexican Northern Power Co. is now to be pushed to completion. Work on the water-power plant has been suspended since October of last year. Floods during the last 12 months have, however, filled the reservoir until now a body of water 30 miles long by several miles wide has been formed. When the plant was abandoned last fall the hydroelectric machinery had already been installed and the transmission line was nearly completed.—*Electrical World.*

Midhurst (Sussex).—Proposed E.L.—The application of the promoters of the Midhurst E.L. Order, 1914, for powers to erect overhead wires for the supply of electricity has been deferred by the R.D.C. for further particulars.

Nelson.—E.L. Scheme.—The South Wales E.P. Co. are proceeding with the E.L. scheme at Nelson. A sub-station is being erected near Abernant, and poles for the overhead installation are being placed in the streets.

Newcastle Emlyn.—Public Lighting.—The U.D.C. has decided to renew the public lighting agreement with the E.L. Supply Co.

Rochdale.—Street Lighting.—The Tramways Committee has decided to agree to the proposal to light Rochdale Road by means of electric incandescent lamps suspended from the tramway span wires and bracket arms, provided that the Bacup Corporation accepts all liability for increased repairs or alterations to the overhead equipment necessitated by this work.

In connection with the Castleton sub-station, the electricity works manager recommended that a permanent sub-station be erected on land to be rented for a term of years from the Rochdale Canal Co. The Gas and Electricity Committee decided that further inquiries be made as to the leasing of the land.

Rochester.—Street Lighting.—The City Council's Works Committee has approved an agreement with the Kent Electric Power Co. for the lighting of the High Street and North Street.

Royston.—Proposed E.L.—The U.D.C. has referred to the General Purposes Committee an application from the Yorkshire Electric Power Co. for the Council's support to a Bill giving the company power to supply electricity for lighting.

St. Anne's-on-Sea.—Annual Report.—The statement of accounts in connection with the Council electricity undertaking for the year ending March 31st shows a gross profit of £4,449, and a net surplus of £1,183; of this amount £448 has been transferred to the relief of the rates. The gross profit is equal to 8·29 per cent. on the capital employed at the commencement of the year. 1,051,815 units were sold during the year, an increase of 112,472. The difference in the gross revenue, £4,449, against £5,598 the previous year, is due to the reduction in price for lighting and traction.

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Salford.—LOAN APPLICATION.—Application is to be made for sanction to borrow £1,361 in respect of half the cost of erecting and equipping the bulk supply meter house at Pendlebury.

Sheffield.—MAINS EXTENSIONS AND AMALGAMATION SCHEME.—£6,831 is to be spent on mains extensions. A Joint Sub-Committee of the Tramways and Electric Supply Committees recommends the amalgamation of the Kelham Island power station, now under the control of the Tramways department, with the electric supply undertaking, subject to the charge for all energy supplied to the tramway feeders, and for other energy, except booster units, to the extent of 150,000 units per annum, being at a flat rate of ·8d. per unit. This price is subject to a revision at the end of three years. It is not thought advisable to continue to develop the Kelham Island power station as a separate and isolated unit. Should the Council approve this recommendation, the Sub-Committee proposes to appoint Mr. H. E. Yerbury, at present tramways electrical engineer, to the position of deputy general manager and engineer of the electric supply undertaking.

Southend-on-Sea.—L.G.B. INQUIRY.—An inquiry was held last week into the application by the T.C. for sanction to borrow £60,000 for the purpose of the electricity undertaking, half that sum being for sub-stations at Leigh and Thorpe Bay, and the rest for additional cables, feeders, &c.

Stamford.—PLANT EXTENSION.—The Urban Electricity Supply Co. were to have enlarged their plant, but the 200-KW. dynamo, which was ready for delivery, has been commandeered by the War Office. A new engine had been installed, only needing the dynamo to complete the equipment. A new machine is being built.

Sunderland.—L.G.B. INQUIRY.—An inquiry was held on the 4th inst. into the application of the T.C. for a loan of £50,000 for mains, and £13,600 for sub-station machinery and switchgear.

Torpoint.—PUBLIC LIGHTING.—A dispute having arisen between the Electric Supply Co. and the U.D.C. relative to the public lighting, a Committee has been appointed to select an arbitrator to deal with the points raised.

Torquay.—LOAN SANCTION.—The L.G.B. has sanctioned the borrowing by the T.C. of £5,000 for the extension of the electricity mains, and has intimated that an inquiry will be held into the application for a loan of £16,000 for an extension of the works. The Board does not object to a portion of the work, viz., two water-tube boilers, fuel economiser, and accessories, estimated to cost £4,400, being proceeded with at once.

Wakefield.—ANNUAL REPORT.—The annual report of the working of the electricity department for 1913 shows a gross profit of £9,848, representing 9·57 per cent. on the capital expenditure. The net profit is £1,712, an increase of £383 on the previous year, whilst the output of energy shows an increase of 17·75 per cent.

Electric light is to be adopted for the public lamps in the Dewsbury Road neighbourhood.

Walmer.—E.L. SCHEME.—The U.D.C. on September 3rd decided to co-operate with the Deal T.C. in obtaining from Mr. E. W. Lacey a report on the E.L. question.

Warrington.—PROPOSED LOAN.—The T.C. is seeking sanction to borrow £2,000 for cables.

Wrexham.—GARDEN VILLAGE SUPPLY.—The T.C. has been informed by the B. of T. that it cannot entertain its application for permission to install electric lighting mains to supply the Wrexham Garden Village, and the Council has resolved to arrange for Wrexham Tenants, Ltd., to pay for the cables, and to repay the amount, with 5 per cent. interest, as soon as a prov. order extending the area of supply is obtained, or in any case before December 31st, 1918.

TRAMWAY and RAILWAY NOTES.

Accrington.—ADVERTISING CONTRACT.—The Electricity Committee has decided that it cannot at present accede to a request from Messrs. J. W. Courtenay, Ltd., that their tramcar advertising contract should be suspended until trade is normal again.

ACCIDENT.—At a meeting of the Electricity Committee last week, Accrington Tramway Workers' Association asked for compensation for conductor Barnfield, who met with an accident on May 20th. The borough treasurer was authorised to pay Barnfield half wages, and the Association were advised that the accident would not have occurred had the printed rules and instructions been adhered to, and that no compensation would be paid in future under similar circumstances.

Continental Notes.—ITALY.—The completion, which has just been effected, of the conversion to electric traction of the trunk line from Lecco to Monza, is only an instalment of the larger scheme for the conversion of the line from Lecco to Milan, which itself is a logical and necessary complement of the Valtellina electric line already working. Realisation of this scheme in its entirety is expected to synchronise with the inauguration of the new railway station at Milan, now under construction. The Lecco to Monza section is 40 km. in length, seven of which, from Lecco to Calolzio, are laid with two sets of rails. The system adopted is three-phase at 15·8 periods. The aerial lines are double, of 200 sq. mm. section. The pressure of supply to locomotives is 3,500 volts. The current is supplied from three power stations owned by private electric supply companies. Some of the machinery and plant is supplied by Italian firms, some by Brown, Boveri & Co., but the major portion has been procured from German firms, through local representatives.

The Italian Council of State, acting on the favourable report of the Superior Council of Public Works, has definitely decided to construct the Central Umbrian Railway from Terni-Todi-Perugia-Umbertide as an electric line. On account of this decision the handing over for working of this line must be postponed for exactly one year. The inauguration, consequently, will take place in September, 1915. Efforts are now being made by the communes interested to obtain the extension of the railway northwards to Forli.

The Società Elettrica Bresciana, whose headquarters are at Brescia, has received Government authorisation to construct and work two new lines of tramway in the city of Mantova, as branches of the existing network.

Doncaster.—The Electricity and Tramways Committee has instructed the tramway manager to prepare specifications for the supply of four new tramcars.

Farnworth.—At the D.C. meeting last week, Mr. Edwardes, manager of the South Lancashire Tramways Co., discussed with the Tramways Committee questions relating to the condition and overcrowding of tramcars. Mr. Edwardes said 20 cars were having new tops put on, and of these 12 were already completed. He assured the Committee he would do everything in his power to keep the cars as clean as possible, having regard to the nature of the traffic.

Leeds.—The Tramways and Electricity Committee of the Corporation has decided to expend £22,000 on the purchase of land between Aire Street and the river Aire, for the purpose of a new electricity generating station, and off Fountain Street, Morley, for the erection of a car-shed and sub-station.

Llandaff.—The District Council on September 2nd decided, subject to certain provisions, to give permission for the Cardiff T.C. to extend the tramways beyond the boundary.

London.—L.C.C.—ELECTRIC TRACTOR.—The London Fire Brigade is at present making some trials of the Lloyd electric tractor, for which Messrs. Mossay & Co., Ltd., Horseferry Road, Westminster, are the British concessionnaires.

Newcastle-on-Tyne.—ANNUAL REPORT.—The total revenue of the Corporation tramway undertaking for the year ended March 31st last was £261,200, an increase of £22,996 on the previous year. The working expenses amounted to £147,552, an increase of £18,533, leaving a gross profit of £113,648, as against £109,184. After paying interest on loans, £31,256, special rents, £1,567, and income-tax, £3,617, there was a balance of £81,291, an increase of £3,231 on last year. From that £41,450 had been placed to the sinking fund, £12,000 to the relief of rates, and, after meeting other expenditure, there was a balance of £25,134 net profit, which has been carried to the reserve and renewal account.

Salford.—The T.C. proposes to borrow £1,200 to cover the cost of laying a double line of tramway in Camp Street, Broughton. Owing to circumstances caused by the war, the Tramways Committee has agreed to forgo the payment to the Corporation by the Bell Punch and Printing Co. of £3 10s. per million tickets supplied to the Corporation in respect of the use of the advertising spaces on the tickets, until further notice.

Torrington-Halwill.—The B. of T. has granted an order for the construction of a light railway from Torrington to Halwill.

TELEGRAPH and TELEPHONE NOTES.

A Secret Wireless Station.—According to a *Daily Chronicle* correspondent at Milan, Mr. Marconi, whilst in Rome last week, discovered, by means of an improved direction finder which he has devised, that a high-power wireless station had been secretly installed in the headquarters of a foreign religious order in Rome. The apparatus was capable of communicating with long-distance stations in other countries. The Italian Government raided the premises and destroyed the installation.

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Australia.—As the result of conferences between the Postmaster-General and the Australian representative of the Marconi Wireless Telegraph Co., the long negotiations between the company and the Commonwealth Government with respect to patent rights have come to a successful termination, and the Balsillie system, which has become the property of the Government, is to be recognised as a legitimate rival to the older systems. The effect of the agreement arrived at is that the Marconi Co. discontinues its action against the Commonwealth and withdraws its opposition to the Balsillie system. The Commonwealth undertakes to pay £5,000 to the Marconi Co. in consideration of licences being granted to the Commonwealth to use the Marconi patents in Australia, and for the purpose of communicating with New Zealand. The Postmaster-General regards the results of the negotiations as very satisfactory. The action might have cost £20,000 in legal expenses. There is to be no payment in cash to the Amalgamated Wireless, Ltd. (the Australian company operating the Telefunken and Marconi patents), but this company has undertaken not to attack the validity of the Balsillie system. In addition the payment of a royalty of £1,000 for Marconi installations on the ships of the Australian Navy now ceases.—*Australian Mining Standard.*

Denmark.—A central office has been opened at Copenhagen for neutral telegrams, and for the private exchange of telegrams of countries between which direct telegraphic communication is interrupted, subject to the censorship of the Danish Government. Personal and private messages will be transmitted, but no telegram in code or of a political nature, and no Press messages will be accepted.

Pacific Cable Cut.—The cable has been cut at Fanning Island by the German cruiser *Nürnberg*, which the cruiser *Australia* is reported to be chasing. The enemy was flying French colours, and thus was able to land a force unopposed and cut the cable.

United States.—The Navy Department has taken over the wireless station of Tuckerton, which will be operated on equal terms by representatives of belligerents and neutrals under strict censorship.

CONTRACTS OPEN and CLOSED

OPEN.

Australia. — Sydney. — September 30th. Telephone instruments and parts, for the Postmaster-General. See "Official Notices" August 21st.

October 7th. Telegraph instruments, measuring instruments, incandescent electric lamps, switchboard parts, for the Postmaster-General. See "Official Notices" August 28th.

October 12th. Vacuum cleaning plant and motor-driven air compressor, for the Sydney Municipal Council.

Tenders are to be invited by the Sydney Municipal Council Electricity Committee for the installation of a battery-charging plant at the Council's motor garage, also for two potential-transformers with four ratios to 100 volts, two standard current-transformers for use on circuits up to 12,000 volts, 50 cycles, ratio, 2,500 to 5 amps.; two low-reading dynamometer type voltmeters, double range, 1·5 to 7·5 and 3 to 15 volts; one Campbell mutual-inductance standard bridge and detector; 1,500 steel cross-arms; potentiometer for calibration and testing purposes; two 500-kw., 33,000/5,000-volt, three-phase transformers, required for supplying the North Shore municipalities.—*Tenders.*

Melbourne.—Victorian Railways Department. October 7th. Motors and switchgear, and motor-driven air compressors for the Ballarat and Bendigo workshops.

October 12th. Three-phase motors for workshop machinery, for Melbourne Suburban Railways. See "Official Notices" September 4th.

Tenders are to be invited for the construction and equipment of the Burwood to Melbourne electric tramway. Messrs. McCarty, Underwood, Consulting Engineers.—*Tenders.*

Kalgoorlie.—Five-ton electric wagon, for Municipal Council. Specifications, &c., may be seen at the Commercial Intelligence Branch of the Board of Trade.

Adelaide. — October 28th. Telephones and flexiphones, telephone instruments and parts, for the Postmaster-General. See "Official Notices" to-day.

Perth. — November 18th. P.M.G.'s Dept. 249 accumulators with assorted apparatus, for telegraph office, Norseman.—*Tenders.*

Brisbane. — December 15th. Switchboard, common battery, automatic or semi-automatic, for the Postmaster-General. See "Official Notices" to-day.

Bacup.—A sub-committee of the T.C. has been ordered to obtain tenders for service cable for immediate requirements and stock.

Burnley. — September 21st. Guardians. Electrical goods and the performance of electrical work during the next half-year.

Eccles.—September 21st. Coal elevator and conveyor at the electricity works, Cawdor Street, Patricroft. Specifications, &c. (£1 1s.), from the Borough Electrical Engineer.

Leith.—September 14th. Corporation. Supply of 8,000 tons washed singles during a period of 12 months, or 3,500 tons washed singles during a period of three months for the electricity department. Specifications from the Burgh Electrical Engineer, Gt. Junction Street.

Limerick.—September 18th. Corporation. One three-cylinder Diesel oil-engine coupled to a 160-kw. d.c. generator; one motor-driven air compressor. See "Official Notices" September 4th.

Liverpool.—September 15th. Electric supplies for six months, for the West Derby B.G. Mr. H. P. Cleaver, Clerk, Brougham Terrace.

London. — L.C.C.—September 28th. Installation, 215 wiring points, 285 lighting points, at Gifford Street Elementary School, Caledonian Road, N. See "Official Notices" to-day.

September 22nd. Induced-draught fans, motors, spare parts and dampers, also alteration of flues and moving of dampers at the generating station, Greenwich. See "Official Notices" August 28th.

St. Pancras.—September 21st. Electric lift for heavy vehicles, for the B.C. See "Official Notices" August 28th.

Middlesbrough.—September 12th. Corporation. Three electric motor-driven sewage pumps, priming pumps, metering arrangement, pipework, overhead travelling crane. See "Official Notices" August 14th.

South Africa.—Johannesburg.—October 9th. Ten single-truck double-decked electric tramcars, for Municipal Council. Specifications, &c., may be seen at Commercial Intelligence Branch of Board of Trade.

Spain.—October 9th. The Spanish Ministry of Public Works in Madrid is inviting tenders for the concession for the construction and working of an electric tramway in the town of San Sebastian (Province of Guipuzcoa).

September 19th. The municipal authorities of Posadas (Province of Cordoba) are inviting tenders for the concession for the electric lighting of the town during a period of three years.

Walsall.—September 29th. Corporation. Extra h.t. switchgear, static transformers, l.t. switchgear. See "Official Notices" to-day.

Warrington.—September 11th. Education Committee. Wiring, &c., at the Evelyn Street Council School. Mr. J. Moore Murray, Secretary and Director, Education Office, Sankey Street, Warrington.

September 15th. Twelve months' supply of earthenware conduits for Tramways Committee. See "Official Notices" August 28th.

Whitby. — September 30th. U.D.C. Construction of cliff tramway or lift. Particulars from the Clerk to the Council.

CLOSED.

Australia.—The following tenders have been accepted:

Postmaster-General's Department, Melbourne:—

100 miles twisted-pair wire, £14 2s. per mile; 15 tons outside distributing ditto, £150 17s. 4d. per ton.—W. T. Henley's Telegraph Works Co., Ltd.
Miscellaneous telephone material.—Noyes Bros. Pty., Ltd.
8 miles tinned-copper wire, £42 10s.; 2 tons h.d. copper wire, £100 per ton.—Callender's Cable and Construction Co., Ltd.
10 tons tinned-copper wire, £127 17s. per ton; 1 ton copper-clad wire, £69 8s. 6d.; also sleeves, tapes, &c.—F. Vanderkelen & Co.
90 tons bronze wire, £89 2s. 6d. per ton.—Gibbs, Bright.
Automatic switchboard apparatus for Geelong P.O., £3,000.—Automatic Telephones (Aust.), Ltd.

South Australia:—

15 c.b. switchboards, £63 15s. each; 5 ditto, £43 7s. 2d. each; 5 non-multiple magneto switchboards, 100 lines, £41 15s. each; 10 ditto, 25 lines, £15 each; 20 ditto, cordless, 10 lines, £8 10s. each.—J. Bartram & Son Pty., Ltd.
11,000 insulator spindles, 9½d. each.—A. Simpson & Son.

Sydney Municipal Council:—

Time switches, £208.—British General Electric Co., Ltd.
Watt-hour meters, £240.—Aus. General Electric Co.

Werribee Shire Council:—

Suction gas engine, £1,029.—R. Hornsby & Son, Ltd.
Dynamo, booster, pump and motor, switchboard, storage battery, cells, and power-house wiring, £1,924.—Sutherland & Ashman.
Conductors, insulators, meters, &c., £609.—Grant & Vincent.
—*Aus. Mining Standard.*

Western Australian Tender Board:—

Insulated wire cable, Railway Department: No. 1, £275 per mile; No. 2, £150 per mile.—J. R. W. Gardam.

Kempsey Municipality, N.S.W.:—

Town electric lighting.—Kynoch & Co.

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Sydney Municipal Council.—The following tenders were received by the Electric Lighting Committee :—

Meters.—Landis & Gyr, Ltd , £1,892, alternative £3,177; B.I. and Helsby Cables, Ltd., £2,766; W. G. Watson & Co., £4,796, alternative £6,819, £6,419, £1,584; British General Electric Co., £5,013; Aust. Metal Co., Ltd., £5,827; Lawrence & Hanson, Ltd., £5,514; Aust. General Electric Co., £5,737; Edison & Swan Co., Ltd., £5,863; Noyes Bros., £5,966; Hayes & Eggers, Ltd., schedule; India-Rubber Co., Ltd., schedule; Standard Waygood Hercules, Ltd., schedule.

Feeder cables (D.C.).—Siemens Bros., £10,521; B.I. and Helsby Cables, Ltd., £10,638; W. T. Henley's, Ltd , £11,070; Noyes Bros., £11,112; Union Cable Co., Ltd., £11,749; Western Electric Co., £11,815; Aust. Metal Co., £11,792; N. Guthridge, Ltd., £12,257; Lawrence & Hanson, Ltd., £14,407.

Box compound.—W. T. Henley's, Ltd., £55; W. G. Watson, Ltd., £78, alternative £87; Siemens Bros., £90, alternative £83; Western Electric Co., £95; B.I. and Helsby Cables, Ltd., £168.

Maximum-demand indicators.—B.I. and Helsby Cables, £187; Aust. G.E. Co., £315; British G.E. Co., schedule; W. G. Watson & Co., Ltd., £364; Noyes Bros., £532.

Insulators (H.T.).—Lawrence & Hanson, portion, £22; Aust. Metal Co., Ltd., £330, alternative £333, £108; Warburton, Franki, Ltd., £169; Aust. General Electric Co., £608; Noyes Bros., schedule.

Insulators (straight stem).—India-Rubber and Gutta-Percha Co., £154; T. Zwicker & Co., £85; W. G. Watson, Ltd., £150; Siemens Bros., £160; Lawrence & Hanson, Ltd., £161; Aust. Metal Co., Ltd., £184; Noyes Bros., £206; Aust. G.E. Co., £243.

Insulators (33,000-volt).—Aust. Metal Co , Ltd., £1,350; Warburton, Franki, Ltd., £1,604; Aust. G.E. Co., £1,025; R. Bryce & Co , Ltd., £1,078; W. G. Watson, Ltd., £1,140; Noyes Bros , schedule.

Carbons.—Aust. Metal Co , £3,869; Union Electric Co., £5,724; Siemens Bros , yellow flame, £6,204, white flame, £7,780; Edison & Swan, Ltd., £6,697; W. G. Watson, Ltd., schedule; Crompton & Co., Ltd., schedule; Aust. Otis Engineering Co., schedule.

Induced draught fans.—H. P. Gregory & Co. (fans only), £3,218; Noyes Bros., £3,625; Ferrier & Dickenson, £5,700; N. Guthridge, Ltd., £5,661, alternative, £5,504, £6,831, £5,284; Falkiner Electric Co., £3,147.

The Electricity Committee has made the following recommendations :—

That the tender of Messrs. Babcock & Wilcox, at £3,795, be accepted for a coal conveyer at the power house, and that of the Aust. General Electric Co. for 33,000-volt transformers and switchgear, at £4,297.

That the following equipment for the Parramatta Road station be obtained from the Aust. General Electric Co., at £1,474, viz., one 5,000-v. transformer panel, £147 10s ; one 10,000-v. ditto, £247; two 33,000-v. feeder panels, £671; two lightning arresters, £108 10s.

For the switchgear required for the refrigerating plant at the abattoirs, the Public Works Department having decided to take energy from the City Council, one 33,000-v. feeder panel, £335 10s.; three 33,000-v. transformer panels, £806; two 33,000-v. aluminium lightning arresters, £408 10s.; three 5,000-v. transformer panels, £346 10s.; four ditto, £462; sixty 5,000-v. bus-bar insulators, £15; seven marble panels, £175.—Aust. General Electric Co.

Four 2,000-K.V.A. 33,000/5,000-v. three-phase transformers for the abattoirs sub-station, at £5,200.—Messrs. Siemens Bros.

That a Lea recording instrument for No. 12 turbine be obtained from Messrs. W. Adams & Co., at £150.

Melbourne City Council :—

C.I. service and cut-out boxes: group No. 1, £219 11s. 6d.; ditto, group No. 2, £280 16s.; group No. 3, £46 6s. 4d.—Cleveland Eng. Co.

Condenser, fuses and transformer blocks, £320.—John McIlwraith & Co. Pty., Ltd.

Sydney Metropolitan Board of Water Supply and Sewerage :—

Recording ampere-meters.—Aust. General Electric Co., £200.

Electric air-drill and pulsator.—Ingersoll Rand Co., £267.

—Tenders.

Postmaster-General's Department, Sydney :—

91,000 insulators, porcelain, £910.—India-Rubber, Gutta-Percha and Telegraph Works, Ltd.

1,800 yards waterproof cloth, £810; 70 yards ditto tubing, £10 10s.—Dunlop Rubber Co. of Australasia.

100 miles copper wire, No. 18, £787 10s.—Noyes Bros. (Sydney), Ltd.

2 miles copper wire, No. 22, £6 19s. 6d.; 800 miles twisted-pair wire, for outside distributing, two No. 18, £4,232 10s.; 100 miles ditto, ditto, two No. 16, £20 10s.—W. T. Henley's Telegraph Works Co., Ltd.

2,000 Hellesen dry cells.—Messrs. W. G. Watson & Co., £208 6s 8d.

Equipment and material for the extension of the Toowoomba telephone exchange.—Western Electric Co. (Australia), Ltd., £203.

Postmaster-General's Department, Melbourne :—

62,500 copper binders, £89 14s. 11d.; 112,000 ditto, £287; 47,000 ditto, £180.—India-Rubber, Gutta-Percha and Telegraph Works, Ltd.

20 tons copper H.D. wire, 100 lb. mile, £1,668; 5 tons ditto, 150 lb. mile, £491 10s.; 250 tons ditto, 200 lb. mile, £19,575; 270 tons ditto, 300 lb. mile, £21,141; 50 miles tinned-copper wire, £175; 100 miles ditto, £282 10s.; 50 miles two-twisted conductor wire, £243 15s.—British Insulated and Helsby Cables, Ltd.

72,000 porcelain insulators, £1,762 10s.—Dalgety & Co.

Postmaster-General's Department, Adelaide :—

25 switchboards, 10 lines, £153 15s.; 25 ditto, 6 lines, £276 18s. 4d.—J. Bartrams & Son Pty., Ltd.

Victorian Railways Department :—

Galvanised telegraph wire, No. 8, £9 8s. 6d. per ton.—Briscoe & Co., Ltd.

N.S.W. Public Works Department :—

Switchboard for Hawkesbury Agricultural College, £394.—Aust. General Electric Co.

Transformers at ditto, £110 15s.—Noyes Bros. (Sydney), Ltd.

Ditto, £118.—Aust. General Electric Co.

13 electric motors at ditto, £368 12s.—Union Electric Co. of Aust., Ltd.

RODNEY.—Victoria Shire Council has accepted the following tenders for plant in connection with the electric lighting scheme for Mooroopna :—

48-B.P suction gas plant.—R. Hornsby & Sons, £604.

Generators, boosters and motor.—Aust. Metal Co., £272.

Storage battery, £389, fuse boxes, £15, street lights, £16.—Silvertown Co.

Meters.—Aust. Metal Co.

70 insulators.—Noyes Bros., £14.

H.D copper cable.—B.I. & Helsby Cables, £176.

Insulated cable.—Henley's Telegraph Works, Ltd., £30.

Poles.—W. J. Heath, £167.

—Tenders.

LAUNCESTON (TASMANIA).—The City Council has accepted the offer of Messrs. H. Jones & Co., Hobart, for the following tramway rails and accessories :—

240 tons No. 1 B.S.S. 90-lb. rails, £7 12s. 6d. per ton; 80 tons No. 1 C.S. 96-lb. rails, £8 2s. 6d. per ton; 350 pairs fish-plates, 4s. 7½d. per pair; 1,832 fish-bolts, £1 8s. 2½d. per 100.

Bacup.—The Electricity and Tramways Committee has accepted the tender of Messrs. Chas. Macintosh & Co., Ltd., for distributing mains.

Buxton.—The U.D.C. has accepted the tender of Messrs. Day & Ferguson, of Buxton, for coal for the electricity works.

Dartford.—The U.D.C. has accepted the following tenders for coal for the electricity works :—

J. Waddell & Sons.—200 tons of Mansfield rough slack, 16s. 6d. per ton.

J. Hudson & Co., Ltd.—2,000 tons South Hetton rough small, 15s. 2d. per ton, and 2s. per ton to cover insurance against war risks as long as is necessary, and 100 tons Shipley slack, 16s. 6d. per ton.

The Council has also arranged with Messrs. E. J. and W. Goldsmith, to keep at New Wharf 500 tons of rubbly culm coal.

Messrs. Browett, Lindley & Co., Ltd., have been requested to replace the uniflow engine with a triple-expansion engine of their best and most economical design.

Derby.—The T.C. has accepted the tender of Messrs. W. A. Boissier & Co. for wiring the Market Hall shops for electric light, at £58 11s. 6d., and that of the Rees Roturbo Co. for a boiler feed pump.

Dewsbury.—The Electricity and Tramways Committee has accepted the tender of Messrs. Crawshaw & Warburton for nine months' supply of coal.

Eccles.—The Electricity Supply Committee has accepted the tender of the Earl of Ellesmere for an annual supply of slack at 10s. 9d. per ton.

Holywell.—The B.G. has accepted the tender of Messrs. Sibcon Bros. for the erection of an electric power house.

London.—WANDSWORTH.—The Guardians have accepted the tender of Messrs. Siemens Bros. & Co., at £74, for providing an additional internal telephone exchange at the St. James's Infirmary.

Manchester.—The Tramways Committee has placed an order with the Daimler Co., Ltd., Coventry, for six motor-'bus chassis to replace those which had been impressed by the military authorities. The tender of Messrs. Davis, Lowe & Sons, Ltd., Manchester, for cast-iron pipes for heating purposes, has also been accepted by the Tramways Committee.

The Electricity Committee has ordered a contract for Sections C and D, and portion of Section E, for a 5,000-KW. turbo-alternator at Stuart Street, with Messrs. Mirrlees, Watson & Co., Ltd., Glasgow, to be prepared and sealed.

The tenders of Mr. R. Carlyle, Old Trafford, and Messrs. J. Garrard & Sons, Swinton, for rebuilding warehouse and repairs to roof at the Dickinson Street station, have been accepted by the Electricity Committee.

The Electricity Committee has also accepted the tender of Messrs. W. T. Glover & Co., Ltd., for a supply of cable, and the following tenders for supplies :—

Oils.—M. Wells & Co., Manchester; C. C. Wakefield & Co., London; Hy. Wells & Co., Salford; Spurrier, Glazebrook & Co., Ltd., Manchester; and Price's Oil Co., Ltd., Manchester.

Carbon brushes.—Le Carbone, and Morgan Crucible Co.

Insulated wires.—Liverpool Electric Cable Co., Ltd.

Flexible conductors.—Chas. Macintosh & Co.

Binding and fuse wires.—I.-R., Gutta-Percha, &c., Co , Ltd.

Incandescent lamps (metal filament).—British Thomson-Houston Co., Ltd.

" " (carbon filament and radiator).—Siemens Bros. Dynamo Works, Ltd.

Fuse boxes.—B.I. and Helsby Cables, Ltd.

Motors.—Siemens Bros. Dynamo Works, Ltd.; Electric Construction Co , Ltd.; Electromotors, Ltd.; British Westinghouse Electric and Mfg. Co., Ltd.; and E. Brook, Ltd.

Motor starters.—Veritys, Ltd.; Ferranti, Ltd.; and G. Ellison.

Meters.—Ferranti, Ltd., and Chamberlain & Hookham.

Current and potential transformers.—Ferranti, Ltd.

Rotherham.—The Corporation has accepted the tender of the Bastian Meter Co., Ltd., for the supply of Bastian meters from 2½ to 5 amperes.

Messrs. Chamberlain & Hookham, Ltd., have also received a Corporation contract for meters.

Stretford.—The tender of Mr. Robert Carlyle has been accepted by the U.D.C., at £325, for extending the battery room at the electricity works.

NOTES.

Bradford Electrical Exhibition.—As already stated in our pages, this exhibition has been postponed. Mr. Thos. Roles has written advising us that a meeting of the Bradford Corporation Exhibition Sub-Committee held on September 8th, the following resolution of the Executive Sub-Committee was approved :—"In consequence of the unsettled condition of the country, due to the present European War, the Executive Sub-Committee deem it inexpedient to proceed meantime with the organisation of the Bradford Electrical Exhibition, and recommend that the enterprise be postponed for the present, but that the Sub-Committee be authorised to continue the organisation of the Exhibition at the earliest favourable moment."

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The Board of Trade and German Capital.—In response to inquiries made just before going to press, Mr. Runciman, President of the Board of Trade, has courteously informed us that he hopes very shortly to make an announcement on the subject of trading with British firms operating in England whose capital is owned, either in part or entirely, by German subjects.

In view of the foregoing statement the following letter received from a correspondent leads us to the belief that while the Government finds it necessary to act with deliberation, the Association mentioned has seen fit to take, at any rate preliminary measures, with precipitancy:—

THE STATE OF WAR.

Herewith I send you copy of a circular letter received from the British Electrical and Allied Manufacturers' Association, together with a copy of the "Resolutions of Council" referred to therein. This appears to me to be a most ill-conceived and short-sighted move.

London. "FORE-SIGHT."

Dear Sir, STATE OF WAR.

The resolutions, of which a copy is handed to you herewith, were passed at a Council meeting here last afternoon, and I am to request you to inform me on or before 9th inst. whether you assent to them.

(Signed) D. N. DUNLOP,
Secretary, British Electrical and Allied Manufacturers' Association.

London, *September 5th*, 1914.

1. Resolved, that having regard to the state of war, it is the opinion of this Council that trading with

(1) Any company incorporated in Great Britain the controlling interest in the share capital of which is held by Germans or Austrians;

(2) Any German or Austrian firm or branch or agency of German or Austrian firm trading here, whether in the same or in another name,

Is against the best interests of the British electrical and allied industries.

2. Resolved that the secretary be, and he is hereby instructed, to invite members of the Association who fall under definition (1) or (2) in the first resolution to resign their membership.

3. Resolved that members of the Association be instructed that in the opinion of this Council it is against national interests for them to buy from or sell to firms falling under definitions (1) or (2) in the first resolution.

Siemens's Employés at the Front.—In view of the attacks that have been made upon the Siemens companies, it is of interest to note that altogether 723 of their staff and employés have joined the colours as reservists, territorials, or volunteers. The Stafford works and offices alone have contributed over 400. The place of every man is being kept open for him. Full wages are to be paid to married men and half wages to single men serving with the colours.

Safety-First Rules for the Electrician.—At the recent convention of the South-Western Electrical and Gas Association at Galveston, Texas, F. N. Lawton, manager, Wichita Falls Electric Co., stated that this company had prepared the following rules for men engaged in electrical work:—

SWITCHBOARD INSTRUCTIONS.

Safety First.—Remember your family and protect your fellow workmen.

When operating the switchboard always stand on the rubber mat.

When throwing the switches, use but one hand.

When necessary, use rubber gloves, hanging upon the board.

Keep the board well lighted. Have oil lanterns always ready.

In case of fire open your exciter switches first, then use sand.

Report the slightest signs of trouble on the board.

Keep instruments and wiring all clean.

Use danger card when circuit is off for repairs or trouble.

Report all trouble on station log.

Watch temperature of oil in constant current regulator.

When working on back of board use wooden stool and rubber gloves.

LINEMAN INSTRUCTIONS.

Safety First.—Remember your family and protect your fellow workmen.

Learn the position of all circuits and wires upon the poles.

Use your rubber gloves in handling all wires. They may be alive.

Take the safest position on the pole.

Keep yourself free from grounds. Watch out for telephone cables and messenger wires.

In coming down a pole, watch out for street signs fastened to the pole.

In using tools on a pole, keep the groundmen away from the pole.

In making wire connections, use but one hand at a time. Don't get in circuit.

Constantly inspect lines for trouble. Keep all primaries clear.

Put away all tools at the end of the shift.

Keep your spurs, body-belt and all tools in good condition.—*Elec. Review and W. Electn.*

Bosch Magneto Co.—The Bosch Magneto Co., Ltd., and Mr. John A. Stevens, of Tottenham Court Road, one of the officials, have been fined £8 4s. (including costs) for refusing to allow Mr. J. Scott, solicitor, of Arthur Street, W.C., to inspect the register of shareholders on August 23rd, and for refusing Mr. F. C. Borer an inspection of the register on August 26th. When the complainants were able to see the register they found that of the 50,000 shares of the company only two were held by Englishmen and the remainder by Germans.

The I.E.E. and the War.—We understand that in response to the notice issued to the members of the Institution of Electrical Engineers a month ago, 1,450 offers of service were received, and after classification the names were placed at the disposal of the War Office, the Admiralty, and other Government departments, and of the electricity supply undertakings of the United Kingdom; some vacancies in the last named have already been filled from the names sent to the Institution.

There was, however, evidence of a desire on the part of many to give more than "spare time" services to their country, and we have received from the Institution the following information:—

"A large number of the members of the engineering profession having expressed the wish to be allowed to serve their country together in one regiment or battalion, the Institutions of Civil, Electrical and Mechanical Engineers have under consideration the formation and training of a battalion enlisted from among their members, with a view to its forming part of Lord Kitchener's Army."

We commend this admirable proposal to the notice of our readers; many will, no doubt, have already enlisted, but we believe they will have little difficulty in exchanging into the new battalion, and we feel sure that there will be no lack of recruits for service as members of that body.

Appointments Vacant.—The Hackney B.C. electricity department recommends that as the new plant and sub-stations will shortly be running, an additional generating engineer be appointed at £120 + per annum.

Trade Returns in War Time.—THE AUGUST FIGURES: FOREIGN TRADE.—The following are the electrical machinery figures given in the official returns for August:—

IMPORTS.	*Month of August.*	*Inc. or dec.*	*Eight months,* 1914.	*Inc. or dec.*
	£	£	£	£
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	37,451	− 82,657	981,442	− 7,483
Machinery	308,299	−222,353	5,085,575	+163,241
EXPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	145,683	− 139,508	2,204,317	−1,272,768
Machinery ...	...1,708,073	−1,177,701	24,482,516	+ 40,513

Stealing Electricity.—On August 28th, at Brighton Police Court, Rose Roper, of 14, Grand Parade, was fined 40s. and costs for fraudulently stealing and consuming certain electricity on July 27th. It was stated that the meter was a 1s. in the slot one, and it had been bridged in such a way that a certain amount of the electricity passed through, but the bulk passed over and was not registered at all.

Fatalities.—Joseph Yorke, 50, a married man, was preparing to clean the roof of a cupola at the Coalbrookdale Works on Saturday, and when he was in the act of throwing a rope to his fellow workmen below, his hand, unfortunately, came in contact with a live electric wire. The result was that his wrist was severed, and he was instantly killed.

An electrician named Reginald Harris, aged 25, employed in Chatham Dockyard, fell from a trestle on which he was standing, and, when picked up, was found to be dead. At first it was thought his death was caused by an electric shock, but the evidence at the inquest on Saturday showed that it was due to the extreme heat from several furnaces in operation in the smithy. A verdict in accordance with the evidence was returned.

John Parker Treeby, a young electrical engineer employed by Messrs. Ferranti, Ltd., Hollinwood, was killed last week whilst cycling to his work, through colliding with a motor-car. At the inquest a verdict of "Accidental death" was returned.

Educational Notes.—We have received from UNIVERSITY COLLEGE (University of London) the Handbook of the Faculty of Engineering and special programmes of courses arranged for engineers in practice for the forthcoming session. Copies can be obtained from the Secretary. The 1914-15 Session begins on October 5th.

BOROUGH POLYTECHNIC INSTITUTE.—The Institute reopens on September 21st for students of Electrotechnics. Particulars are given in our advertisement pages to-day.

CITY AND GUILDS TECHNICAL COLLEGE, Leonard Street, E.C.—The Entrance Examination for students who have not matriculated will be held on September 22nd.

WEST HAM MUNICIPAL TECHNICAL INSTITUTE.—Electrical Engineering Department. The 1914-15 Session opens on September 21st.

Inquiries.—A correspondent wants information regarding a "Wireless Light"—a bulb on a sheet of plate glass, which lights up intermittently and has no visible communication with the mains.

British makers of Water-jet Lightning Arresters are asked for.

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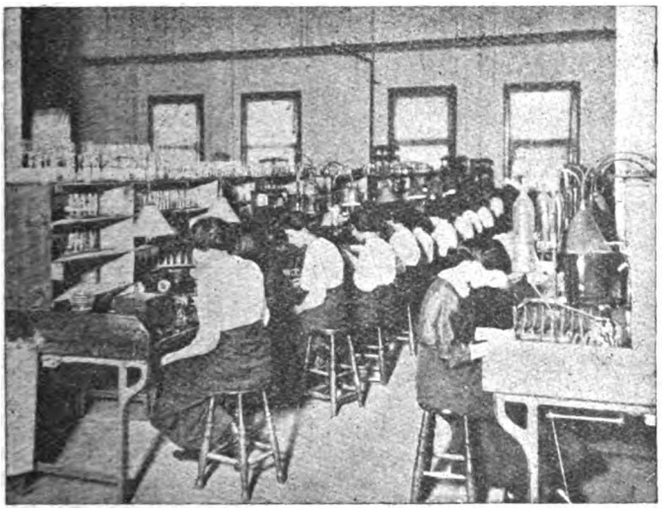
British Half-Watt Lamps.—We recently enjoyed the privilege of inspecting the works where the British Thomson-Houston Co., Ltd., make their half-watt lamps, at Rugby. We call it a privilege advisedly, for not only is it, we believe, altogether exceptional for any person other than the staff to be accorded admission to that jealously-guarded department, but also we derived keen pleasure and satisfaction from what we saw. The department is run on lines which were to us entirely novel, and which we believe to be unique as regards the treatment of the employés, most of whom, as is usual in lamp works, were girls (as a matter of fact, the Army has drawn heavily upon all the company's works, more than 50 per cent. of the men of fighting age and fitness having joined the colours). Without entering into details at this time, we may say that the greatest pains are taken to employ only girls of superior class and ability, and no less care is taken to retain their services when trained; individual attention is bestowed upon each employé, and handsome rewards are offered for increased output, enabling good workers to command comparatively high wages—not only for a time, but permanently. A premium is set also upon good work, with the result that the percentage of throw-outs at every stage of the manufacture is insignificant—a feature of importance in lamp making. Special precautions are also taken to safeguard the health of the workers; the enormous number of blow-pipe gas flames employed in the joining and sealing of the glass parts, and for other operations, tends to vitiate the air, and to prevent this large air trunks have been provided, with ventilating fans to draw off the products of combustion. A convenient "rest room" has also been set apart and fitted with all appliances necessary for the restoration of tired or ailing humanity.

As for the manufacture of the Mazda half-watt lamp, it is one of the most interesting series of processes that we have ever seen. As in so many other industries, attention to detail is of the first importance, and an apparently trifling feature may prove to be essential to success. The filaments are made of tungsten wire produced from the ore at the Rugby works, where also all the wire required is drawn.

Although the production of tungsten wire in the first instance necessitated so long and costly a research, it is now drawn with the greatest facility and in enormous continuous lengths, so perfectly uniform in section that if it were necessary, the lamps could be made of correct wattage and candle-power without submitting them to any electrical test. The wire is so strong and yet ductile, that it can be spiralled cold round a wire of its own diameter to make the "coiled filaments" which characterise the half-watt lamp, without fear of cracking or breakage. The filaments are mounted on spiders of special design to withstand the



Filament Shaping and Mounting.

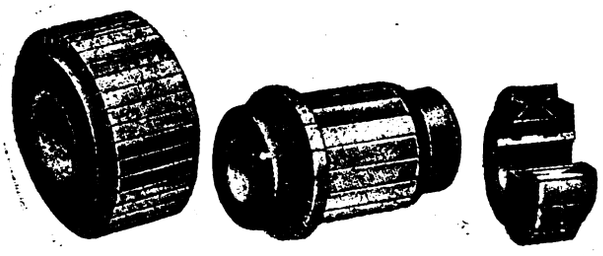
high temperature of the filament, and a mica shield prevents convection currents in the gas from overheating the neck; but the very long necks considered necessary by foreign makers have been found useless, and have been abandoned by the B.T.H. Co. Numerous special machines, of highly ingenious design, have been evolved by the company's staff as a result of patient and enduring effort, which very greatly simplify the manufacture and improve the products, and no detail of manipulation is considered too insignificant to receive minute attention, with the result that the output has been immensely increased without corresponding additions to either plant or personnel—though, of course, both these are being extended to cope with the rapidly growing demand. Life tests are constantly in progress, and the only trouble in this respect that appears to perplex the makers is the fact that the lamps last too long—renewals are too rarely needed. The exhaustion of the half-watt lamp has to be carried to an extremely high degree before admitting the inert gas, and for this reason the installation of pumping plant is exceptionally elaborate. The gas in the lamps when hot is at a pressure slightly below atmospheric, so that if a bulb is accidentally broken there is no risk of glass being thrown outwards by explosion. Owing to the fact that no deposit occurs on the bulb except at the neck, the candle-power of the lamps hardly ever diminishes appreciably—certainly not to the 80 per cent. standard, which is usually regarded as marking the limit of useful life.

The manufacture of the ordinary Mazda tungsten wire lamps and of carbon-filament lamps, as carried on at Rugby, is only less interesting than that of the half-watt lamp; readers may be surprised to learn that the carbon lamp still has so many applications, that more lamps of this type are now being made than at any previous period in the company's history. But we are mainly concerned here with the half-watt Mazda lamp, which, as we can personally vouch, is made throughout at the Rugby Works, with British labour and materials.

Sealing-In Mazda Half-Watt Lamps.

Certain new developments in connection with both the half-watt lamp and the ordinary Mazda drawn-wire lamps, though extremely interesting, we must leave until the time is ripe to deal with them. Our illustrations show the processes of shaping and mounting the filaments, and sealing them into the bulbs.

Commutator with Moulded Insulation.—In a test recently carried on by the United States Light and Heating Co., Niagara Falls, N.Y., with an automobile starting motor having its commutator built up with "bakelite" moulded insulation, a speed of 9,060 R.P.M. was attained before the commutator failed. As the maximum speed at which such a commutator is operated in actual service is usually about 3,500 R.P.M., the factor of safety indicated in the above test was approximately 6·7. The type of commutator tested is shown in the accompanying illustration. This commutator has a total weight of 8·46 lb. and an outside



Commutator with Moulded Insulation.

diameter over the tangs of 13·375 in. When tested the tangs were removed so that the commutator then weighed 7·06 lb. and had an outside diameter of 10·375 in. This is the diameter at the commutator face. In order that the commutator, while being tested, should approach service conditions as to temperature, it was heated to 265° F., this temperature being somewhat higher than that which would occur in actual service. Calculations show that the disrupting force—that is, the force tending to pull the commutator apart—was 15,230 lb. per sq. in.—*Electrical World.*

Lightning in Australia.—The *Sunday Times*, of Western Australia, gives an account of a violent thunderstorm at the Ironsides North Mine at Boulder. The mine has, or had, an iron smoke stack 45 ft. high made of ½-in. plating, and 4 ft. in diameter, which attracted the lightning. "It was struck near the base, and the electric fluid appeared to traverse the whole length, shearing off fully 20 ft. This seemed to be literally hurled into the air, crashing on to the top of the winding engine room, to which it did considerable damage—naturally." For some minutes after the lower portion of the stack was red-hot, the rain falling on it being at once turned to steam. But for the rain there is no doubt a serious conflagration would have resulted, as some of the wooden beams of the engine room were ignited, but were easily extinguished. The electric cables were broken, but this did not affect the running of the mill, as they were connected with a motor in an adjoining building. The damage is estimated at £150.

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Late Correspondence.—The following letter has been received since our "Correspondence" pages were closed :—

CARBONS.

Referring to the letter appearing in your issue of August 28th, under the signature of Mr. Alwood, may I be permitted to ask that gentleman two questions?

1. Does he seriously suggest that the loss of £70,000 is entirely due to the apathy of English engineers?

2. Has the Witton Carbon undertaking any past or present connection, agreement, understanding, or agreement, direct or indirect, with any foreign firm or individual?

I am sure if Mr. Alwood will answer these two questions, many of your readers will be relieved.

INQUIRER.

London, *September 9th*, 1914.

[We should have thought that our readers' greatest relief would be to know that when foreign sources of supply are cut off, the most pressing needs can be met from within.—EDS. ELEC. REV.]

Electric Fire Brigade Vehicle Costs in the United States.—Following on the particulars we have recently given with regard to the running and maintenance costs of electric motor vehicles in fire brigade service in Berlin and London, we have been able to procure some recent figures in relation to the electrically-propelled steam fire engine owned by the Fire Brigade of New York.

It may be remembered that we gave some particulars of this machine, which was put in service in April, 1912, in our issue of December 26th last. It may, however, be repeated that the vehicle is one of the Brigade's old horse-drawn steam fire engines which, after having been in service for 10 years, was converted to electric traction by the Couple Gear Freight Wheel Co., of New York, who removed the old front portion of the machine and replaced it with steering gear and a front axle, the road wheels of which are provided with hub electric motors, the necessary current being supplied by an 80-cell storage battery divided into two sections.

For its first year of service, during which there was not a single instance of damage to, or breakdown of, the electrical equipment of the machine, although street accidents necessitated some repairs to the mechanical portion, the vehicle was able to effect an economy of roundly £56 over the annual costs when horses were employed, the costs for the 12 months, including energy, battery maintenance and depreciation, being just under £80. Based on the performance and cost of keeping three horses, the annual charges, including also an allowance for depreciation, for horse haulage, worked out at approximately £136.

The figures now available are for a period of two years, and indicate that the vehicle, with its modern form of propulsion, is still able to show an economy in running and maintenance costs, the total bill for the two years amounting to £274; this included £97 for battery renewals, which were made after the vehicle had been in use for 18 months, £52 for mechanical repairs, tires, &c., and £125 for cost of energy, depreciation and decoration, the machine having taken part in two street parades. The cost of horse traction, as based on the record of the two American Fire Brigades which ordinarily respond to about the same number of calls per annum as the New York electric machine, is given as £293, so that, notwithstanding the outlay for battery renewals, there is still an economy in favour of electric traction. As a rule, better service costs more money; in this case, however, the New York Fire Department not only has a more efficient appliance, but one which is saving money. Not only so, but no account is taken in the quoted figures of the saving in space at the fire station that is effected by the disappearance of the old horse stalls, which is now used for the garaging of one of the officer's motor-cars.

The Disputed Carbons Case.—Sitting as Vacation Judge, Mr. Justice Sankey had before him on Wednesday, September 9th, the action of the Beck Engineering Co, Ltd., and Another *v.* Foster Engineering Co. and Another, the plaintiffs asking for the appointment of a receiver and manager of a large number of carbons for flame arc lamps said to be now in the hands of the police.

Sir Frederick Lowe, K.C., now appeared for the plaintiffs, and the defendants were represented by Mr. Colefax, K.C., and Mr. Clayton.

Sir Frederick Lowe, in opening the motion, dealt at length with the agreements entered into between the parties whom, it would appear, were in one way or another interested in a patent known as the Beck lamp. Mr. Billington, the second plaintiff, had the English rights vested in him, while the foreign patents were in the hands of Mr. Conradty, who resided in Bavaria, and was not a party to the proceedings. In order that these patent lamps could be used, said counsel, certain carbons were required, and those carbons were made by Mr. Conradty, in Germany, and supplied through the Sloan Electrical Co., the second defendants, who acted as his agents. A licence having been granted to the Beck Co. to make the lamps under the patent, the Sloan Co. agreed to keep such stock of these carbons as was necessary, not only for fitting the lamps, but for replenishing them. An agreement for carrying into effect that arrangement was entered into with the Foster Co., but a Receiver of that company having been appointed by the debenture-holders, the agreement with them had come to an end, and the Beck Co. had to look for its carbons to the Sloan Co. as agent of Conradty. The carbons in question being in the possession of the Foster Co. at Wimbledon, the Beck Co. went there and took possession, and in consequence the Foster Co., who so far as counsel could see, had no real interest in the matter at all, preferred a farcical charge of stealing, and the magistrate had committed for trial Mr. Billington, and others, on this extraordinary charge.

His Lordship asked where were the carbons now?

Sir Frederick said that in point of fact they were in the hands of the police. The plaintiffs applied to the Foster Co. to hand over the carbons, but they said they could not do it without the sanction of the Sloan Co.; the Sloan Co. refused unless they could get the consent of Mr. Conradty, and that assent, of course, they could not obtain as they would be dealing with an alien enemy. He submitted that this was merely an attempt by these defendants to get a rise of 30 per cent. in the price for the benefit of this German gentleman.

Mr. Colefax repeated his offer to supply the carbons for cash at the market price of unpatented carbons, and to keep the money in a joint account to be dealt with as the Court might direct at the trial. He submitted that these carbons were admittedly the property of the Sloan Co., and the Court should not, therefore, appoint a Receiver; such appointment would cause great inconvenience.

Sir Frederick said he was prepared to pay the price that existed on August 3rd.

Mr. Colefax said that would not do, as all carbons had risen in price by 50 per cent.

Sir Frederick: Yes, because they are made in Germany. The proper person to decide the price was a Receiver under the direction of the Court, and the appointment of a Receiver was the only satisfactory way of dealing with the matter.

His Lordship said that, if wrong, he had the satisfaction of knowing that he could soon be put right by the Court of Appeal, and his opinion was that at the present time the plaintiff was entitled to have a Receiver. He accordingly appointed a chartered accountant to be Receiver and Manager of the carbons until trial or further order.

Standardisation of Electrical Installations on Motor-Cars.—At the recent meeting of the American Society of Automobile Engineers, the first half of the report presented by the Electrical Equipment Committee was adopted. This covered a recommendation for a standard test of moulded insulation. It was stated that there was no intention of infringing on present practice with respect to certain magneto parts, but that the recommendations had regard solely to certain fittings in other parts of motor-cars, as, for instance, switch-blocks and the like, carrying heavier currents, that, if improperly constituted, would be liable to distortion under excessive currents. It was pointed out that the sole object of the Committee was to lay down a trend that would forestall further and restrictive action on the part of insurance underwriters, besides rendering the operation of the electrically-lighted and started car more satisfactory and safe. The second half of the report, carrying a recommendation in favour of the single-wire system for car electric lighting installations, was lost by a narrow margin, the matter being referred back for further consideration. It is admitted that there are distinct advantages in the two-wire system, but it is claimed that there are equally distinct advantages in the single-wire or earthed return system. The Committee had decided to recommend the single-wire system, believing that the number of motor-car manufacturers using it was bound to increase, and on the score that to hasten such a development would be beneficial rather than harmful. As already mentioned, however, the recommendation was not adopted.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Stretford Electricity Committee has appointed MR. A. H. SMITH, of Pendleton, as shift engineer.

MR. E. JORDAN, of Sheffield, has been appointed assistant engineer at the Northampton electricity works, in place of MR. G. G. SMITH, resigned.

MR. H. R. BARNWELL having resigned from the position of works superintendent at Barrow Corporation electricity works, MR. D. B. BREARLEY, assistant, has been appointed to succeed him, at a commencing salary of £170. It is not proposed to appoint an assistant, but to re-arrange the duties of the staff and appoint an additional junior.

Tramway Officials.—MR. R. VINCENT EDWARDS has been appointed to succeed the late Mr. Holliday as engineer and general manager of the Hastings and St. Leonards tramways. Mr. Edwards has been deputy manager for several months; he is a native of Derbyshire, and was articled in 1891 with J. Davis and Sons (a Midland firm of engineers). He had experience in electric lighting and tramway work in Madrid, Corunna and Barcelona. Then for about seven years he was with Messrs. Dick, Kerr & Co.,

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Ltd., on contract work in various places, and subsequently had charge of the rolling stock department at their head office in London.

General.—The *British Australasian* states that Mr. A. R. Hanson, son of Mr. M. Hanson, of the firm of Messrs. Lawrence & Hanson, electrical engineers and contractors, of Sydney, has been detained as a prisoner of war in a military prison at Paderborn, in Germany, but communications received from him show that he is well, and is not suffering any ill-treatment.

At Christ Church, Staincliffe (Yorks.), on August 29th, the marriage took place of Mr. Richard Dawson Fairclough, A.M.I.E.E., of Bolton, son of the late Dr. Fairclough, of Mirfield, and Miss Elsie Rowland Sandford, only daughter of the Rev. F. P. Sandford, of Staincliffe.

Mr. Harry Jones asks us to state that having now no business connections with Messrs. Frederick Thomas & Co., his temporary address is 92, Great Portland Street, W. Telephone No. 6020, Gerrard.

Mr. D. Coyle, formerly of Japan, has recently returned to London, and has now permanently settled down at 21, The Drive, Ilford.

Reuter reports that Sir James Sivewright has been arrested at Nuremburg, and is being kept as a prisoner of war.

Mr. F. J. Bell has left the service of the B.T.H. Co., Rugby, having been appointed to a position on the electrical staff of Messrs. Cammell, Laird & Co., Ltd., Sheffield. His departure was marked by a presentation from other members of the staff.

Obituary.—Mr. T. B. Holliday.—Very great respect was shown at the funeral of the late Mr. T. B. Holliday (manager of the Hastings Tramways) on Friday last, at the Hastings Borough Cemetery. Mr. Holliday, who had been in failing health for about a year, was 60 years of age. He was born in Yorkshire, and in early life went to Australia, where he remained for 16 years, and was associated with the cable tramways in Melbourne. Returning to England, he was one of the first to be engaged in tramway construction work in various parts of the country as chief engineer to the late Sir J. Clifton Robinson. Previous to going to Hastings, the late Mr. Holliday was manager of the Brighton Tramways. He had two sons; one is engineer and manager of the Rhondda Valley Tramways, and the other is a member of the Canadian Contingent which volunteered for active service. A large number of tramway employés attended the funeral, also many prominent residents of Hastings, and Mr. G. Kitchin (chairman of the Hastings Tramways Co.). One of the many floral tributes—that from the tramway employés—was in the form of a tramcar with the trolley pole broken.

Mr. H. E. Packham.—The death occurred on August 31st, after a long illness, of Mr. Herbert Edwin Packham, of the firm of Packham & Sons, electrical engineers, of 144, Western Road, Brighton.

NEW COMPANIES REGISTERED.

Boonzaiers, Ltd. (137,558).—This company was registered on September 2nd, with a capital of £10,000 in 5s. shares, to take over from W. G. Boonzaier, of 11, Bramfield Road, New Wandsworth, the benefit of and turn to account certain existing inventions relating to improvements in pump valve structures, to manufacture and deal in pumps, valves, and accessories, galvanometers, ammeters, (voltmeters, carbons, cut-outs, switches, motors, batteries, turbines, pipes, wires, lamps, mantels and appliances used in connection with engineering, and to adopt an agreement with the said vendor, S. Hartley and N. W. Bins. The subscribers (with one share each) are:—W. G. Boonzaier, 11, Bramfield Road, New Wandsworth, S.W., engineer; S. Hartley, B.Sc., A.M.I.C.E., Cranford, 35, Arron Road, Catford, S.E., engineer; N. W. Bins, 2, Artillery Mansions, Nightingale Road, Woolwich Common, S.E., traveller. Private company. The number of directors is not to be less than three or more than five; the first are W. G. Boonzaier, S. Hartley and N. W. Bins; qualification, 1,000 shares; remuneration as fixed by the company. Registered office, Tuff's Wharf, Glass Yard, High Street, Woolwich, S.E.

Simplex Self-Starters, Ltd.—This company was registered on September 3rd, with a capital of £10,000 in £1 shares, to carry on the business of manufacturers of, and dealers in, electric or other apparatus designed for starting motor-cars, motor-boats, aeroplanes or other mechanically-propelled vehicles, electricians, &c., and to adopt agreements with B. Lawrence, L. Johnston and J. R. Roberts. The subscribers (with one share each) are:—H. A. Back, 28, Pall Mall, S.W., solicitor; H. Clough, 86, Lime Street, E.C., engineer's agent. Private company. The number of directors is not to be less than three or more than seven; the first are R. R. Bevis, M.I.C.E., A. Spurrier, L. Johnston and H. Clough. Solicitors: Surtees, Philpotts & Co., 6, St. Helen's Place, E.C.

Highfield & Co., Ltd. (137,563).—This company was registered on September 2nd, with a capital of £1,500 in £1 shares, to carry on the business of manufacturers of electric appliances of all kinds, marble and slate electric switchboards, mantelpieces, &c. The subscribers (with one share each) are:—E. J. Eades, 51, Harrington Road, Leytonstone, Essex, stationer; G. R. Wadleigh, 68A, Silver Crescent, Gunnersbury, W., clerk. Private company. The number of directors is not to be more than two. G. Highfield is permanent chairman and managing director, with £135 per annum as remuneration; qualification, £100. Solicitor, G. A. Baker, Prudential Buildings, Corporation Street, Birmingham.

Phœnix Electric Heating Co. (1914), Ltd. (137,586).—This company was registered on September 4th, with a capital of £3,000 in £1 shares, to take over the business of a manufacturer of, and dealer in, electrical apparatus carried on by S. D. Cox at 16-17, Morwell Street, Tottenham Court Road, W.C., as the "Phœnix Electric Heating Co." The subscribers (with 751 shares each) are:—S. D. Cox, "Bindon," West Byfleet, Surrey, manufacturing electrical engineer; B. L. Klemens, 2, Tanza Road, N.W., commercial traveller. Private company. The number of directors is not to be less than two or more than five; the first are S. D. Cox and B. L. Klemens (both permanent); qualification, £100. Registered office, 16-17, Morwell Street, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Aldeburgh Electric Supply Co., Ltd.—Two charges on certain land in Aldeburgh, Suffolk, dated August 7th and August 16th, 1912, to secure all moneys due or to become due from the company to Barclay & Co., Ltd., not exceeding £2,500. (Registered July 11th, 1914, pursuant to order of Court.)

Nu-Lines Manufacturing Co., Ltd.—Debenture dated August 24th, 1914, to secure £400, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: G. Ineson, 82, Evington Road, Leicester.

Whitstable Electric Co., Ltd.—Particulars of £10,000 debs., created August 15th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged. The company's undertaking and property, present and future, including uncalled capital. No trustees.

J. Davis & Co. (Southampton), Ltd.—Particulars of £1,000 debs., created August 27th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged on the company's undertaking and property, present and future, including uncalled capital. No trustees.

Hong-Kong Tramway Co., Ltd.—A memorandum of satisfaction to the extent of £2,200 of trust deed dated July 1st, 1908, securing £195,000, has been filed.

United Electric Car Co., Ltd. (formerly Electric Railway and Tramway Carriage Works, Ltd.).—A memorandum of satisfaction in full on January 1st, 1914, of mortgage dated November 28th, 1901, securing £50,000, has been filed.

CITY NOTES.

United Electric Car Co., Ltd., Preston.

The directors' report on the company's trading for the year ending June 30th, 1914, states that the works have been efficiently maintained as regards buildings and machinery, the cost of which has been charged against revenue. After paying debenture interest amounting to £642, and charging £6,184 for depreciation (including £4,500 added to reserve), the profit for the year is £16,096, to which is added £1,559 brought from last year, making a total of £17,654; deduct preference dividend for the six months ending December 31st, 1913, £3,000, leaving an available balance of £14,654. The preference dividend, less income-tax for the half-year ending June 30th, 1914, absorbs £3,000, a dividend of 5 per cent. less income-tax on the ordinary shares for the year ending June 30th, 1914, £7,500; there is placed to general reserve £2,000, and £2,154 is to be carried forward. The balance of the debenture stock was redeemed on January 1st, 1914. Mr. George Richardson and Mr. John Kerr have retired from the board during the year, and Mr. John Greenwood has been elected a director.

South London Electric Supply Corporation, Ltd.—The directors having declared the dividend on the 6 per cent. cumulative preference shares for the half-year to October 1st next, payment of the same will be duly made on that day.

Dumbarton Burgh and County Tramways Co., Ltd.—A dividend of 1¼ per cent. on the ordinary shares for the year is recommended, carrying forward £4,265.

Davis & Timmins, Ltd.—The directors announce an interim dividend at the rate of 6 per cent. per annum, less income-tax, on the ordinary shares for the half-year, payable September 15th.

British Electric Transformer Co., Ltd.—The directors have paid an interim dividend at the rate of 6 per cent. per annum, less income-tax, on the ordinary shares for the half-year.

Electric Supply Co., of Victoria, Ltd.—A dividend at the rate of 6 per cent. per annum on the preference shares for the period to March 31st, 1913, is recommended, allocating £1,000 for depreciation of stores, £2,175 written off discount and commission on debenture stock account, and carrying £3,626 forward.

Clyde Valley Electrical Power Co.—The directors report for the half-year ended June 30th last a profit of £30,665, plus £9,477 brought forward. After payment of the dividends on preference shares to April 30th, 1914, amounting to £8,724, and after adjusting interest and transferring £12,500 to contingency fund for depreciation, &c., there remains a balance of net profit of £19,297. £1,925 is to be transferred to special reserve fund, and £17,372 carried forward.

Fairbairn, Lawson, Combe Barbour, Ltd.—The directors announce (says the *Financial Times*) that in view of the present unsettled conditions created by the war, they have decided not to declare an interim dividend on the ordinary shares.

Alabama Traction, Light and Power Co.—The *Financial News* states that owing to the war, &c., the directors have decided to defer the payment of interest on the first mortgage bonds due September 1st.

Oxford Electric Co., Ltd.—An interim dividend at the rate of 5 per cent. per annum, less income-tax, on the ordinary shares for the half-year is announced, payable September 15th.

Manila Electric Railroad and Lighting Corporation.—The directors have declared a quarterly dividend of 1¾ per cent. for the quarter ended September 30th on the common stock.

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Puebla Tramway, Light and Power Co.—The directors' report states (says the *Financier*) that the net profits in Mexico for the year 1913 amounted to $736,953 (Mexican), as compared with $753,636 for 1912. Reckoning the earnings at the parity of exchange, there is a balance, after meeting all expenses, bond interest and first mortgage bond sinking fund, of £1,105, but owing to the heavy loss in exchange, which amounted to £19,456, the net result is a debit balance of £18,350, which amount has been carried to the balance-sheet. The directors are pleased to report that, except for some slight damage done from time to time by bandits, the company's various properties have suffered no material damage, and, in view of the disturbed condition of Mexico, the result of the year's working is a matter for congratulation. Until conditions improve, and during such time as the rate of exchange remains at the present low figure, the earnings of the company must continue to be adversely affected.

Aberdeen Suburban Tramways, Ltd.—At the half-yearly ordinary meeting of the shareholders Mr. James Mearns, chairman of directors, stated that the company continued to make satisfactory progress, and they were now finding some advantage in the reduction in the price of the electric power which they got from the Town Council. The renewal and the depreciation fund now amounted to the substantial sum of £14,000, being nearly one-half of the paid-up capital of the company. The chairman moved that a dividend at the rate of 2½ per cent. per annum be declared, and this was agreed to.

Nairobi Electric Power and Lighting Co., Ltd.—The directors report a satisfactory result of the working for the half-year ending June 30th, 1914, showing an improvement upon the previous year's result quite up to their anticipations. They announce an interim dividend at the rate of 6 per cent. per annum on both the preference and the ordinary shares in respect of that period.

Monterey Railway & Power Co.—The report for 1913 shows total net revenue of $144,251, a decrease of $74,177. After meeting fixed charges, interest on debenture stock, and providing for the 5 per cent. dividend on the preferred, a balance of $127,251 was shown, which increased the surplus carried forward to $601,098. From this, $150,000 was placed to reserve for contingencies, increasing that fund to $450,000. This left a balance to profit and loss account of $451,098.—*Financial News.*

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the five weeks ended July 31st, 1914, amounted to 1,713,183, compared with 1,443,028 units in the corresponding five weeks of 1913.

STOCKS AND SHARES.

Tuesday Evening.

Weight of opinion gathers cumulative force in pressing the Stock Exchange Committee to reopen the House with the least possible delay. This pressure is applied from various directions. It is pointed out that inconvenience, hardship and suffering are inflicted upon many people what time the markets remain closed; and suspension of all Stock Exchange rules—should that be necessary—is advocated as justifiable in the unique circumstances at present ruling. We tabulated last month the principal causes militating against such an opening of the Stock Exchange as would inevitably bring panic, and make matters much worse than they are at present; and the Stock Exchange Committee continue to maintain the attitude that, until definitely good news comes from the seat of war, it is impossible, from the point of view of public financial safety, to consider the question of putting the machinery into motion once more.

Holders of all high-grade securities—such, for instance, as those comprised in the preordinary issues of electricity supply and telegraph companies—have a keen interest in the discussions that is raging round the price of Consols. Since the Stock Exchange closed, the dealers in the Consol market have purposely retained the price of the Funds at a high level, at which they were prepared to sell, rather than reduce it in response to ordinary market conditions where supply exceeds demand.

The view is that, if Consols are allowed to fall away, a blow is struck at national credit and at the values of all first-class securities, which might have a serious effect upon the public mind. A ring was accordingly formed of jobbers who declined to sell below certain figures. Other people, however, were not bound by this, and they have been dealing on a basis substantially lower. It is maintained that this latter practice offers an opportunity for hostile finance to strike at British credit, and a strong effort has been made to bring into line all the prices of stocks in that class where Consols stand as leader. What will be the upshot of the petition it is difficult to say. To tamper with a free market is at all times a dangerous policy, but a good many theories have to go by the board in these days of a war unique in the history of the world.

Various inquiries reach stockbrokers daily as to what bargains are to be picked up. The action of the Consol market, outlined above, has been so generally followed that there has been no scaling down of values anywhere. Sellers find it difficult to get anything like the quotations current at the end of July, but, on the other hand, buyers discover that nothing is being offered at a knock-out price. And the reason for this is obvious—sellers certainly do not wish to spoil their own markets by forcing prices down at a time when everything is nominal, but they are quite open to bids, and it is for the buyers to name what prices they are prepared to give.

The buyer, however, finds himself in the position of hardly knowing what to offer for shares which he might be tempted to secure at a low figure. To assist him at this point, we have prepared a short set of tables showing the yields per cent. obtainable from leading electrical securities at varying prices. For example: City of London Ordinary shares, when the Stock Exchange closed at the end of July, gave a return of 6¼ per cent. on the basis of the last 10 per cent. dividend. The shares then stood at 16. Assuming the distribution to be maintained, at 15, the shares would pay 6⅔ per cent.; at 14, 7⅛ per cent.; and at 13, nearly 7¾ per cent. Such calculations serve to give an idea of levels at which prices may be regarded as attractive, and the annexed tables follow the same line of demonstration as that cited in the case of City of London Ordinary:—

Ordinary share.	Dividend.	Price.	Yield.
Brompton	10	July 30th, at 9⅜	£5 6 9
		,, ,, 9	5 11 1
		,, ,, 8	6 5 0
		,, ,, 7	7 2 10
Charing Cross Ordinary	6	,, ,, 5½	5 9 8
		,, ,, 5	6 0 0
		,, ,, 4½	6 13 5
		,, ,, 4	7 10 0
County Ordinary.. ..	7	,, ,, 12½	5 14 8
		,, ,, 11½	6 1 9
		,, ,, 11	6 7 2
		,, ,, 10½	6 13 4
Kensington	9	,, ,, 7½	5 16 8
		,, ,, 7	6 8 7
		,, ,, 6⅔	6 18 6
		,, ,, 6	7 10 0
St. James's	12	,, ,, 9⅞	6 1 6
		,, ,, 9	6 13 4
		,, ,, 8	7 10 0
		,, ,, 7½	8 0 0
Westminster	10	,, ,, 8⅛	5 12 9
		,, ,, 8	6 5 0
		,, ,, 7	7 2 10
		,, ,, 6	8 6 8

Other calculations can be worked out from these tables, and no difficulty will be found in arriving at yields from prices between those given above. Examples from the Telegraph and Manufacturing sections must be reserved for another week.

Rumours are current in the City as to a possible *rapprochement* between one of the big London companies and a smaller one, operating in a contiguous area. Possibly, of course, the negotiations may have started before the war did, and recent transactions may have been simply to wind up the preliminaries. It looks, however, as though interesting developments might be expected before long.

Not much business has been transacted amongst electrical issues. A fair number of the stocks which were wanted, and which we catalogued here two or three weeks ago, have come to market, but there are still buyers for certain others. We hear of British Westinghouse Preference changing hands this week on the basis of 34s., and of the Prior Lien bonds being done at 102; while a number of electricity supply Debenture stocks can also be placed on quite good terms. The Rubber share market is quiet; and of the armament issues the only traceable activity has been in Vickers, which stand now at 30s.-31s., *ex* a shilling dividend.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	..	..	..	..	..	..	..	..
Blackpool-Fleetw'd	Sept. 5	6,333	—2,915	35	20,596	— 3,108	8	..
Bristol	,, 4	35,684	— 389	36	307,522	+20,969	30·5	..
Brit. Elec. Trac. Co.	Aug. 28	241,629	+8,200	..	..	..	429·8	..
Chatham and Dist.	Sept. 8	4,146	— 69	35	83,684	+ 585	14·98	..
Cork	,, 8	2,118	— 94	35	17,820	+ 126	9·89	..
Dublin	,, 4	24,647	+3,233	36	209,103	— 1,274	54·25	..
Hastings	,, 2	5,110	—1,931	..	..	— 1,452	19·8	..
Lancashire United	,, 2	6,743	— 50	35	58,968	+ 4,894	42	..
Llandudno-Col. Bay	,, 4	1,995	—1,456	40	12,788	— 1,567	6·5	..
London United ..	,, 4	25,874	—1,470	36	294,930	— 912	..	..
Tyneside	,, 2	2,659	+ 396	10	5,884	+ 463	11	..
Anglo-Argentine ..	Aug. 26	200,653	—13,096	34	1,869,506	—15,006	..	..
Auckland	..	..	..	..	..	..	25·42	1·03
Brisbane	August	33,172	+3,902	31	281,827	+24,649	..	..
Calcutta	Sept. 5	17,975	+ 318	..	..	+ 7,843	20·5	..
*Madras	Aug. 15	1,883	+ 85	32	29,074	+ 3,966	15·25	..
Montevideo ..	August	26,075	—2,754	41	302,758	— 6,693	..	..
Cen. London Rly.	..	..	..	..	..	..	..	..
City & S. Lon. Rly.	..	..	..	..	..	..	..	..
Dublin-Lucan Rly.	Sept. 4	625	— 93	9½	1,628	— 163	7	..
L'pool Overh'd Rly.	..	..	..	..	..	..	..	..
London Elec. Ry. Co.	..	..	..	..	..	..	..	..
Mersey Railway ..	..	..	..	..	..	..	..	..
Metropolitan Rly.	..	..	..	..	..	..	..	..
Met. District Rly.	..	..	..	..	..	..	..	..

* Two weeks.

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AMERICAN EXPORTS OF ELECTRICAL GOODS.

The following figures, showing the exports of electrical goods from the United States during the year ended June, 1913, are taken from the recently-issued trade statistics; where possible, figures for 1911-12 have been added for purposes of comparison, and notes of any increases or decreases given :—

	1911-12. Dollars.	1912-13. Dollars.	Inc. or dec. Dollars.
Telegraph instruments.—			
To Canada	17,000	37,000	+ 20,000
,, Central America	9,000	6,000	− 3,000
,, Mexico	13,000	15,000	+ 2,000
,, Columbia	—	33,000	+ 33,000
,, Argentina	11,000	—	− 11,000
,, Cuba	4,000	66,000	+ 62,000
,, Other countries	14,000	58,000	+ 44,000
Total	68,000	215,000	+ 147,000
Telephone instruments.—			
To United Kingdom	56,000	151,000	+ 95,000
,, Canada	582,000	779,000	+ 197,000
,, Central America	17,000	7,000	− 10,000
,, Mexico	24,000	42,000	+ 18,000
,, Cuba	107,000	79,000	− 28,000
,, Brazil	59,000	107,000	+ 48,000
,, other S. America	20,000	37,000	+ 17,000
,, Japan	21,000	30,000	+ 9,000
,, Australia	53,000	5,000	− 48,000
,, Other countries	35,000	135,000	+ 100,000
Total	974,000	1,372,000	+ 398,000
*Other electrical instruments and appliances.**—			
To Canada	3,102,000	5,968,000	—
,, Mexico	926,000	1,153,000	—
,, Central America	286,000	1,145,000†	—
,, Cuba	594,000	610,000	—
,, Argentina	414,000	362,000	—
,, Brazil	2,206,000	2,375,000	—
,, Japan	08,000	1,067,000	—
,, Philippine Islands	319,000	344,000	—
,, Australia	184,000	672,000	—
,, United Kingdom	828,000	781,000	—
,, Other countries	1,235,000	2,970,000	—
Total	10,692,000	17,447,000	—
Electrical machinery.—			
To Canada	1,870,000		—
,, United Kingdom	883,000		—
,, Mexico	950,000		—
,, Central America	136,000	Shown	—
,, Cuba	346,000	under	—
,, Argentina	153,000	separate	—
,, Brazil	906,000	headings	—
,, British India	147,000	in	—
,, Japan	941,000	1912-13,	—
,, Australia	534,000	see	—
,, Philippine Islands	117,000	below.	—
,, South Africa	134,000		—
,, Other countries	1,238,000		—
Total	8,415,000		—
Gas engines, stationary.—			
To Canada	131,000	150,000	+ 19,000
,, Argentina	74,000	23,000	− 51,000
,, Australia	38,000	28,000	− 10,000
,, Europe	57,000	104,000	+ 47,000
,, Other countries	94,000	107,000	+ 13,000
Total	394,000	412,000	+ 18,000
Electric meters.—			
To United Kingdom		150,000	—
,, Canada		1,033,000	—
,, Panama		233,000	—
,, Mexico		441,000	—
,, Cuba	Included	148,000	—
,, Argentina	in	82,000	—
,, Brazil	electrical	272,000	—
,, Chile	machinery.	104,000	—
,, British India		105,000	—
,, Japan		399,000	—
,, Australia		264,000	—
,, Other countries		567,000	—
Total		3,798,000	—
Petrol engines, stationary.—			
To Canada	755,000	1,269,000	+ 514,000
,, Argentina	397,000	334,000	− 63,000
,, Australia	307,000	341,000	+ 34,000
,, Mexico	43,000	40,000	− 3,000
,, United Kingdom	98,000	100,000	+ 2,000
,, Other countries	863,000	793,000	− 70,000
Total	2,463,000	2,877,000	+ 414,000
Steam engines, stationary.—			
To Canada	248,000	260,000	+ 12,000
,, Cuba	90,000	100,000	+ 10,000
,, Mexico	61,000	51,000	− 10,000
,, Brazil	42,000	78,000	+ 36,000
,, Philippine Islands	22,000	20,000	− 2,000
,, Other countries	288,000	199,000	− 89,000
Total	751,000	708,000	− 43,000
Electric locomotives.—			
To Canada	46,000	146,000	+ 100,000
,, Panama	—	25,000	+ 25,000
,, Cuba	—	43,000	+ 43,000
,, Haiti	—	21,000	+ 21,000
,, Chile	18,000	17,000	− 1,000
,, Other countries	24,000	22,000	− 2,000
Total	88,000	274,000	+ 186,000
Dynamos and generators.—			
To Canada		585,000	—
,, United Kingdom		342,000	—
,, Panama		121,000	—
,, Mexico		166,000	—
,, Cuba	Included	122,000	—
,, Brazil	in	114,000	—
,, Peru	electrical	109,000	—
,, Japan	machinery.	848,000	—
,, Australia		117,000	—
,, Other countries		249,000	—
Total		2,773,000	—
Fans.—			
To Canada		133,000	—
,, Argentina		53,000	—
,, Brazil	Included	20,000	—
,, China	in	25,000	—
,, British India	electrical	37,000	—
,, Japan	appliances.	10,000	—
,, Other countries		81,000	—
Total		359,000	—
Arc Lamps.—			
To Canada	Included	91,000	—
,, Brazil	in	52,000	—
,, Other countries	electrical	43,000	—
	appliances.		
Total		186,000	—
Carbon filament lamps.—			
To Canada	Included	13,000	—
,, Mexico	in	113,000	—
,, Brazil	electrical	28,000	—
,, Other countries	appliances.	74,000	—
Total		228,000	—
Metal filament lamps.—			
To Canada		56,000	—
,, Mexico		55,000	—
,, Cuba	Included	38,000	—
,, Argentina	in	42,000	—
,, Brazil	electrical	53,000	—
,, Australia	appliances.	34,000	—
,, Other countries		117,000	—
Total		395,000	—

* Owing to changes in classification (see below), the figures under this heading for the two years are not on a comparable basis.

† Panama, 1,012,000 dollars.

Import Duty on Catalogues for South Africa.—

The following alteration has been made in the South African Imports Tariff :—

Catalogues or price lists of foreign firms addressed to importers, merchants, or manufacturers—

Previous duty.	*Alteration.*
25 % *ad valorem*, or 2d. per lb., whichever is the higher; with a rebate to British goods of 3 %.	Duty free.

We learn that this alteration in the law of the Union of South Africa was initiated by the British Electrical and Allied Manufacturers' Association, and effected through the instrumentality of Sir R Sothern Holland, H.M. Trade Commissioner, Cape Town.

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LARGE ELECTRICAL SMELTING FURNACES.

[BY OUR CORRESPONDENT IN NORWAY.]

At a recent meeting of the Polytechnical Association at Christiania, Mr. A. Helfenstein, who is a well-known expert on large electrical furnaces, and who has now one furnace of 10,000-12,000 H.P. of his own type at work in Sweden for the production of electric pig-iron, read a paper on the above subject, of which the following is an abstract.

In comparison with other furnaces the electrical furnace has four special features which are characteristic of all the smelting processes that can be carried out with it, and also of the construction of the furnace itself :—

1. The total absence of all kinds of fuel from the furnace. This has the great advantage to the smelting process that it allows a much better concentration of the materials under treatment to be achieved, and further, that all the impurities which otherwise are conveyed to the bath through the fuel, and, consequently, are absorbed by the metal and appear in the finished product, are avoided. The electrical furnace has, in other words, the advantage, in comparison with other furnaces, that the same quantity of raw material can be dealt with in much smaller smelting chambers than those required in ordinary blast furnaces, and that a product of considerably greater purity can be obtained, because there are no other impurities to be dealt with than those which the raw material itself contains.

2. The second peculiarity in connection with electrical heating is the higher temperature that is attained. This is the essential quality which has made possible the manufacture of certain products which previously could not be produced at all, or, if it were possible, only with the greatest difficulty by means of the old methods of heating. Reactions, for which a high temperature is required, have been rendered practicable by the aid of electrical heating, and there are now employed in the industry several processes for which a temperature of more than 3,000° C. is necessary.

3. The third peculiarity of electrical heating is the heating from the interior outwards. The heating of the raw material by means of ordinary fuel is usually effected from the exterior and inwards, and the two heating processes are thus based on two different principles, quite opposite to each other. In the case of electrical heating, the core or the centre of the charge is first heated to a high temperature, and the hot zone is then gradually extended in an outward direction towards the wall of the furnace, which thus very seldom is exposed to such a high temperature as that ruling in the centre. It is just this peculiarity which explains the possibility of employing processes that require very high temperatures with the aid of apparatus of a comparatively simple and plain construction.

4. As the fourth advantage of electrical heating as compared with ordinary heating may be mentioned the ease of regulation of the heat.

By regulating the current and voltage and the current density in the electrodes, the temperature can be varied as may be desired, and this is of fundamental importance for the carrying out of thermal processes, especially in cases where the object is to produce special products of high quality. It is beyond all doubt that it is possible by means of electrical heating to obtain higher limits for the reaction temperature than in cases where ordinary fuel is employed. The charge can be heated to a temperature of 200°-300° above the temperature which is absolutely necessary for the reaction, by means of which it becomes possible to obtain certain effects which are not without importance to the refining of the products on the whole. Such beneficial effects are excluded if ordinary fuel is employed, because the whole charge is heated to and kept at the lower reaction temperature.

After having mentioned the advantages of electrical heating, it is only just to point out certain drawbacks as well, which first of all are due to the electrodes which conduct the energy to and from the furnace. (Electrical heating by induction is not dealt with in the present case, because it is of minor importance, at all events at the present moment, it being only employed on a small scale by certain manufacturers.)

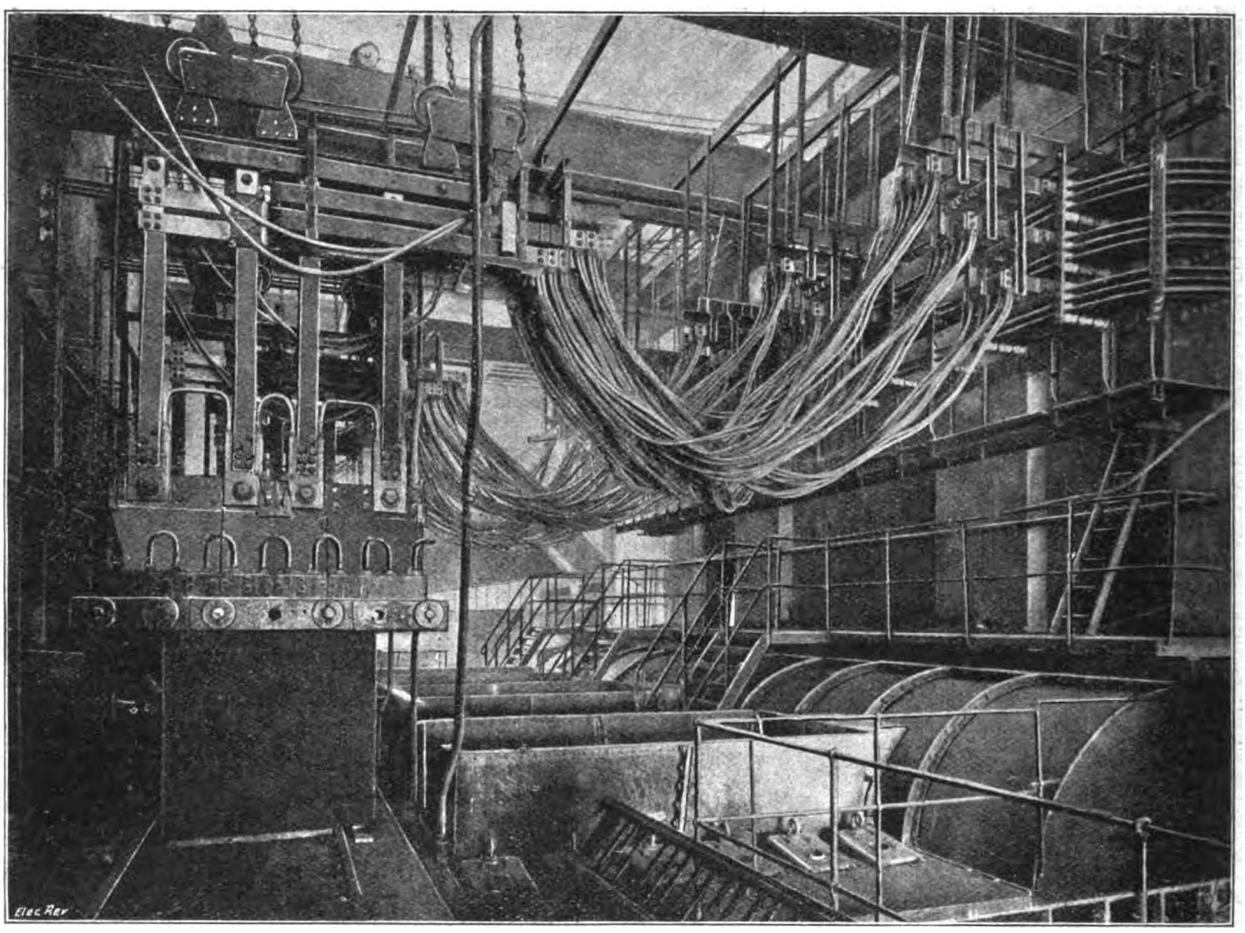

FIG. 1.—TRANSFORMERS AND ELECTRODES OF HELFENSTEIN FURNACES; ELECTRODES WITHDRAWN.

It is well known that as far as small electrical furnaces are concerned, the energy can be conducted to the furnace through electrodes, which enter the furnace-chamber itself in a horizontal, vertical, or oblique direction from above. Electrodes can also be placed at the floor of the chamber.

Years of experience have proved, however, that the vertical position of the electrodes is the only one suitable for large furnaces from a technical and practical point of view, and, further, that an electrode at the bottom should be avoided. A uniform and exact regulation of the current is much more necessary in large than in small furnaces, and the electrodes must always have the necessary voltage and ampere load, as it otherwise would be quite impossible to take advantage of and utilise the full amount of power at disposal. And it stands to reason that a loss of 10-15 per cent. of the energy is of greater importance in cases where large quantities of energy are dealt with than in the case of only small amounts. The practice of employing fixed electrodes for large powers is anything but profitable, and it is therefore advisable to use movable electrodes placed in a central position above the bath. Bottom electrodes have also their drawbacks, because a conductor placed in this position would weaken the construction of the furnace itself, causing difficulties and making continuous work impossible. In furnaces to which the energy is conveyed through the bottom, it is also necessary that the floor should be a good conductor, and it might thus be made from carbon electrodes; but

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such a floor would be very unpractical for certain products, as, for instance, iron, because the whole floor would gradually be corroded. In large furnaces, *i.e.*, for large quantities of energy, there is thus no other way of conducting the energy to and from the furnace than by means of vertical electrodes, which are suspended, and are easy to regulate. This arrangement has also the great advantage that the size of the electrode bundles can be increased at any time as it may be required, so that it may become possible to raise the efficiency of the furnace. The employment of an electrode at the bottom forms a striking contrast to the above-mentioned system, because the difficulties increase in proportion to the load, and this would completely frustrate the development of really large plants.

To conduct even 20,000 amperes through the floor of a furnace involves great technical difficulties, and, as far as is known, no one has ever attempted to go beyond that figure. In addition to this, it has also to be considered that by the employment of bottom electrodes the floor of the furnace is heated, producing an injurious effect on this very important part of the furnace. By employing vertical electrodes all these drawbacks are avoided, and the possibilities of operating with large quantities of power are almost unlimited. There are now furnaces that have been in operation for the last seven years, and working with 40,000 amperes per bundle of electrodes without any difficulties, and it is only a question of time for a higher load to be employed. Large electrical furnaces will thus generally have the appearance of a square or circular short shaft, in which the electrodes conducting the energy to and from the furnace hang freely, and here it is now necessary to mention something about the form and construction of such furnaces.

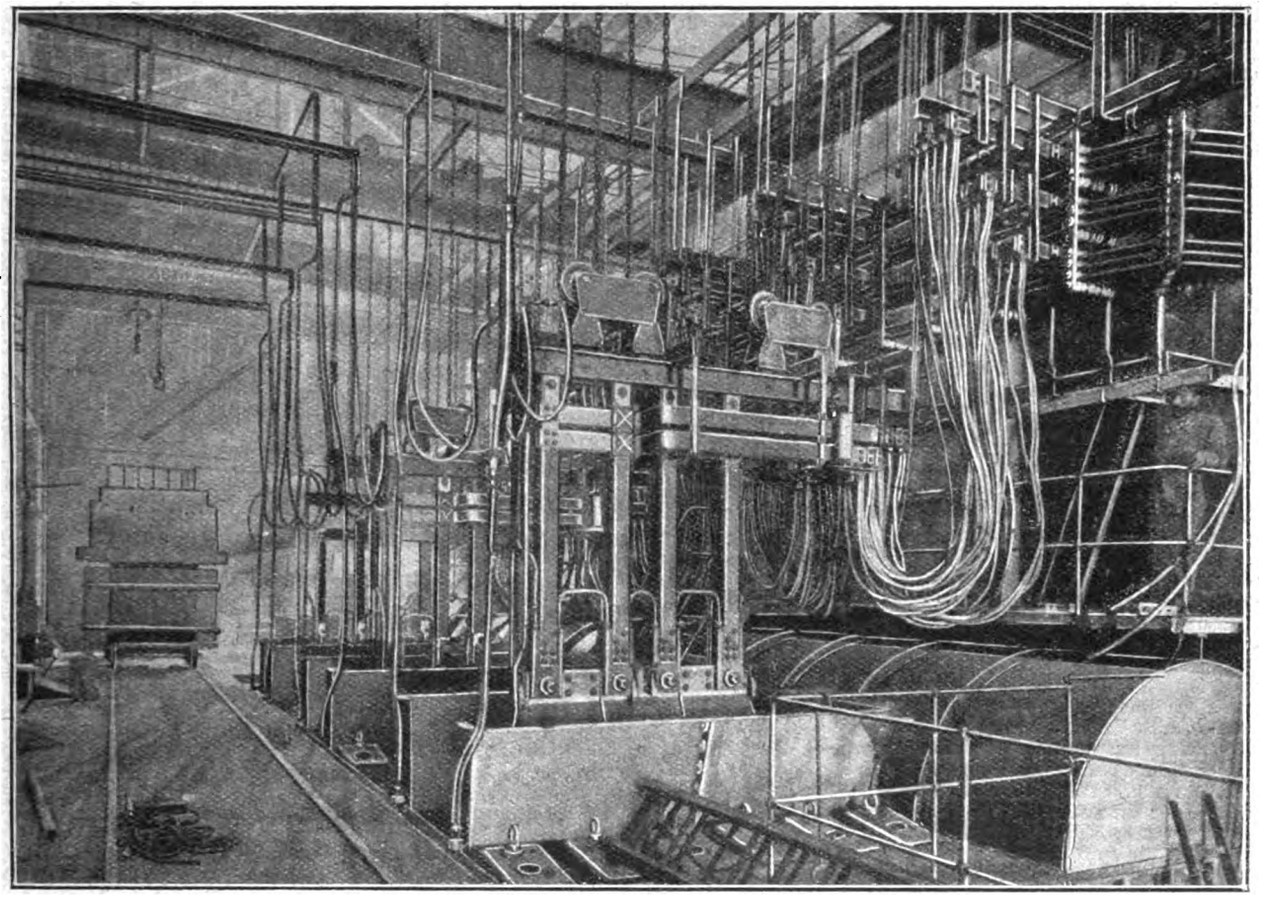

Fig. 2.—Row of Helfenstein Furnaces, Top View; Electrodes in Position.

For furnaces in which ordinary fuel is employed, the most common shape of the furnace has been the circular form, for the reason that this construction was the most suitable one for an easy arrangement of the supports. In the commencement the same pattern was also adopted for electrical furnaces, but as the furnaces increased in size it soon became necessary to adopt a form which was in accordance with that of the electrodes. For large quantities of power only electrodes in bundles can be employed, and as these, for various reasons, have to be manufactured with a rectangular cross-section, it also became necessary to give the shaft of the furnace a rectangular or oval form. This is the chief reason why all the large and open electrical furnaces are now constructed in the form of a square shaft with the electrode bundles, of which there are two or more, hanging in a vertical position, and parallel with each other. The number of the electrode bundles depends chiefly on the current employed, and two, or several, double bundles are thus used for continuous or single-phase alternating current, whilst three, or several bundles made up from three, electrodes are used for three-phase current. It is, however, almost out of the question to employ continuous current for the manufacture on a large scale, because the plant would become too expensive, and in addition to this, the working expenses would also be too high on account of the wear of the brushes and the commutators. There are also certain difficulties connected with the transmission of continuous current, for which reason only single-phase or three-phase current is employed in the electro-metallurgical industry on a large scale. But here comes in, especially in large electrical furnaces, the effect of phase displacement, increasing the capital expenditure, because the generators have to be constructed with larger dimensions in order to be able to supply a certain amount of power. A power factor of 0·8 may pass, and it is possible to limit it to this figure in large three-phase furnaces with a capacity of up to 12,000 H.P., when certain precautions are taken with regard to the frequency and to the supply of the secondary current. It is even possible that the same result may be achieved with larger amounts of energy without any corresponding increase of the phase displacement, but this depends first of all on the construction of the plant. When the furnaces are closed, it will become possible to place the transformers so near them that the secondary conductors become very short. And here we arrive at the main problem in connection with large electrical furnaces, viz., the closing of the furnaces, and, in consequence thereof, the utilisation of the gas. Free combustion of the gas above the open furnace represents a great drawback, which grows in proportion to the increase of the load. The intense heat has, first of all, an injurious effect on the conductors and on the electrode holders. The conductance of the conductors is considerably reduced, and their durability as well, for which reason either the dimensions must be enlarged or cooling arrangements must be provided. Secondly, the workmen are exposed to the heat and smoke from the large open furnaces to such a degree that their working capacity is reduced, for which reason the number of men must be increased. There are thus sufficient reasons for employing closed furnaces and providing for the removal of the furnace gases. These have, moreover, a high thermal value, which should not be overlooked, especially in cases where the object is to produce metals, and iron in particular, because the electric furnaces have to compete with the ordinary type, in the working of which the utilisation of the gas plays an important part.

The lecturer has worked upon the problem of closing large furnaces since 1906, when he succeeded in getting into operation furnaces with a capacity of up to 12,000 H.P. for the production of carbide and ferro-alloys. The solution of the problem depends on the three following factors:—

1. A durable cover or roof.
2. The utilisation of the gas.
3. The charging to be made continuous.

The first question was solved by building water-cooled partitions between the electrodes, which served both as supports for the arch and as charging funnels. In these funnels the electrodes hang freely, and are movable and surrounded by the charging material. Underneath the roof the partitions form chambers, in which it is easy to collect the furnace gases. These chambers are connected with a common gas-pipe for the removal of the gases, which run

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alongside of the furnace. The space around the electrode is closed by the charge itself, and the work is conducted in such a way that the furnace is always kept under a slight pressure of gas, *i.e.*, small gas flames are formed around the electrodes above the roof, which prove that no air is being admitted to the furnace. Years

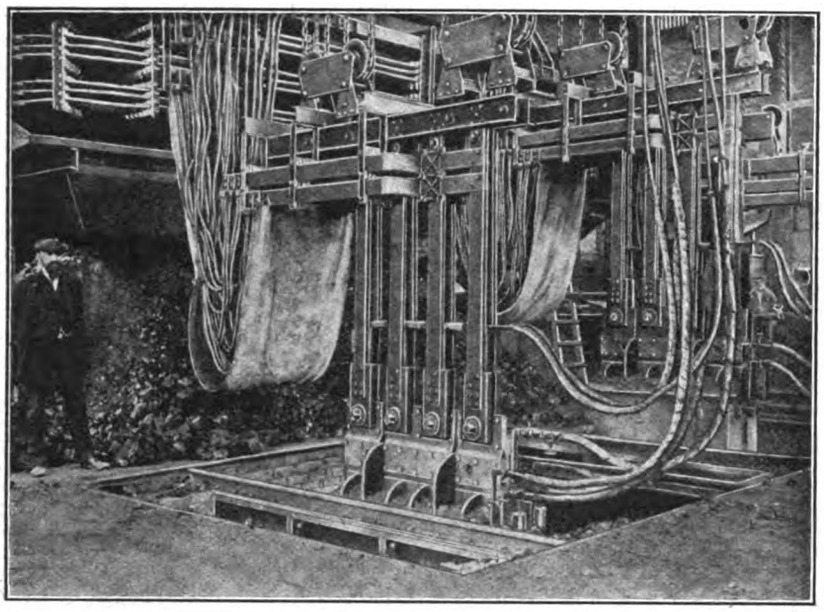

Fig. 3.—Suspension of Carbon Electrodes, and Flexible Connections for Electricity and Cooling Water.

of experience have shown that this principle answers the purpose for carbide and ferro-alloy furnaces with a capacity from 6,000 to 12,000 H.P.

It is obvious that the capital cost of buildings and plant is considerably less for large than for smaller plant in proportion to their capacity. Large furnaces require much less space than an equivalent number of small furnaces, and if a comparison be made between carbide furnaces of 1,000-1,500 H.P. and large closed furnaces, the capital expenditure for the former, including buildings and electrical plant and outfit, will amount to about £4 9s. per H.P., while the cost of the latter will scarcely exceed £2 10s. or £2 16s. per H.P.

As regards labour, a 10,000-H.P. furnace will require no more than seven men per shift, while 10 single-phase furnaces of 1,000 H.P. will require double the number.

The consumption of working materials in large furnaces will scarcely be more than one-half or one-third of the corresponding consumption for small furnaces, and in addition the conductors are protected against heat and smoke, for which reason they are more durable, while the loss of energy in the secondary conductors is also far less.

As regard the efficiency, this is not much higher in large furnaces than in smaller ones of 1,000 H.P., for instance, if the loss of energy, arising from the employment of bottom electrodes, be not taken into account. The utilisation of the current in small furnaces has been brought to such a stage that it would be difficult to improve upon it. As regards the consumption of electrodes, this is higher in large than in small furnaces, on account of the higher voltage employed, but this is compensated for by the electrodes being protected against the air by the charge.

It is also an advantage with large furnaces that the working on the whole is facilitated, and that it is easier to supervise the whole plant. By means of certain arrangements in connection with the transformers, it has also become possible to operate with large variations of the supply of power. Furnaces that are constructed with a rating of 10,000 H.P. can thus be kept running for months with only 4,000 H.P., without any harm being done either to the furnace itself, or to the working, on the whole, from a technical point of view, and this is one of the most important advances recorded in the technics of large furnaces, that a furnace constructed for a certain medium load can be worked with a much higher load, as well as with a much lower load, without injury. The furnaces are now constructed in such a way that they can be kept running for years without any repairs worth mentioning being required.

As regards the removal of the furnace gas by means of suction, this can only be done profitably in large furnaces, because the supply of gas in small furnaces is so small and irregular that it would be very difficult to remove gas of a sufficiently good quality constantly and regularly.

On the basis of the experience gained from the construction and working of large furnaces for the manufacture of carbide and ferro-alloys, the lecturer and his engineers turned their attention to the problem of producing electrically pig-iron directly from iron ore, which has resulted in the construction of the large electrical furnace at the Domnarfvet Iron Works in Sweden.

The fundamental principle of this furnace is the same as that of the other carbide and ferro-alloy furnaces, and, therefore, there has not been employed any shaft for the material, as it was of great importance to make the construction of this furnace, which is the first one of its kind, and may thus be regarded as an experimental furnace, in which the gas is removed close to the place in which it is produced, as plain and simple as possible. The question about the shaft is, however, left open, to be decided at a future date.

The furnace was started in May, 1913, and worked well from the commencement. It was constructed for a load of 10,000 to 12,000 H.P., and the dimensions of the conductors are in accordance therewith. However, it was soon found that it was quite impossible to employ the above-mentioned power, because the generators at the Domnarfvet power station were working at a frequency of 62 cycles per second, resulting in so low a power factor that it was not practicable to run up to 10,000 H.P. The furnace was then worked with 6,000 to 8,000 H.P.—*i.e.*, 120 volts between the phases and 26,000 amperes per bundle of electrodes—and with this load it became possible to limit the phase displacement to $\cos \phi = 0{\cdot}8$. The maximum output of the furnace was 65 tons of pig-iron per day of 24 hours,

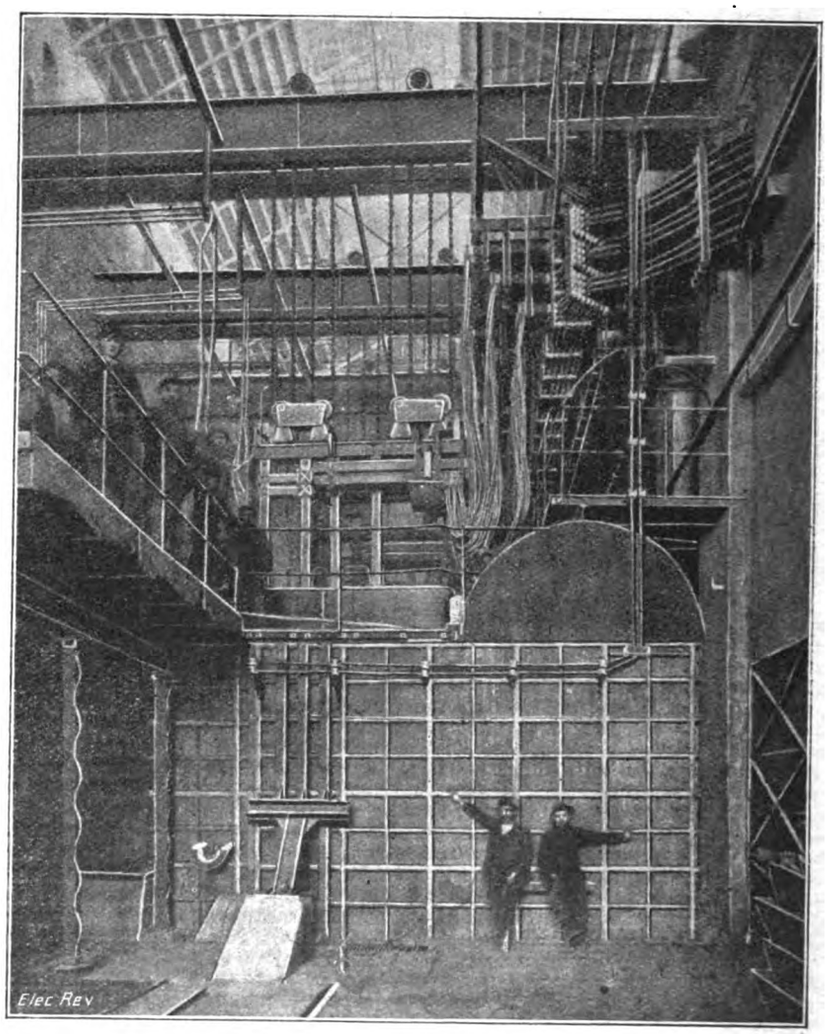

Fig. 4.—Helfenstein Furnaces, from Lower Floor.

and the average production per month varied between 1,200 and 1,600 tons. The consumption of energy, fuel and electrodes, per ton of pig-iron, was, on the average, as follows, the ore containing

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60 per cent. iron :—Energy 2,000 KW.-hours; charcoal, 330-400 kg.; electrodes, 7 kg.

The calorific value of the furnace gases amounted to 2,800-3,000 calories per cb. m.

A comparison with the Electro-metal furnace is somewhat unfavourable to this furnace in regard to the consumption of energy and fuel, while both furnaces are about equal in respect of the consumption of electrodes, as this can certainly be reduced to an average of 5 kg. per ton of pig-iron. On the other hand, the present furnace has the following advantages :—

1. The capital expenditure is considerably lower, viz., about £2 15s. per H.P. for the whole plant, while the Electro-metal plant involves an expenditure of £4 9s. for a corresponding plant.

2. A richer gas is produced in this furnace, having a heating value of 2,800-3,000 calories, as compared with only 2,300 calories from the Electro-metal furnace.

3. The whole plant is easier to work and can be better controlled and supervised. This large furnace can be started much more easily and quickly than the large shaft furnaces of the Electro-metal type, and it has thus been possible, even after a stoppage of two or three days, to start the furnace and have the full load on in the course of 10 to 15 minutes, after which the tappings can be made in the normal course after a few hours.

It is of special importance that additional materials can be added to the charge directly at the melting place, because the effect will then be an immediate one. In furnaces with high shafts it may sometimes take hours before the additions are able to reach the smelting zone. The working of the low smelting furnaces is also considerably safer than that of the shaft furnaces, as there is no danger of explosions taking place.

4. Pulverised ore can be employed without any risk of obstructing the smelting process, and it need scarcely be pointed out that this is one of the greatest and most important advantages of the whole system. At Domnarfvet charges were employed with up to 70 per cent. of "slig" (not briquetted) without the working being obstructed in any way. As an experiment, 30 per cent. of dust from the throat of the furnace was added to the charge without any injurious effect on the smelting process being observed. This circumstance that the furnace can be worked with such large quantities of slig is of the utmost importance under the conditions obtaining in Norway.

5. Minimum of labour. The number of men required for a 10,000 H.P. furnace is as follows :—Three chargers, one regulator, and three men for the tapping, or seven men per shift in all. Out of the total number of 21 men, three men for the charging may possibly be dispensed with, if a charging-crane be employed.

6. In the utilisation of coke for the reduction, we have arrived at the real crux of the question of electrical pig-iron. The conditions for the employment of coke as a substitute for charcoal are the following :—

(*a*) A lower pressure in the smelting furnace and a higher current density in the electrodes.

(*b*) The removal of the furnace gas after it has passed the comparatively thin layer of materials which covers the smelting place. In other words, large shafts for the pre-reduction ought to be avoided.

In large furnaces it is possible to employ a higher voltage than in small furnaces, no matter what the process is, and this applies also to working with coke for the reduction, but the pressure cannot be kept as high as when charcoal is employed. With charcoal it is easy to work with 70 volts per phase, while this figure with coke must be reduced to 50-55 volts per phase. The reason for this is the high conductivity of the coke. It should, however, be observed that the development in this direction is not a closed chapter, and it is thus quite possible and probable that a higher voltage can be employed later on with coke as fuel. For working with coke a greater current density in the electrodes is required on account of the lower voltage and the greater weight of the ore per unit of volume. With charcoal as reducing agent, the density of the current in the electrodes need not exceed 2 to 3 amperes per cm.^{2}, while with coke it should be at least 4, or preferably 5-6 amperes per cm.^{2}. Owing to these circumstances, and in consequence of the unsuitable frequency of the generators at the power station, it became necessary to reduce the load on the Domnarfvet furnace to 5,000-5,500 H.P. when coke was used for the reduction, but with this load the smelting proceeded without any difficulties.

The second condition for the employment of coke is a speedy removal of the gas from the furnace, and the gas should consequently not have to pass through thick layers of materials, as this might lead to explosions.

Bridges and empty spaces are easily formed in a furnace by a material like coke, and this is one of the main reasons why large shafts, filled with charging materials through which the gases must pass, are not to be recommended in connection with coke as reducing agent in large furnaces. If coke is to be used the only shafts permissible are the low ones, so that the gases will have to pass through only a thin layer of materials. This represents in one sense a disadvantage, viz., that the reducing power of the gas is not properly utilised. The gas obtained will be rich in CO, while the consumption of energy and coke, on the other hand, will increase.

With coke the consumption of energy in the large electric furnace has thus been 2,400 KW.-hours per ton of pig-iron (60 per cent. Fe), while that of coke amounted to 310-320 kg., and the consumption of electrodes to the same as with charcoal, viz., 7 kg. per ton of pig-iron.

In order to review the whole situation it is, however, necessary to look into the question of the gas problem. When it is thus by the employment of coke, not possible to utilise the furnace gas fully in the large furnace itself, there must be found a way for utilising it outside the furnace. It is well known that these gases, which are so rich in CO, can be employed for a pre-reduction of the iron ore in the so-called rotating furnaces, and it should thus be the most natural solution of the problem to connect the large furnaces with rotating furnaces, in which a preparatory reduction of the ore is effected before it reaches the large furnace. This refers to ironworks which are only engaged in the manufacture of electrical pig-iron, and in which there is no other use for the gases.

These can be utilised in the manner described above, and it is obvious that the consumption of energy and of electrodes per ton of pig-iron can thus be reduced considerably. In such works where the electrical pig-iron is going to be employed for the manufacture of steel, the gases can, of course, be used for the heating of the Martin furnaces. This is now being done at Domnarfvet, where the gaspipes from the large electrical furnaces are connected with the steel works. In this way it makes no difference at all in regard to the cost of the finished product of steel, whether a smaller quantity of coke is used in the electric furnace, from which an inferior gas is produced, or there is consumed a larger quantity of coke, which is able to produce a rich and valuable gas for the further treatment of the pig-iron. But the gas problem has also a third side worth looking at, which may be considered to be of just as much importance, although for the time being it will have to stand in the background.

As far as it is known there is no apparatus at the present time which is capable of producing such pure carbon-monoxide as the electrical furnace, and it is produced from the large plants in such quantities, and with such regularity that there ought to be great scope for the utilisation of this excellent material for the synthetic manufacture of organic substances. This gas is really far too good to be used as fuel, and if judged by its purity and by the readiness with which it enters into chemical combination, its real function ought to be to serve the chemical industry. Carbon monoxide represents the connecting link between the electrical pig-iron industry and the chemical industry on a large scale. If pure carbon monoxide be conducted over caustic soda, there will be formed sodium formate which can be easily transformed into oxalic acid, and this is one way of utilising carbon-monoxide. Another possibility for its utilisation is to produce oxymethylene, CH_2O, from which it should not be impossible to produce synthetic sugar. These are chemical problems, which can, of course, be multiplied, but the fact that pure carbon-monoxide can now be obtained from the electric furnace in connection with the production of electrical pig-iron seems to open a very wide field of future possibilities to this industry.

It should also be mentioned that coke produced from peat would represent an excellent material, which would, no doubt, be of vital importance in countries like Norway.

In conclusion, it should be stated that the question of charging will most probably be solved by arranging shafts for the materials around the electrodes. Such an arrangement would allow of an easy and continual charging, and these shafts will not, if coke be used, be employed for the pre-reduction of the ore, as it is the intention to remove the gas through an opening as far down in the furnace as possible.

COSTING.

BY "SURPLUS."

AN efficient and simple system of costing will no doubt be acknowledged to be an important factor to-day in electrical supply, and, as competition grows keener, those in charge of electrical undertakings will require costs statements more and more analytical, in order that every increased item of expenditure, however slight, may be obvious, and steps may be taken to prevent further increases, if possible; and, further, that the effect of economies instituted may be plainly seen, as this displayed in £ s. d. is undoubtedly an incentive to all concerned to work with a view of furthering that desirable and necessary result—"efficiency consistent with economy."

The remark has been made that the days of the economist of the coal-heap are over, but economy will still have to be exercised. No doubt in the past the revenue-earning side of electrical supply undertakings was more or less shelved in favour of the operating departments, but this state of affairs exists no longer in up-to-date undertakings. With publicity campaigns, smart advertising, showrooms and canvassing, the revenue-earning side is receiving more than ordinary attention; but whilst admitting that every attention should be given for the purpose of increasing the number of consumers, we must not lose sight of the fact that the expenditure also merits attention, as, whatever the increase of revenue may be, expenditure is relative to profits, and the cost per unit sold governs the result; therefore an efficient system of costing is necessary so that the progress of an undertaking can be observed at any time, and not only after the expiration of the financial year.

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For this purpose many advocate a card system, and in the case of a manufacturing undertaking, where cards follow the manufacture of an article or a piece of machinery through various departments to the assembling room, it is, no doubt, the up-to-date system; but with regard to the electrical supply industry, this is not necessary, and better results may be obtained by a simple system of works order numbers in conjunction with the use of a loose-leaf ledger. Card-trays, to say the least, are cumbersome, and where they can be dispensed with for account-keeping it is desirable to do so. The loose-leaf ledger answers the same purpose and, moreover, is easily handled, the sheets cannot possibly be mislaid, except wilfully, inasmuch as they are never taken away from their particular location, except when the matter is dead, or the data therein relate to a past period and the accounts for such period are closed, when they are placed in one or other of the makes of mechanical binders for future reference.

The system hereafter described can be made to suit any conditions of supply. It may be thought that the system is too analytical, but it takes very little longer to allocate to 100 accounts than to 50; further exception may be taken to the amount of space used; however, paper is cheap and inefficient records expensive, and further, the system is described minutely in order to show how the accounts can be dissected to a degree if the particular conditions render it necessary or desirable.

Works Order Numbers.—These are arranged as far as possible in the same manner as the Board of Trade returns, so as to facilitate the filling-in on the statutory forms of the necessary information.

A number should be given to each principal account and subsidiary accounts should be numbered as shown :—

WORKING COSTS.

1. *Generating.*
   - Coals ..... 1·1
   - Oils, waste, &c. ..... 1·2
   - Wages ..... 1·3

MAINTENANCE AND REPAIRS TO STATION PLANT.

2. *Boilers.*
   - Boiler No. 1 ..... 2·1
   - ,, ,, 2 ..... 2·2
   - ,, ,, 3 ..... 2·3
   - ,, ,, 4 ..... 2·4
3. *Engines.*
   - ..... 3·1
   - ..... 3·2
4. *Generators.*
   - ..... 4·1
5. *Pumps and Pipes.*
   - *
6. *Buildings.*
   - *
7. *Electrical Instruments.*
   - *

DISTRIBUTING CHARGES.

8. *Wages*
   - ..... 8·1
   - ..... 8·2
9. *Rent, Rates and Taxes.*
   - *
10. *Management Charges.*
    - *
11. *Law Expenses.*
    - *
12. *Insurances.*
    - *
13. *Public Lamps.*
    - *

* Subsidiary accounts added as required, and numbered ·1, ·2, ·3, and so on.

There is no hard-and-fast rule regarding the order of the accounts, and this is only an example; the accounts can be arranged in any manner to suit either Board of Trade requirements or local conditions.

A printed copy of the works order numbers should be handed to all interested, and the various superintendents will mark the pay-sheets, stores orders, &c., with the number relative to the account to be charged.

Wages Accounts.—It is not proposed to deal here with any methods of time-keeping, but purely with account-keeping.

The following is a summary sheet for a week, and for the purpose of simplicity it is proposed to deal with one main account only—viz., maintenance of engines. The wages of drivers, &c., will, of course, be charged to Generating W.O. 1·3.

Fitter John Smith has been doing repairs to turbines Nos. 1, 2 and 3; the time-sheet is therefore as follows :—

TIME SHEET.

Name..... *Week ending* ....., *191*

Day.	Time.	Hours.	W.O.	Description of work.
Thursday ...	6.30			Particulars to be filled in.
	8.30	2	3·1	
	9.0			
	12.0	3	3·2	
	1.0			
	5.30	4½	3·3	
Friday ...				
Saturday ...				
Sunday ...				
Monday ...				
Tuesday ...				
Wednesday ...				
	Total ...			

Certified ....., *Superintendent.*

This time-sheet is self-explanatory, but there yet remains the weekly summary of time chargeable to each particular account. This is dealt with as follows :—A small summary slip gummed at the left-hand edge is affixed to the time-sheet, and the total week's time chargeable to each particular works order is totalled and entered thereon as follows :—

WAGES ANALYSIS. *Date* .....

Hours	Work	W.O.	Rate	Amount
20	Repairs	3·1	8½	14 2
13	,,	3·2	8½	9 2½
20	,,	3·3	8½	14 2
53				£1 17 6½

From this analysis slip the time is then entered into the Wages Analysis Book as follows :—

WEEK ENDING ..... 191 .

Name.	Occupation.	Rate.	Generating.		Maintenance and Repairs to Station Plant.										Distributing Charges.				Management.								Total Time.	Total Wages.
					Boilers.		Turbines.		Generators.		Pumps and pipes.		Buildings.		Electrical instruments.		Distributing.		Sub-stations		Engineer's Department.		Clerical Staff.		Public lamps.		Capital			
			W.O. Time.	Amount.	W.O. Time.	Amount.	W.O. Time.	Amount.	W.O. Time.	Amount.	W.O. Time.	Amount.	W.O. Time.	Amount.	W.O. Time.	Amount.	W.O. Time.	Amount.	W.O. Time.	Amount.	W.O. Time.	Amount.	W.O. Time.	Amount.	W.O. Time.	Amount.	W.O. Time.	Amount.		
J. Smith.	Fitter.	8½					3·1	£ s. d. 14 2																				
							3·2	9 2½																				
							3·3	14 2																			53	£1 17 6½

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At the end of the month it will be necessary to prepare a summary of the total amounts chargeable to the different costs accounts, and the following will be found to be a convenient and neat method. Instead of writing the summary across the analysis rulings, which are not in keeping with the summarised data, a foolscap summary sheet, gummed at the left-hand edge, is inserted opposite the particulars for the last week of the month :—

Summary Sheet.

For Month Ending .....

——	W.O.	£ s. d.	£ s. d.	——	W.O.	£ s. d.	£ s. d.
Generating	1·3		100 0 0				
Maintenance and repairs :							
Boilers	2·1	1 10 0					
,, ...	2·4	2 0 0					
,, ...	2·5	3 10 0					
			7 0 0				
Engines	3·1	3 3 0					
,, ...	3·4	2 0 0					
,, ...	3·5	3 7 0					
(And so on)							

Stores Received and Issued Book.

Received.

Date	Quantity	Description	From	Invoice book page	Rate		

Issued.

Date	Quantity	Description	For	W.O.	Rate			

The stores issued will be entered up weekly from the Stores Issued sheets, all stores against the different works orders being grouped together thus :—

		£ s. d.
250 tons unscreened coal, generating	1·1	.....
25 gallons turbine oil, ,,	1·2	.....
28 lb. waste, ,,	1·2	.....

And so on. At the end of the month a summary sheet should be inserted in the same manner as for the wages analysis.

Invoice Book.

Date	——	— Details	Capital	Maintenance	Stock	Total

(*To be concluded.*)

"POOCHEES."

By CHARLES S. JEFFREY, A.M.I.E.E., A.Amer.I.E.E.

The word "poochee" may not be found in the English dictionary, but it is one which has a distressing significance for every one who has lived in India. It is from Tamil, one of the native languages of Southern India, and means literally "flea." It is, however, used colloquially as an inclusive name for all kinds of flying insects.

The fascination of the candle for the moth is proverbial, but as we in India know to our discomfort, it is not the moth alone which is so attracted. At certain seasons an extraordinary variety of flying insects are drawn in myriads by the high-candle-power lamps which are in vogue now in every town which boasts an electric supply system. Some of these are wonderfully beautiful, others equally hideous. For example, the writer has seen glorious moths 8 in. from tip to tip of the wings. A frequent visitor is a large flying beetle which has a body the size and shape of a walnut, and makes a noise like a synchronous motor out of step. The Memsahib, who is not an admirer of the Government, declares that his facial expression is exactly that of a prominent member of the Liberal Cabinet.

These creatures vary in size from the large ones mentioned to little ones no larger than a pin's point. One exasperated visitor, after an evening of torment, summed up the position feelingly when he declared that this town possessed "the fauna of delirium tremens." Fortunately we rapidly become accustomed to them, and in ordinary circumstances the majority of them do not cause us much inconvenience. Ladies who at home would shudder at the sight of a cockroach, after a few months here are indifferent to their presence on the dining table, and do not dream of rejecting the soup because some flying creature has taken an involuntary bath in it.

There are one or two among these insects, however, which compel attention, notably an odoriferous little beggar known in polite circles as the "smelling beetle," and in other circles by the more eloquent designation of the "stink bug." When one of these gets into the soup the dog will not touch it. When they get into Memsahib's hair one does *not* sing with the poet—

> O loaded curls, release your store
> Of warmth and scent, as once before.

In passing, it may be remarked that that king of pestilential nuisances, the mosquito, does not obey the same laws as most of the other insects. Like the poor, he is always with us. The lamp has no fascination for him ; on the contrary, he loves the dark. Whilst the other poor creatures are battering themselves against the lighting fixtures, he lurks under the table and draws sustenance from the ankles of any unwary human who has not provided himself with double hose. The mosquito is receiving a good deal of attention in scientific circles, and for the purposes of this article we are not concerned with him.

When the insects are numerous, travelling in brightly-lighted tramcars is a trying ordeal. Often the conditions are so intolerable that the traffic revenue is seriously affected. Reducing the illumination in the cars is of little use, because they of necessity pass close to the public lighting standards, at each of which there is a dense column of insects. The tramcar acts as a kind of butterfly net and collects numerous samples from each standard. These street arc lamps, by the way, are a source of profit to our Chinese friends, who collect a succulent type of grasshopper, which they are said to find a valuable article of diet.

It is possible to secure protection from these flying insects, and particularly from the mosquito, in the houses by fitting every door and window with fine wire mesh screens. However, in the Tropics, where every breath of wind is valued, people are loath to do anything which will interfere with the ventilation, unless the mosquitoes are present in sufficient numbers to make it imperative.

The cost of making a building mosquito-proof is very considerable. The plan has been suggested, and the writer believes carried into effect, of erecting powerful searchlights, close to which are placed large exhaust fans. These fans draw all the insects which collect round the searchlights into a receiver, from which they are removed periodically and used as manure. This also is financially out of the question.

It is well known here that by using ruby globes, or covering the lamps with red fabric, the number of insects attracted is very much reduced, and this is the plan which is usually resorted to. It is known that the eyes and ears of certain insects are not sensitive to colours and sounds over the same range as human beings, and it has been suggested to the writer that the efficiency of the red lamp is due to this

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fact. In the ordinary incandescent lamp the red rays do not constitute a very large percentage of the total light, and for this reason it is most uneconomical to use a red screen.

The only electric lamp known to the writer which is rich in red rays is the "Neon" lamp (described in a lecture delivered by the inventor, M. Georges Claude, at a joint meeting in Paris of the Institution of Electrical Engineers with the Société Internationale des Electriciens in May, 1913, and published in the *Journal* of the former Institution in October, 1913), and he has suggested to the manufacturers the desirability of experimenting with it in this connection. In the form in which it is at present made this lamp is not adapted for house lighting, but if the manufacturers realise that there is a market for it, it may be possible suitably to modify it. That there is a market for an efficient red lamp is evident from the number of houses in which the inefficient combination of metallic-filament lamp and red shade is in use.

It may be that the red ray is not the only one to which the insects are insensitive, and that a fuller investigation may reveal some other form of lighting which is equally efficacious.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,991. "Electric cooking apparatus." W. P. Perry. August 24th.

19,005. "Electrically-operated tramway points." L. T. Healey and B. D. Healey. August 24th.

19,013. "Systems of teledynamic control." J. H. Hammond, Jun. August 24th. (Convention date, September 8th, 1913, United States.) Complete.

19,017. "Electric starters for motor-car engines and the like." H. Leitner. August 24th.

19,045. "Telegraphy." W. M. Bruce, Jun., and United Telegraph & Cable Co. August 25th. (Complete.)

19,054. "Receiver for wireless systems." A. J. Roberts. August 25th. (Convention date, August 25th, 1913, Australia.) Complete.

19,057. "Speed-controlling devices for electric motors." British Thomson-Houston Co., Ltd. (General Electric Co., United States). August 25th.

19,078. "Electric cooking apparatus." W. P. Perry. August 26th. (Complete.)

19,110. "Electrical control of railway traffic and the like." H. H. Dyer. August 27th.

19,121. "Electrical continuity of electrical conduits and other tubes." R. W. Perry. August 27th.

19,122. "Electric switch-boards." C. H. Worsnop. August 27th.

19,150. "Anode supports for use in the electro-deposition of metals." S. O. Cowper-Coles. August 27th.

19,151. "Flux for soldering zinc surfaces." S. O. Cowper-Coles. August 27th.

19,152. "Process for obtaining adhesive deposits of lead upon iron and steel surfaces." S. O. Cowper-Coles. August 27th.

19,184. "Electric mains and the like." W. B. Woodhouse. August 28th.

19,191. "Lamp holder." St. Helen's Cable & Rubber Co., Ltd., and J. C. White. August 28th.

19,192. "Wall junction boxes for electric cables." J. C. White and St. Helen's Cable & Rubber Co., Ltd. August 28th. (Addition to 22,198/13.) Complete.

19,197. "Boxes or containers for electric batteries, chiefly designed for use on automobile vehicles and in like positions." F. H. Blecmel & Blecmel Bros., Ltd. August 28th.

19,198. "Electro-magnetic brake system for feed-reels and the like." H. V. James. August 28th.

19,232. "Iron alloy of low hysteresis and method of producing the same." S. O. Cowper-Coles. August 29th.

19,237. "Mechanism for printing-telegraph systems." E. C. R. Marks. (Morkrum Co., United States.) August 29th. (Complete.)

19,238. "Electro-magnetic track brake." Diedrich Storjohann. August 29th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

15,633. Engine Starting Systems for Automobiles. A. E. White (Dayton Engineering Laboratories Co.). July 7th.

16,040. Supply of Electricity for Heating, Lighting, and other purposes. A. F. Berry. July 11th. (Cognate application 26,494/13.)

18,008. Train Electric Control Systems. B. Starie. August 7th.

18,019. Automatic Signalling and Alarm Systems for Railways and the like. O. M. de Munnick. August 7th.

18,170. Cables for the Transmission of Electric Energy. J. G. Cunliffe and R. G. Cunliffe. August 9th.

18,502. Transformers for High-frequency Currents. J. Marconi and W. S. Entwistle. August 14th.

18,765. Oscillatory Electro-dynamic Apparatus for Submarine Signalling and other purposes. R. A. Fessenden. August 18th. (January 29th, 1913.)

19,366. Method and Apparatus for the Transmission of Messages or Designs such as Photographs, Cliches and the like. W. P. Thompson (Soc. Anon. des Telegraphes Edouard Belin). September 4th.

21,036. Telegraphic Receiving Apparatus. J. Gell. September 17th.

21,646. Electric Joint and Apparatus therefor. C. J. Beaver and E. A. Claremont. September 25th.

22,419. Lighting Systems. O. H. Mohr. October 4th. (October 5th, 1912.)

22,421. Resinous Condensation Products. British Thomson-Houston Co. (General Electric Co.) October 4th. (Addition to 24,254/12.)

22,782. Bells or Gongs. R. Nicholas. October 9th.

24,074. Automatic Safety Shunting-devices for Electric Arc Lamps. A. H Railing and A. E. Angold. October 24th.

24,569. Porous Containers or Diaphragms for Voltaic Cells. J. G. Lucas. October 29th.

24,594. Electric Switches or Circuit Breakers. F. B. Holt and H. Smith October 29th.

25,846. Apparatus for converting Alternating into Direct Current. H. Wade (D. A. Heyman). November 11th.

26,252. Apparatus for Perforating Strips in Dot-and-dash Codes or the like. C. F. Casella & Co., and R. M. Abraham. November 15th.

27,182. Electric Switches, Fuses and the like. British Thomson-Houston Co., and E. B. Wedmore. November 25th.

28,075. Electric-fuse Holders. H. W. Young. December 5th.

1914.

66. Electrical Apparatus for imparting Intermittent Motion at Predetermined Intervals. A. C. Banfield. January 1st.

597. Equipment for Producing Welded Seams by means of the Electric Arc and added Welding Material. F. W. Heuser. January 8th. (July 29th, 1913.)

2,628. Spark-Plugs. P. T. Campbell. January 31st. (January 31st, 1913.)

3,149. Electrical Regulators. F. W. Merrill. February 6th.

3,699. Electro-Magnetic Relays. Western Electric Co. (Woodward, acting for Western Electric Co.) February 12th.

3,919. Starting and Lighting Devices for Motor Vehicles. Willocq Regnault et Cie. (November 5th, 1913.) February 14th.

4,619. Telephone System. P. Lavery & W. E. Bandlow. February 23rd. (February 24th, 1913.)

4,822. Method of Fixing and Preserving Metal Fence-posts. Telegraph Posts and the like driven into the ground, and devices therefor. C. A. Denis. February 24th.

5,247. Systems for the Transmission of Electrical Energy. T. Shaw. February 28th. (February 28th, 1913.)

5,640. Telephone Instruments. Compagnie Francaise Pour L'Exploitation des Procedes Thomson-Houston. March 5th. (April 4th, 1913.)

6,352. Vapour Electric Devices. E. Weintraub. March 12th. (March 13th, 1913.)

7,201. Electrical Connection for Electric Relays. C. Stille. March 21st.

8,807. Supports for Electric Lamps. C. A. Schaefer. April 7th. (January 2nd, 1914.)

10,082. Safety-devices for Electric Circuits. Siemens-Schuckertwerke Ges. April 23rd. (May 3rd, 1913.)

10,794. Duplex Telegraphy. F. Ryan & The Eastern Telegraph Co. May 1st.

14,119. Electric Accumulators. A. Dinin. June 11th.

14,686. Construction of Electric Pocket-lamp, Dry Batteries and Outer Shell or Case containing the aforementioned Dry Batteries. J. S. Hamilton. June 18th. (Divided application on 3,643/14. February 12th.)

Natal Contracts and Public Tendering.—Amended regulations relating to tenders and contracts for the provincial administration of Natal came into force on August 1st. Under these rules, subject to certain reservations, all public works exceeding £250 in value, all new supplies and services exceeding £100, and all recurrent supplies and services exceeding £50 in value in any financial year are to be put up to public tender. The text of the regulations may be seen by United Kingdom manufacturers and contractors at the Commercial Intelligence Branch of the Board of Trade, in London.

Electric Annealing Furnace for Brass and German Silver Ware.—A recent issue of our American contemporary, *Metallurgical and Chemical Engineering*, describes an electric interheating furnace for annealing brass and German silver flat-ware blanks which has recently been installed by a well-known maker of plated goods at Niagara Falls. The furnace measures 15 ft. × 8 ft. × 7 ft. 6 in. high, and has doors at both ends.

A mechanical pusher operated by compressed air is located at the charging end, the material being packed in steel pans 20 in. sq., which are pushed through one after the other, seven pans being in the furnace at once. The pans are supported on cast-iron grids while in the furnace, and when discharged are automatically dumped into a water-sealed discharge hood, the metal falling into a tank of water or pickling solution, while the pan is caught, held suspended, and may be removed from under the water-sealed hood.

The compressed-air operation of the furnace is largely automatic; the front and rear doors open simultaneously to admit the new charge and release the original charge; as the automatic pan dumping mechanism operates, the pusher recedes from the charging side of the furnace and both doors close.

The dumped material falls into a perforated copper basket for removal; it is not exposed to the atmosphere at any time after entering the furnace until cold, and this eliminates possibility of oxidisation.

The electrical equipment consists of a special 200-K.V.A. transformer, with 12 voltage taps, connected to a special controller, and arranged to give very fine voltage regulation. A Weston wattmeter and a Foxboro pyrometer are provided, the latter connected up with a 48-in. couple placed directly over the pan about to be pushed out of the furnace.

The use of this furnace has demonstrated clearly the superiority of continuous electric furnaces for the class of work handled, as the exact temperature requirements can be met, and the risk of oxidisation is *nil*.

The plant was installed by the Electric Furnace Co., of America.

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THE

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VOL. LXXV. SEPTEMBER 18, 1914. No. 1,921.

ELECTRICAL REVIEW.

Vol. LXXV.] CONTENTS: September 18, 1914. [No. 1,921.

	Page
Patriotism or Prejudice?	385
Lead	386
Task Setting and Efficiency	387
Suspension of Creditors' Remedies	387
Correspondence—	
Strange Behaviour of a Motor	388
Arc Lamp Globes	388
Arbitrary Action of a Public Authority	388
Carbons	388
New Electrical Devices, Fittings and Plant (*illus.*)	388
Trading with the Enemy	391
War Items	393
Business Notes	398
The Works of Messrs. T. Harding Churton & Co., Ltd., Leeds (*illus.*)	399
A New Cable-Repairing Steamship (*illus.*)	401
Notes	406
City Notes	409
Stocks and Shares	409
Market Quotations	410
The Rating of Bare Copper Conductors, by W. A. Coates	411
Costing, by "Surplus" (*concluded*)	412
A New Electric Tractor (*illus.*)	413
The Faraday Society	414
British Bulbs for Electric Lamps (*illus.*)	415
Legal	415
Foreign and Colonial Tariffs on Electrical Goods	416
New Patents Applied For, 1914	416
Abstracts of Published Specifications	416
Contractors' Column	Advertisement page xviii

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PATRIOTISM OR PREJUDICE?

IN view of the anxiety that legitimately possesses the minds of so many traders lest they should be guilty of trading with alien enemies, we publish elsewhere the terms of the King's Proclamation, issued last week in supersession of previous announcements on the same subject. We also print extracts from the new Bill imposing penalties upon those who fail to obey the Proclamation, and the remarks made by the Attorney-General when the Bill was before the House of Commons. The provisions should be very carefully studied, and we have no doubt that they will be. It has, of course, been impossible to cover in detail all the points likely to arise, and recognising this difficulty, the Government has appointed a Trading with the Enemy Committee; queries respecting doubtful points should be addressed to the secretary of that committee at the Treasury. With the assistance that it may be possible to obtain from that authoritative source, and with the Somerset House files relating to companies and their shareholders and shareholdings available for inspection, traders should be able to ascertain what is the correct course for them to pursue in particular cases as they arise.

It is incumbent upon everybody, both for his own protection and in the best interests of British trade expansion, to refrain from doing anything which shall in any way benefit the nations with which we are at war, and we have every sympathy with those who are asking questions due to a genuine state of perplexity. With the best intentions in the world, no doubt, hundreds of people are asking whether so-and-so is an alien enemy under the new Trading Rules. But there are others who, we fear, are influenced more by a desire for an answer in the affirmative than by an anxiety lest they should transgress the law. We have ourselves received innumerable inquiries, most of which we have answered to the best of our ability, in the hope of assisting those appearing to us to be in a difficulty and genuinely in search of information. But we are not an evening newspaper, and we have no desire to flounder in the mire. There are too many who are showing themselves adepts at mud-throwing, whether with or without just cause, and seeing that public sources of information are available, we have no wish to make the ELECTRICAL REVIEW the vehicle for the conveyance of questions and reflections which are not made in a proper spirit and are best dealt with in other ways. By telephone message (anonymously), by post (anonymously), we have been favoured with multifarious items of information often in the form of inquiries. Some of the information that we are asked to furnish, we do not possess, nor have we facilities for obtaining it. We may have our own opinions concerning particular individuals or companies, but no reasonable firm will expect us, even from our coign of vantage, to utter publicly all our thoughts regarding such. Those who appear to regard us as a detective agency because we are editors, might be advised to remember that we may have "heard things" about others as well as about those concerning whom they ask questions or make suggestions. We suppose there is nobody who is called upon to "hear things," whether they be about individuals or about associations, so much as the editors of such a publication as this. The suggestions that have been made to us at different times would, for their sheer absurdity, be amusing enough in a London Electrical Charivari, but we are generally regarded as a serious technical and trade journal, and we prefer to spend our days in the matter-of-fact production of serviceable information rather than in making apologies for correspondents' indiscretions committed as the result of incomplete knowledge or information, or in whiling away hours at

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the Law Courts. The latter we have done time and time again when it has been in the interests of the electrical industry, but we are not inclined to repeat the process unless it is for some good purpose, at any rate some better purpose than the mere circulation of gossip calculated to damage somebody's reputation or other interests.

Frequently a good deal depends upon the inquirer or the critic. He may be a former employé, or even a trade rival, adopting the shield of anonymity behind which to hide in safety the while he makes insidious insinuations and reflections. Generally speaking, we have no great objection to anonymity, as we have seen that much valuable information obtains currency in that way that would never see the light without it; what we do object to is its abuse. When it is carried the length that it has been of late, we are obliged to write in this way. We give one experience. A telephone caller who declined to give his name informed us that a certain gentleman was a German—"his name used to be so-and-so." We knew that our informant was mistaken, and that the gentleman named was unquestionably an Englishman, and we corrected his information. We believe that he left the instrument a wiser, and, perhaps, a sadder man, having found that not every member of the Institution of Electrical Engineers knows all that is to be known about electrical men in London. We cite this experience, because we believe it to be typical of many statements based on incomplete information that are gaining currency just now. A second example of this sort of thing reached us early in the present week. A correspondent, evidently anxious to know the truth, informed us that his opinion regarding a certain company would have to be materially altered if something that he had read in a certain newspaper was correct. By the same post we received a detailed statement concerning the company mentioned, which showed that there was not the slightest foundation for the statement. The explanation appears on another page to-day, and we were able to set our correspondent's mind at rest promptly by post. Editors who have, as the result of long experience, been impressed with the desirability of making sure of facts before publication, do not see their way to allow themselves the very free licence that is used by some campaigning newspaper writers, and even by some of their own correspondents.

We publish in our "War Items" a further batch of letters relating to the proposed attack upon German capital in British electrical industry, but we think that in view of the fact that the Government has made it clear that it desires such concerns to be regarded as British businesses, it would be more profitable to devote attention to the actual measures that should be adopted for preventing future British electrical orders being placed in Germany or Austria, and for securing for British factories a greatly increased share of Germany's export trade. We venture to make a couple of suggestions. Following upon the views expressed in our leading article of last week, we propose that there be an effort made by some representative British electrical engineering or trading organisation to get into touch with leading representative electrical authorities of a like kind in France, Belgium and Russia with the object of sounding them as to the chances of our increasing our business connections with their countries. Though the war still rages, such steps should be taken at once. There will be a new co-operative spirit between all of the Allies, and we do not think that our attentions will be regarded with suspicion, for in the prevailing temper all of us together will be out to do as far as we can without Germany and German manufactures. We throw out the suggestion for what it may be worth. Our other proposition is that there be a combined effort on the part of British electrical manufacturers, large and small, past buyers of German electrical goods, including, of course, specialised lines, and, if necessary, financial authorities too, with the object of definitely proceeding to prepare ourselves for dealing with the classes of machinery, apparatus, and supplies for which we have too long placed too great a dependence upon German and Austrian works.

In our opinion, to direct our thought and action along such lines as these, and to deal in a thorough manner with the new trading possibilities that will open out for us as soon as hostilities are at an end, is likely to be more profitable for British industry than some other methods which are finding favour here and there at the present. Let us try to be ready, so that the opportunity does not slip through our fingers while we take isolated action and prepare belated schèmes.

The British Commercial Attaché at Frankfort (Sir F. Oppenheimer), just before the war broke out, reported to the Board of Trade upon the combined nursing effort which was in progress among German manufacturers, merchants and shippers who had formed themselves into societies for dealing with trade in foreign markets. Everywhere there was a strong movement in support of the effort; the Government was assisting, and the various societies had formed themselves into a union for the interchange of experiences. Military error has, however, deferred German commercial expansion; while some time-tables have gone wrong, the trade time-piece has not only stopped, but the hands have been put back. But there need be nothing to hinder success attending an immediate effort for British combined electrical nursing along the lines suggested above.

Lead.

THERE has not been a great deal of alteration in the position of the lead market during the past couple of weeks or so. The main feature has been the steady buying of metal on account of the needs of the British and allied Governments, these absorbing a good many thousand tons, while the requirements of the ordinary rollers, &c., are on a limited scale, and it is possibly significant that the past week has seen a slackening in specifications from the general consuming trades.

There has been a good deal of lead coming in available for disposal. This is shown by the fact that the agents for the Convention declared all their September lead on the first day of the month, when the premium on near deliveries practically disappeared, which bears silent testimony to the material relaxation of pressure which has been set up.

Production at all the main sources of supply has been much reduced. In Australia, for instance, there is a practical suspension of operations in the Broken Hill field, and a very similar state of things exists in Spain. The position of lead is, indeed, a very curious one. The output of the Broken Hill mines, which is won by British labour and capital, is handled by German houses practically exclusively, and it is felt that the time has now come when we as a nation can no longer allow our national resources to be exploited by the Germans. Hence it may be taken for granted that the end of the war will see a radical alteration in many industrial connections so far as the metal trade is concerned. It is most probable, for instance, that there will be increased smelting facilities provided for the Australian production, and that the world's lead trade can continue to be indefinitely controlled by the German Convention, which for years has had it in the hollow of its hand, is unthinkable. Hence the indications are pointing very clearly to an entire alteration in the position.

For the present there is an ample supply of metal available, and the imports into the country for the first eight months of the year show an increase over 1913, amounting, as they do, to 147,145 tons, compared with 136,704 tons in 1913, the August arrivals being 19,287 tons, against 17,189 tons last year. There may be a reduction in the arrivals coming forward later in the year, owing to the interference with output already commented upon, but it must not be forgotten that, meantime, all the lead available from Spain and Australia is coming to the United Kingdom, and that a good deal of this is lead which has been diverted here, and which, had not war broken out, would have gone to Germany. There is an all-sufficient supply on the market now, and as trade generally is poor, there need be no apprehension as to there being any scarcity. The easiness of the market, indeed, should be regarded as being assured. There have been some good orders placed for Russia; considerable quantities have been shipped to Archangel, and more is to follow. America has adopted an entirely passive policy, and nothing has been heard of offers from across the Atlantic for some weeks now. At round present prices there is not the least chance of America being a seller. According to returns just to hand, the stocks of bonded lead in the U.S. on June 30th were 6,461 tons, against 5,956 tons on May 31st, and 7,707 tons a year ago.

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Task Setting and Efficiency.

All the United States is apparently bitten with the magic of efficiency—no bad thing in its way, but one which in America calls to its aid a sort of universal cant of writers who bow down before the Juggernaut of Taylorism as though it were some deity or devildom to be feared.

In the *Transactions* of the American Society of Mechanical Engineers we have been told how one Walter A. Polakov reorganised a power plant along successful lines to such good purpose as to lead him to write a paper thereon. Mr. Polakov does at least start on a good basis. He has as datum so much steam to produce, and if he can keep this steam flowing with less coal than before, each fireman will be doing less physical work in stoking. But, to reduce this physical work of foot-pounds, he has to do much other work by way of observing gauges and apparatus, listening for the tinkling of a bell, and acting on its behests, so that, after all, may he not be more fatigued? Mr. Polakov rightly says that the opposition of labour organisations in some instances where greater efficiency is demanded of working men, without a lequate safeguards to their vitality and ability to work, is a just and well-grounded fight against the short-sightedness of some self-termed efficiency-experts. This dictum of Mr. Polakov is what thinking men have to say against Taylorism as a workshop religion. In this country the reverse has happened, at least, in the skilled trades.

In America things have gone to the opposite extreme especially where, unlike the case of the boiler house, there is no datum line. Better efficiency in a power house means, *primâ facie*, less manual work, unless it be followed by staff reduction. It is doubtless very difficult to reduce the coal, fired by six men, by one-fifth, and not feel that at least one man may go. The very reduction by one-tenth of the work may have so eased the men that they increased the tenth to a fifth; and to cut out one man might rub out the saving. It would certainly upset the men, f r men have always been upset by the almost inevitable decisions of piecework procedure. The author's studies are too long and involved to admit of their being reproduced. Suffice it to say that they were based on a series of tests made to determine the conditions of best efficiency, and as a result, a 70 per cent. heat efficiency was fixed upon as a task that could be demanded, the desired result being obtained by such an attention to the maintenance of fire conditions, regularity of firing, and so on, that a minimum of air was used in the furnaces. The task does not certainly appear very high, and, as a fact, it was exceeded in the attainment as a permanency of 73·1 per cent. for boilers which, when specially tested, gave as much as 76 per cent. on 89·6 per cent. load and 77·66 on a load of 115·5 per cent. of the rating. The permanent level of 73·1 per cent. represented a saving of 25 per cent. of the fuel bill without any capital expenditure beyond that necessary for a few extra instruments.

The firemen's pay amounted to 10 to 15 per cent. of the coal bill, so that in saving 25 per cent. of the coal bill, there was evidently a good sum available for a bonus to the men. If a power station can be fired for a tenth or a seventh of the coal bill, it would be interesting to have some genuine information as to the comparison between a hand-fired station on one hand, and the same machine-fired, including capital charges on the machines. So large a station on this side of the Atlantic would probably be machine-fired.

Incidentally, the studies indicated that a man working 12-hour shifts was 4·5 per cent. less efficient than the man working eight-hour shifts. If the 4·5 per cent. is the difference in the fuel efficiency, it would hardly appear to warrant the eight-hour shift, which would cost 5 to 7½ per cent. of the coal cost if the wages per shift remained the same. But, anyhow, 12 hours is too long for a shift. It is only fair to say that the author puts forward his views with every consideration for humanity in his words, in spite of our prejudice.

SUSPENSION OF CREDITORS' REMEDIES.

[FROM OUR LEGAL CONTRIBUTOR.]

Creditors who imagine that upon the abolition of the Moratorium, their difficulties will be at an end, are doomed to disappointment. In our issue of September 11th we drew attention to the fact that writs will be numerous as soon as the time mentioned in the proclamation which postpones payment of debts comes to an end: but an Act which was passed on August 31st may do much to render the issue of a writ of little avail in order to secure the payment of a sum due. Nay, more, the measure in question may even have effect to prevent security being enforced.

The Act is termed the Courts (Emergency Powers) Act, 1914. It provides that after August 31st no one may proceed to execution on, or otherwise to the enforcement of, any judgment or order of any Court (whether entered or made before or after the passing of the Act) for the payment or recovery of a sum of money to which the Act applies, *except by leave of the Court.*

The Act applies, practically speaking, to all debts due under contracts made prior to August 4th, 1914. The only exception is rent due under a lease where the rent does not exceed £50 per annum. Such rent cannot be recovered except in accordance with the provisions of this Act whether the lease is entered into before or since August 4th, 1914.

The powers of the Court are thus defined. If a creditor applies for leave to enforce a judgment, and the Court is of opinion that time should be given to the person liable to make the payment on the ground that he is unable to make the payment immediately by reason of circumstances attributable directly or indirectly to the present war, the Court may, in its absolute discretion, after considering all the circumstances of the case, and the position of all the parties, by order, stay execution or defer the operation of all such remedies as aforesaid (as to which see *infra*) for such time and subject to such conditions as the Court thinks fit.

The following are a few examples of the kind of payments, the discharge of which may be suspended by the Court under the powers above mentioned:

(*a*) The price of goods or machinery sold and delivered under an agreement or contract made prior to August 4th;

(*b*) Rent due under a lease made prior to August 4th;

(*c*) Instalments due on the hire of machinery.

The operation of the Act is not, however, confined to judgments. The other remedies which are sometimes open to creditors are also suspended. Thus, unless leave be obtained, no person may levy any distress, take, resume, or enter into possession of any property, exercise any right of re-entry, foreclose, realise any security, forfeit any deposit or enforce the lapse of an insurance policy for the purpose of enforcing the payment or recovery of a sum of money or in default of the payment of any sum of money.

By virtue of the powers thus conferred upon the Court the prudent creditor may be deprived of the advantages which he thought his care and foresight had secured to him. He may not:—

(*a*) Distrain for rent due;

(*b*) Recover possession of premises for non-payment of rent;

(*c*) Sell a security which he has taken to secure the repayment of an advance;

(*d*) Forfeit any deposit, *e.g.*, the deposit paid on entering into a contract for the sale of land, or the deposit paid by a consumer of electricity;

if the Court is of opinion that the default of the debtor is due to the war. There is some doubt in the writer's mind whether a surety could be called upon to make good the default of his principal, except by leave of the Court.

Finally, the new Act takes away from the creditor his most potent weapon for compelling payment of money justly due. In the piping times of peace, your judgment debtor can often be made bankrupt if he does not comply with the order of the Court. The mere suggestion of "bankruptcy"—which generally involves commercial disgrace—is anathema to the ordinary man. Now, however, a debtor threatened with bankruptcy proceedings can plead the war, and if he pleads it successfully he may so escape a receiving order.

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The rules under which the new Act is to be administered have not yet been drafted. Until we have an opportunity of seeing them, it will be impossible to say upon what principles the Court will be allowed to act in granting relief. We can only hope that in exercising their new functions, the Courts will have due regard to the rights of creditors, and that by insisting upon strict proof that misfortune is due to the war, the designs of a debtor who can, but will not, pay may be frustrated.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Strange Behaviour of a Motor.

The motor is a 220-volt D.C. four-pole machine, and is connected on to the mains in the ordinary way with starter and main switch, &c. This motor had been running for a short time when a slight repair became necessary. This repair, I may state, was not electrical.

No connections had been altered, but on running up again we found that it ran up in the *reverse direction* and with *no field*. We tested the starter, switches, &c., and connections, and they were all O.K., but we found a brush pillar had gone to "earth." On insulating it and running up, the motor ran in the right direction and with a field. It is a shunt motor, and connected just the same as any other shunt motor. There is a "dead earth" on our system, but I do not know on which side the "earth" was on the motor.

The only possible explanation I can find as regards the reverse running is that in a motor the brushes lag behind the neutral point, and so supposing there is no field it would tend to run in the opposite direction, whereas if the brushes were leading in any case the motor, with or without field, would run in the proper direction. But we cannot account for the loss of the field, which was easily apparent by excessive speed and sparking greatly.

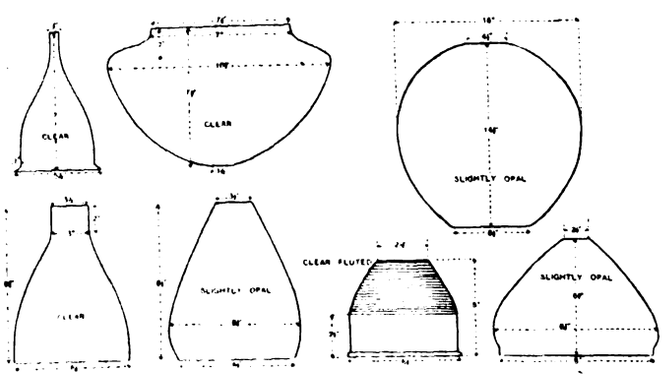
We should be greatly obliged if any of your correspondents could put us on the right track.

A. F. Cranford.

Croydon, *September* 11*th*, 1914.

Arc Lamp Globes.

I enclose you drawings of the different arc lamp globes used in this borough, and I shall esteem it a favour if you will insert same in your paper, so that other corporations



and municipalities of the British Isles who use similar globes can get into communication with myself, with a view to arriving at the approximate quantity used per annum.

This information would greatly assist British firms in a position to manufacture, who will no doubt get into touch with us on seeing this article.

Sydney W. Baynes,
Chief Electrical Engineer.

St. Pancras Electricity Department,
London, N.W., *September* 11*th*, 1914.

Arbitrary Action of a Public Authority.

In view of the present wave of patriotism, the following incident, which occurred a month or two ago, is interesting. A certain public body invited tenders for some plant, and issued General Conditions which were grossly unfair—engineer sole arbitrator, and similar clauses. The makers in a body refused to agree to the conditions, and the purchasers then said they would obtain the material abroad. Will Mr. Purse, or some other champion of the right of purchasers to dictate their own terms, arise in his might and show that the action referred to was correct?

Incidentally, it may be mentioned that it is (and was then) almost, or quite, impossible to obtain the apparatus in question abroad, and the purchasers said that if they could not buy it from some other country, they would adopt a different method of working. Evidently, therefore, they were not only willing to spend money abroad—and pay more, as English plant would certainly have been cheaper—but were also ready to waste public money by utilising a less efficient scheme rather than agree to Conditions of Contract which the I.E.E. consider fair.

Advocate of Patriotism in Time of Peace.

Carbons.

On page 374 of this week's issue under the heading "Late Correspondence," "Inquirer" addresses two questions to me, which I am authorised by my board to answer, either if you think it to be of use to the industry, or if "Inquirer" will make his name public in your columns, instead of hiding himself behind a *nom de plume*.

General Electric Co., Ltd.,
K. Alwood, *Secretary.*

London, *September* 11*th*, 1914.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electric Hand Lamp.

Messrs. Ward & Goldstone, of Sampson Works, Salford, have recently brought out a new electric hand lamp arranged on a novel system, for which they have obtained provisional protection. They inform us that whereas a dry battery will only light a bulb consuming a certain current for a fixed number of hours, if the current be reduced to one-half, there is an enormous increase in the output; they, therefore, use two refills in parallel for a lamp which in the ordinary way would be supplied with one. The result, we understand, is that whilst one refill would keep the lamp burning for only four or five hours, the two (connected in parallel in the particular way that they have devised) will keep it

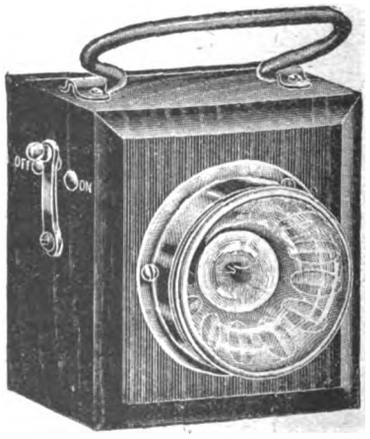


Fig. 1.—The "Multifil" Electric Hand Lamp.

going for no less than 31 hours. The refills are of the ordinary standard pocket lamp size, which can be obtained anywhere. Burning the lamp one hour daily on this method, 40 hours' light has been obtained. The hand lamp is light and compact, and entirely British made. The act of switching-on puts the refills in parallel, and in connection with the lamp, but when the light is turned off, the cells are also disconnected from one another, so that no discharge can take place between them.

The results claimed by the makers are certainly startling, the effective life of the cells being more than trebled.

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The B.T.H. Magneto.

In view of the fact that the manufacture of ignition magnetos, as we recently pointed out, has hitherto been practically a German monopoly, we learn with great pleasure that a new magneto of British manufacture will shortly be placed on the market in quantities, by the British Thomson-Houston Co, Ltd., of Rugby. The B.T.H. magneto is manufactured at the Coventry works of the company, and is the result of over a year's systematic experimenting, both in laboratories and in actual practice on the road and elsewhere. We are informed that it has demonstrated its ability to withstand the severest service conditions. In designing and building this magneto, the company has brought its wide electrical experience to bear upon the subject, and has followed, with the greatest care, the accepted line of magneto manufacture and practice, so that the B.T.H. magneto is interchangeable with the standard make of magneto, and will give equally satisfactory, if not superior, results.

No branch of engineering manufacture requires more accurate work than the production of magnetos, and in view of the fact that the company is one of the largest British manufacturers of electrical apparatus and has been engaged for many years in constructing electrical machines in which the highest grade of workmanship is essential, it is in an exceptionally favourable position to manufacture and supply reliable magnetos. The machining of the magneto is on a very high level of accuracy, the fits of the majority of parts being absolute, and where limits are allowed they

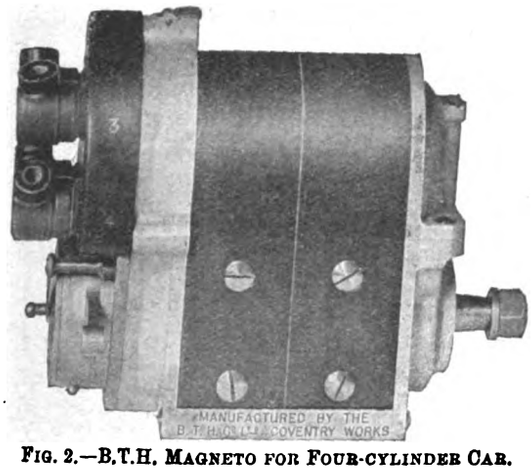

Fig. 2.—B.T.H. Magneto for Four-cylinder Car.

are reduced to less than a thousandth of an inch. This high level of accuracy is obtained by the use of special jigs and limit gauges, over 3,000 of which are required.

Like most modern magnetos, the B.T.H. has a base and end plates of aluminium, and is totally enclosed and weatherproof There is a fine gauze protection cover over a small opening in the top of the magneto, which enables air to reach the armature so as to dissipate any vapours which may be formed. The magnets are made longer than is usual, this resulting in a more permanent magnet, and a hotter spark at low speeds; they are manufactured from a special grade of tungsten steel possessing great retentivity.

The armature is neat and compact, the condenser being contained in a brass cap at one end of the core; its dielectric consists solely of pure mica sheets. The armature shaft is mounted on ball bearings, and the greatest care has been exercised to ensure good lubrication, while at the same time totally excluding oil from the windings. The coils, after they are wound, are impregnated with a filling material which cannot subsequently soften. The coils are also covered with a heavy jacket of suitable insulating material, which by subsequent treatment is converted into a homogeneous waterproof unit. As an additional safeguard for the armature insulation, a safety spark gap is provided, which, in the event of the voltage rising to an abnormal value, acts as a safety valve to prevent breakdown of the insulation.

Fig. 2 is a side view of the B.T.H. magneto for small four-cylinder cars. The contact maker is shown in fig. 3, and is easily accessible and detachable. The contact points have been given special attention to ensure long life. Fig. 3 also gives a good view of the rotating and stationary portions of the distributor. Fig. 4 shows an exploded view of the B.T.H. motor-cycle magneto, from which the construction of the parts can easily be seen. The high-tension slip-ring is on the left side of the armature, and the condenser on the right. The end cover on the extreme right of the illustration shows the arrangement of the high-tension terminal, which is absolutely waterproof, as it contains a metal socket, but no hole through into the interior, and the spark gap.

B.T.H. magnetos are at present available in three sizes: a small size suitable for single-cylinder motor-cycles, and two larger sizes intended for use on four-cylinder cars. Other sizes are in course of development.

New Lamp Lock.

Messrs. C. G. M. Bennett and C. H. Jeffcoat, of 18, Ranelagh Gardens, Hammersmith, W., trading as "Lamlok Specialities," have recently obtained provisional protection for a complete new locking lampholder. They take advantage of the groove in the side of the porcelain; a socket is provided on the dome of the lampholder, over one of the grooves, into which is inserted a steel screwed pin; the pin passes down the groove, and when screwed home, bears on the edge of the brass ferrule of the lamp, rendering it impossible to remove the latter from the bayonet socket. The lamp is released by unscrewing the pin with a special key, and the pin is so designed that it cannot be moved without the key, nor can it even be seen without difficulty. The inventors are in negotiation with leading firms of lampholder makers with a view to the manufacture of the holders in quantity. Persons interested in the matter should communicate with Mr. Jeffcoat, at the above address.

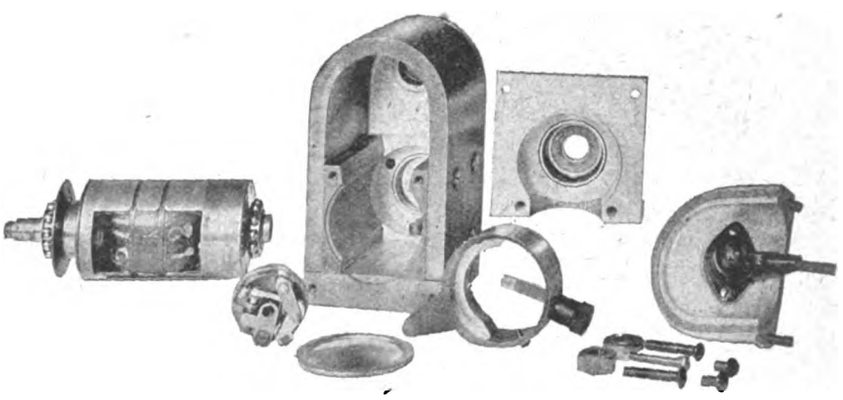

Fig. 4.—Exploded View of B.T.H. Motor-cycle Magneto

New Hand-Lamps.

Two new patterns of hand-lamps complying with the Home Office Regulations have recently been introduced by Messrs. Simplex Conduits, Ltd., of 116, Charing Cross Road, W.C. These are so constructed that neither the wire guard nor the brass clamping ring can become charged, and as the lampholder and lamp cap are surrounded with a sheath of insulating material, there is no need to earth the hand-lamp. The flexible cord is securely gripped at the top and bottom of the wooden handle, to which a leather loop is attached. We illustrate one of the new types; the other is provided with a more substantial iron guard.

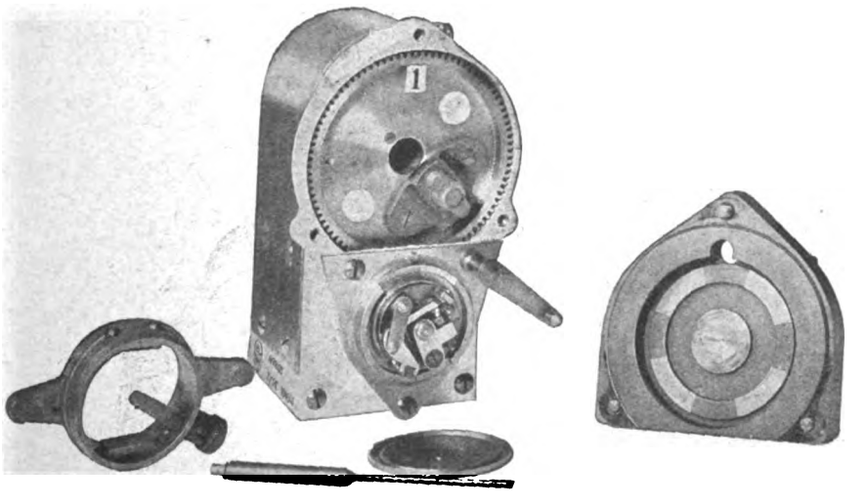

Fig. 3.—B.T.H. Magneto with Covers of Distributor and Contact-maker Removed.

Fig. 5.—New Simplex Hand-Lamp.

Electrically-Driven Hoists for Wharf Use.

We illustrate in fig. 6, p. 390, an electric friction hoist installed at the Odessa Wharf, Rotherhithe, and driven by an 8-H.P. 480-volt, 800-R.P.M. Vickers motor. The motor, which is protected by guards

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from mechanical injury, is of the totally-enclosed type, shunt wound, with continuous rating for a direct-current supply. The starting gear, which could not be included in the view, consists of a Vickers standard panel, with double-pole switch and fuses, and double automatic totally-enclosed starter.

This hoist is installed at the riverside, and is used for unloading paper from the ships' holds. There is a similarly equipped hoist at the opposite end of the warehouse, which is used for lowering the bales into lorries for distribution by road.

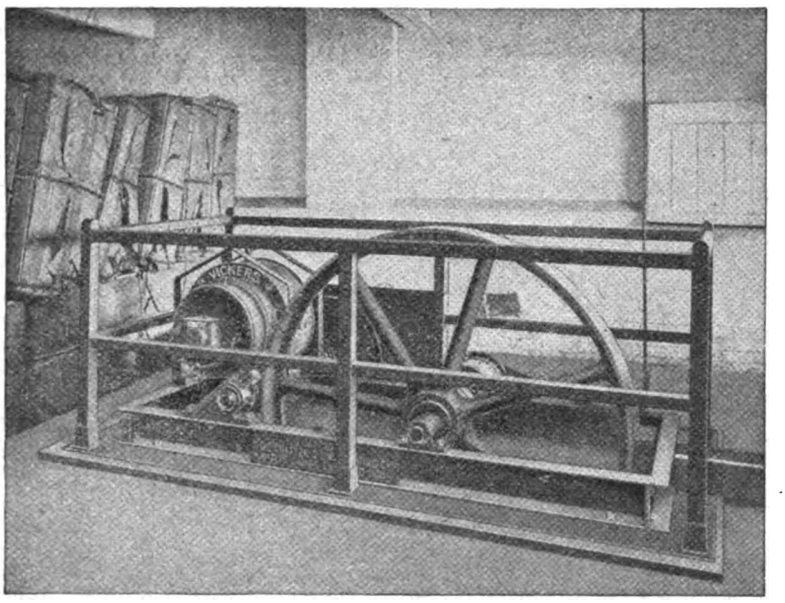

Fig. 6.—Friction Hoist with Vickers Motor Drive.

The hoist, operated by the vertical rope, is of the friction type, and capable of carrying a load of 1 ton. The rope controls the hoist by lifting the lever and balance weight to which it is attached. Ordinarily the large wheel which is attached to the winding drum rests against a brake block, but when the rope is pulled the lever acts on an eccentric in which the bearings are mounted, and so lifts the wheel more or less free from the brake block and allows the weight to descend.

A further movement of the rope brings the wheel against the friction pinion on the opposite side which is geared to the motor, which runs continuously in one direction, and this effects the hoisting.

Quite a number of these friction hoists, operated and controlled by Vickers motors and switchgear, are in daily use for wharf and similar work.

The Chatteris Engineering Works Co., of Old Broad Street, E.C., are the makers of the hoisting apparatus, and were also the contractors for the installation and wiring work in connection with the Odessa Wharf equipment.

Hollow Bars.

Messrs. Dunford & Elliott (Sheffield), Ltd., of Attercliffe Wharf, Sheffield, have introduced square, round and other section steel bars with a central small round hole from end to end, in sizes from ⅛ in. to 3 in. in diameter. These bars have a number of useful applications in engineering work, as for shafting with internal forced lubrication, stay bolts, &c.

Bell-pushes and Connections.

One of the simplest and commonest electrical appliances is the ordinary bell-push; considering its primitive construction, it is remarkable how well this little thing does its work. But the design is obviously open to criticism on various grounds, and the "Pixy" patent push movement made by Messrs. A. P. Lundberg and Sons, of 477-489, Liverpool Road, N., is designed on sound scientific lines as a high-class substitute for its elementary prototype. From the section, fig. 7, it will be seen that a smooth and rectilinear movement of the plunger is ensured by a split guide pin, which also makes rubbing contact with a close-fitting tubular terminal, while a second pin and terminal carry platinum contacts; two shorter pins serve as guides to two steel springs, and the terminals are effectively shielded from one another. The device can be wired without separating the body from the barrel, which is provided with a flange for fixing to the support, one type of which is shown in fig. 8. The brass cover is screwed on like that of a tumbler switch, and a great variety of patterns and finishes is available. Flush patterns with wood, brass or porcelain fronts are also made. Fig. 9 shows a "Pixy" push combined with a plug-connection for an extension push or a house telephone, and fig. 10 a carpet plug-connection, which is sewn into the carpet, the leads being run under the carpet to a second plug-connection on the skirting-board; this device enables a bell, telephone, &c., to be connected up at any point on the floor, without cutting into the latter, while allowing the carpet to be removed when desired. Many other pushes, keys, &c., are made by Messrs. Lundberg.

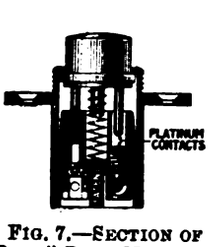

Fig. 7.—Section of "Pixy" Push Movement.

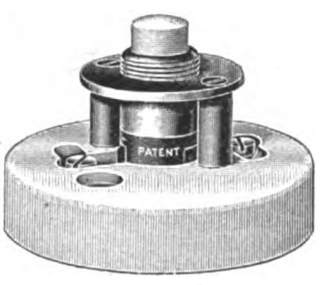

Fig. 8.—"Pixy" Switchbase Push.

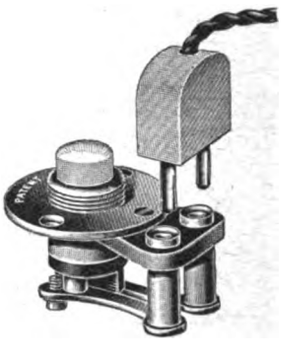

Fig. 9.—Push and Plug-connection Combined.

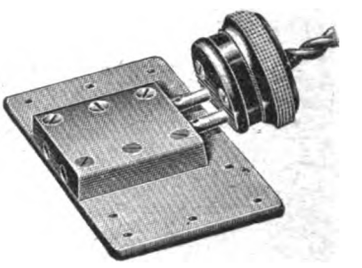

Fig. 10.—Carpet Plug-connection.

The N.P. Pump Bucket.

We have received particulars of the new one-ring design of the patent bucket of the N.P. Pump Bucket Co., of 11, Queen Victoria Street, E.C., which can be used where their standard two-ring design is inapplicable. The ring is of a special composition, and is not split; by means of ports which admit water under pressure behind the ring, the fit is maintained and leakage reduced to the minimum.

Miniature Electric Letter Signs.

An extremely clever device has been shown to us by Mr. F. B. Converse, of 117, Oxford Street, W., manager of the company bearing the above title. It consists of tubular glass letters, as shown in fig. 11, each of which constitutes in itself an electric lamp,

Fig. 11.—Miniature Lamp Letter.

being provided with a series of tiny carbon filaments connected in series. The back of the letter is covered with a white composition, so that in daylight the sign consists of white letters, and when switched on each letter shines out brilliantly. Although the number of filaments varies according to the shape of the letter, each letter takes exactly 11 watts; the letters are mounted on porcelain base blocks provided at one end with spring contacts and at the other with sockets to receive the contacts of the next lamp, so that when the blocks are slid into a trough-shaped frame, as in

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fig. 12, the whole of the connections are automatically made, the lamps burning in parallel on a circuit of 110 volts. Thus any combination of letters to form words can be quickly and easily made. If two groups of letters or words, each comprising about the same number of letters are used, they can be connected in series on 220 volts; otherwise a resistance, such as a glow lamp, can be

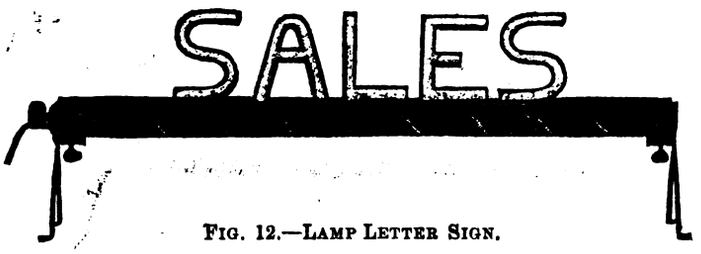

Fig. 12.—Lamp Letter Sign.

inserted in series with them for the higher voltages. The frame can be modified in various ways, to stand on a table, to be fastened to the wall, or to form a hanging frame. The device is intended for indoor use, and is strikingly effective. Letters, numbers and various special characters are made with a maximum height of 3½ in.

New Interphones.

The Sterling Telephone and Electric Co., Ltd., of 210-212, Tottenham Court Road, W., have recently effected some noteworthy improvements in their "Era" automatic interphones. The chief of these is the production of standard strips of levers, rigidly mounted on iron plates, as illustrated in figs. 13 and 14 herewith.

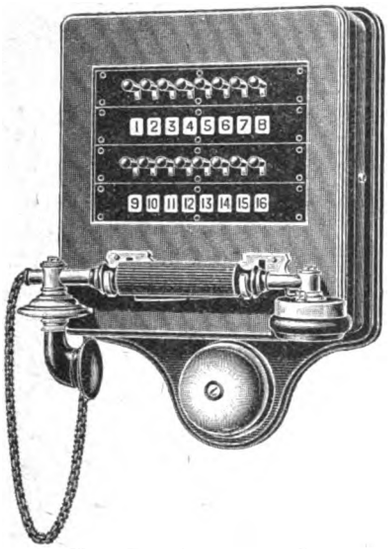

Fig. 13.—New Era Automatic Interphone.

The strips are standardised in five, eight and ten levers each, and are of handsome appearance and excellent workmanship; the parts are simple and robust, and the design leaves little to be desired from a mechanical as well as an electrical point of view. Selecting and ringing are accomplished in one operation by pulling

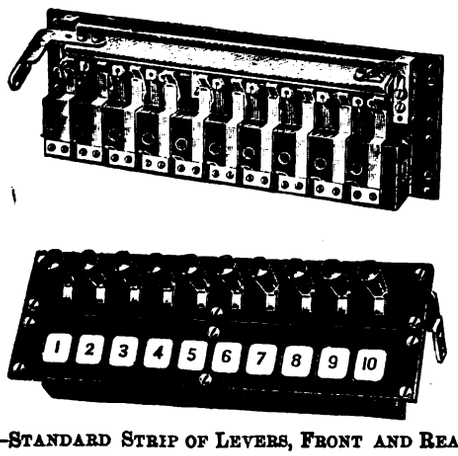

Fig. 14.—Standard Strip of Levers, Front and Rear Views.

a lever over as far as it will travel, to ring, and releasing it, when it remains locked in position for speaking. At the conclusion of the conversation the replacement of the hand-combination on the cradle automatically restores the lever to its normal position. Besides the wall pattern illustrated, a table pattern is made.

TRADING WITH THE ENEMY.

We print below the "Trading with the Enemy" Proclamation No. 2, which was issued on September 9th, and which is in substitution for the previous announcements on the same subject:—

1. The expression "enemy country" in this Proclamation means the territories of the German Empire and of the Dual Monarchy of Austria-Hungary, together with all the colonies and dependencies thereof.

2. The expression "enemy" in this Proclamation means any person or body of persons of whatever nationality resident or carrying on business in the enemy country, but does not include persons of enemy nationality who are neither resident nor carrying on business in the enemy country. In the case of incorporated bodies, enemy character attaches only to those incorporated in an enemy country.

3. The expression "outbreak of war" in this Proclamation means 11 p.m. on the 4th August, 1914, in relation to the German Empire, its colonies and dependencies, and midnight on the 12th August, 1914, in relation to Austria-Hungary, its colonies and dependencies.

4. From and after the date of this Proclamation the following prohibitions shall have effect (save so far as licences may be issued as hereinafter provided), and We do hereby accordingly warn all persons resident, carrying on business or being in Our Dominions—

(1) Not to pay any sum of money to or for the benefit of an enemy.

(2) Not to compromise or give security for the payment of any debt or other sum of money with or for the benefit of an enemy.

(3) Not to act on behalf of an enemy in drawing, accepting, paying, presenting for acceptance or payment, negotiating or otherwise dealing with any negotiable instrument.

(4) Not to accept, pay, or otherwise deal with any negotiable instrument which is held by or on behalf of an enemy, provided that this prohibition shall not be deemed to be infringed by any person who has no reasonable ground for believing that the instrument is held by or on behalf of an enemy.

(5) Not to enter into any new transaction, or complete any transaction already entered into with an enemy in any stocks, shares, or other securities.

(6) Not to make or enter into any new marine, life, fire or other policy or contract of insurance with or for the benefit of an enemy; nor to accept, or give effect to, any insurance of, any risk arising under any policy or contract of insurance (including re-insurance) made or entered into with or for the benefit of an enemy before the outbreak of war.

(7) Not directly or indirectly to supply to or for the use or benefit of, or obtain from, an enemy country or an enemy, any goods, wares or merchandise, nor directly or indirectly to supply to or for the use or benefit of, or obtain from any person any goods, wares or merchandise, for or by way of transmission to or from an enemy country or an enemy, nor directly or indirectly to trade in or carry any goods, wares or merchandise destined for or coming from an enemy country or an enemy.

(8) Not to permit any British ship to leave for, enter or communicate with, any port or place in an enemy country.

(9) Not to enter into any commercial, financial or other contract or obligation with or for the benefit of an enemy.

(10) Not to enter into any transactions with an enemy if and when they are prohibited by an Order of Council made and published on the recommendation of a Secretary of State, even though they would otherwise be permitted by law or by this or any other Proclamation.

And We do hereby further warn all persons that whoever in contravention of the law shall commit, aid, or abet any of the aforesaid acts, is guilty of a crime and will be liable to punishment and penalties accordingly.

5. Provided always that where an enemy has a branch locally situated in British, allied, or neutral territory, not being neutral territory in Europe, transactions by or with such branch shall not be treated as transactions by or with an enemy.

6. Nothing in this Proclamation shall be deemed to prohibit payments by or on account of enemies to persons resident, carrying on business or being in Our Dominions, if such payments arise out of transactions entered into before the outbreak of war or otherwise permitted.

7. Nothing in this Proclamation shall be taken to prohibit anything which shall be expressly permitted by Our licence, or by the licence given on Our behalf by a Secretary of State, or the Board of Trade, whether such licences be especially granted to individuals or be announced as applying to classes of persons.

The Trading with the Enemy Bill was introduced and passed its second reading in the House of Commons last week, and questions on the matter were put by several members. This Bill, among other things, provides for heavy penalties by way of imprisonment, or fine, or both, or forfeiting of goods or money in question, for any person trading with the enemy during the war. A person shall be deemed to have traded with the enemy if he has entered into any transaction or done any act which may have been prohibited by or under any Proclamation issued by His Majesty dealing with trading

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with the enemy for the time being in force, or which at common law or by statute constitutes an offence of trading with the enemy. The following extracts will be of interest:—

Provided that when it appears to a Secretary of State or the Board of Trade that the case is one of great emergency, and that in the interests of the State immediate action is necessary, a Secretary of State or the Board of Trade may, by written order, give to a person appointed by him or them the like authority as may be given by a warrant of a justice under this sub-section:—

(2) Where it appears to the Board of Trade—

(a) In the case of a firm, that one of the partners in the firm was immediately before or at any time since the commencement of the present war a subject of, or resident or carrying on business in, a State for the time being at war with His Majesty; or

(b) In the case of a company, that more than one-third of the issued share capital or of the directorate of the company immediately before or at any time since the commencement of the present war was held by or consisted of persons who were subjects of or resident or carrying on business in, a State for the time being at war with His Majesty; or

(c) In the case of a firm or company, that the firm or company were acting as agents for any person, firm, or company trading or carrying on business in a State for the time being at war with His Majesty; the Board of Trade may, if they think it expedient for the purpose of satisfying themselves that the firm or company are not trading with the enemy, by written order, give to a person appointed by them, without any warrant from a justice, authority to inspect all books and documents belonging to or under the control of the firm or company, and to require any person able to give information with respect to the business or trade of that firm or company, to give that information.

For the purposes of this sub-section, any person authorised in that behalf by the Board of Trade may inspect the register of members of a company at any time, and any shares in a company for which share warrants to bearer have been issued shall not be reckoned as part of the issued share capital of the company.

(3) If any person having the custody of any book or document which a person is authorised to inspect under this section refuses or wilfully neglects to produce it for inspection, or if any person who is able to give any information which may be required to be given under this section refuses or wilfully neglects when required to give that information, that person shall, on conviction under the Summary Jurisdiction Acts, be liable to imprisonment, with or without hard labour, for a term not exceeding six months, or to a fine not exceeding fifty pounds, or to both such imprisonment and fine.

Where the Board of Trade are satisfied either that an offence under this Act has been or is about to be committed in connection with any business or trade, and that it is in the public interest that the business or trade should continue to be carried on, or that any business or trade which, in the public interest, should continue to be carried on, is in danger of being discontinued owing to difficulties of management connected with the war, the Board of Trade may apply to the High Court for the appointment of a receiver of the trade or business, and the High Court shall have power to appoint such a receiver for such time and subject to such conditions as they think fit; and, subject to any such conditions, when a receiver is so appointed, business or trade may be carried on with and by that firm or company.

In his speech in the Commons the Attorney-General, according the *Times* report, from which we venture to extract freely owing to the importance of the matter, said that the proclamation issued against trading with the enemy was designed primarily as a warning. The question had been raised of the position of companies registered as English but found to be in substance enemy concerns. This Bill did not deal with that case save to the extent that it conferred upon the proper Department of State the power to investigate the books of any such company in order to ascertain the facts. It would be foolish, however, to say that just because some enterprise had Austrian or German connections it should be ostracised. The true method was to make certain that such an enterprise did not transmit goods or profits to the enemy's country. Again, in regard to the payment of dividends to shareholders who were foreigners, we were not engaged in any process of confiscation. It was a matter not only of commercial good faith, but it was good business to make it plain to private citizens that their reasonable commercial interests and vested rights in this country were safe. The question had been raised whether objection would be taken to payments which English merchants or others wished to make in discharge of just debts to agents here of firms in the enemy's territory. He had some doubts whether a man could be said to have any such agency once the war had broken out, but he hoped arrangements might be made to enable such liabilities to be discharged, taking proper security that money or goods would not be transmitted to the hostile country. Some plan by which they might be able to collect such moneys and hold them on account might be found to be the best method. In the Proclamation they were issuing that day they were slightly varying the permission previously given about dealing with branches. So long as the branch was, for example, in China or South America, the advantage accruing to our own trade by allowing ordinary dealings to continue was infinitely greater than any advantage which would accrue from stopping such trade. Of course they could not have any new transactions entered into with the head office in the enemy's country. There was no objection to the entering into transactions with the branch in a neutral territory of a house established in Germany as long as the contract was made with, and the goods were delivered to, the branch and as long as there was no direct contract with the head office in Germany or Austria. But it could not be permitted if the branch was in neutral territory on the Continent of Europe. To allow trade with a branch in some neutral country—say Italy—with borders on the frontiers of the countries with which we were at war would be to supply a very considerable loophole for trading with the enemy. In suitable cases, with proper security, it would still be possible to grant licences, and the effect would be that no offence would be committed under the Proclamation by trading with a branch of a German or Austrian house as long as the branch was out of Europe or in the United Kingdom, where it could be controlled. Although he did not encourage the multiplication of inquiries, they should be addressed to the Secretary of the Trading with the Enemy Committee at the Treasury. They could not allow any new sale or purchase of shares as between persons in Germany or Austro-Hungary and ourselves which would be a new contract, but there would be no objection to writing the new name in the register in the case of contracts already made.

On September 11th the Attorney-General (according to the *Times* report) said that they wanted on the one hand to take every security that was proper and possible to prevent the enemy profiting by transactions carried on here. On the other hand, it was not desirable to take steps which would interfere with British interests, including among these British commerce and employment. He thought this Bill went a long way to give the necessary security. There was a great advantage from some points of view in treating enterprise in this country, even though it had a considerable enemy element in its composition, as British. If it entered into transactions with a foreign country in hostile territory it was committing a crime and subject to the same penalties as purely British firms. Power had been taken to enable the Board of Trade to examine books and documents, as well as for the appointment in proper cases of a receiver or manager, to see that a business was carried on in the proper way. Referring to a question about business profits accruing to enemy shareholders, he said he would be slow to say it would be right to do anything in the nature of confiscation of the private property of subjects of an enemy State. Such a policy would be capable of provoking considerable reprisals.

Commenting on the attacks of the daily Press upon German-owned concerns, the *Practical Engineer* says that the warlike policy in trade has taken a turn which should not be continued without careful consideration.

"A practice has been widely adopted in the Press of publishing particulars of the business of German firms trading or having works in this country. There are wide differences between these firms and there are circumstances which are not fairly taken into account. In the first place there are German firms which use British names and wilfully pose as makers or sellers of British goods. We have no excuse to offer for any kind of pretence or hypocrisy in business. . . . In these cases the facts should be laid before the Government and the law enforced. A further class of German-owned businesses are those which are properly conducted with no unfriendly intent and to which no objection would be taken but for the fact that the nation to which the owners belong has provoked an unjustifiable war and prosecuted it in an inhuman manner. To these firms the law allows a certain toleration. . . .

"There is, however, another and separate class of foreign-owned business which stands on a different footing, and of which there are many in the engineering trades and many German owned. Only a few years ago we revised our patent law in order to induce foreign owners of patents to make their special goods in this country. They were invited to come here and establish works. Men and leaders of all parties agreed that it was a great advantage to us that home labour should be employed and home rates and taxes paid instead of having the goods imported fully manufactured. There was no restriction as to the nationality of the ownership of these works and no suggestion that the profits must remain here. It seems to us that in these cases some consideration is due—always provided that during the war the firms rigidly observe the rules imposed. . . . The stranger invited into our territory who has not abused our hospitality cannot be treated like him who tries to break in.

"Above all, we feel that it is not the duty of the Press to hold up lists of individuals or firms to public hatred and contempt. Editors may be critics, but not judges or executioners. Personal malice is bad enough, but there is something terribly cruel about this kind of heedless wholesale malice which seeks to degrade national resentment into a kind of man-hunt. It is better not to mention specific cases, but there are some in which the attack was entirely without justification. The duty of the Press is to bring public opinion to a fair appreciation of general principles. . . . It is foolish to make a general attack on foreign goods or foreign traders. Our whole system of production is based on large exports and imports. Our true policy is to discriminate correctly as to the classes of goods

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which we should encourage the importation of and the foreign nations with whom we should encourage business dealings. If we can establish clear principles of action on these lines it will be much better than spending our efforts in exhibitions of bad temper."

The *Hardware Trade Journal* deals with the matter on similar lines:—

"We are as determined as anybody to do all in our power to make this market impregnable to German goods in future. We shall continue week after week to render assistance to British manufacturers, so that by the time the war is over there may be no more call in these islands for German goods of any kind whatever. The grounds upon which we object to the importation of German manufactured goods are that they find employment for German workpeople, that they produce profits to German manufacturers, and that the majority of the benefits associated with their production are enjoyed in Germany instead of in England.

"But these arguments do not apply to the employment of German capital in this country. Great Britain has more capital invested abroad than any other nation in the world. An Englishman should be the last to object to the investment of capital abroad. But there are other and much more important considerations which lead us to think that we should welcome rather than otherwise the presence in this country of German capital. This money has been invested here very largely as the result of Mr. Lloyd George's last Patent Act, which made it necessary that British patents should be worked within these shores. The immediate result of that legislation was to bring over here large quantities of foreign capital to establish with foreign money large works and industries and to find employment for large numbers of British workmen. When an industry is established the capitalist is the very last man to benefit from it. Rent, rates, taxes and wages, all of which have to be expended in the locality where the industry is carried on, amount in every case to a sum many times the size of any profit made. If, therefore, the *Evening News* were to get its way and the concerns mentioned above were to be shut up as a result of its agitation, German capitalists might lose such interest as they may be receiving for their money, but a sum many times as big would be lost to English landlords, to English ratepayers, and to English workmen."

Our contemporary, *The Engineer*, emphasises the fact that the destination of the profits made in the course of manufacture and trade is of less importance than the distribution of wages, and quotes a concrete example from practice, where a locomotive was built at an actual cost of £2,800 for wages and material, whereas the profit that might have gone abroad would have been only £400. "The fact is that if a German or American firm elects to build a works in Great Britain it must spend a great deal of money here, and for that reason such undertakings have always been welcomed." On the other hand, it is pointed out that such a firm may buy its raw materials in its own country, thereby robbing the argument of much of its force, and it may act as agent for its own branches or head house in its own country, of which many examples could be given. But these practices can be provided against; "the matter rests in all important cases in the hands of the purchaser, and if he is patriotic enough to insist that the product he proposes to buy shall be wholly British, then wholly British it will be."

We have received the following letters:—

TRADING WITH THE ENEMY.

We have received a copy of the King's Proclamation "Relating to Trading with the Enemy," and have acknowledged same in the terms of the enclosed copy of letter to the Assistant Secretary of the Board of Trade (Commercial Department).

We are of opinion that the attitude we have taken up is a correct one, and we shall be glad to know that we have the support of all our British competitors.

For DORMAN & SMITH, LTD.,
REG. A. SMITH, *Director*.

Manchester, *Sept. 15th*, 1914.

[COPY.]

The Assistant Secretary, Board of Trade
(Commercial Dept.), Gwydyr House, Whitehall,
London, S.W.

Dear Sir,—We are in receipt of your communication of the 12th inst., enclosing copy of the King's Proclamation of the 9th September "Relating to Trading with the Enemy," and we further note that under Clause 5 (sub-clause 7) of same, it would be a contravention of the law to supply goods for the use or benefit of an enemy.

We have before us at the moment the status of the A.E.G. Electrical Co., Ltd., and as we are informed that the bulk of the shares of this company are, or were quite recently, held in Germany, we have declined to continue any business relationship with this company, in compliance with the above Clause 5 (sub-section 7).

We are, however, threatened with penalties by the A.E.G. Electrical Co., Ltd., for the non-execution of an order for which we had tendered, and we are asking for the support of our competitors in the attitude we have taken up.

For DORMAN & SMITH, LTD.,
(*Signed*) REG. A. SMITH,
Director.

Salford, *Sept. 15th*, 1914.

There appears to be a considerable confusion of ideas on the subject of trading with firms in this country whose capital is largely or exclusively of alien enemy origin. The following appear to me to be fundamental principles:—

1. This country must benefit by the employment of capital *for productive purposes* regardless of the place of origin of such capital.

2. Conversely this country must lose by the non-employment of such capital.

3. Although not material to the point at issue, this country benefits most when the owners of such capital are citizens living in this country.

4. Every possible means must be taken to prevent any of the profits on enemy-owned capital, or any of the assets representing such capital, from leaving the country.

Any refusal to have dealings with concerns whose capital is largely alien enemy-owned, but who are employing such capital for the purposes of production in this country, is therefore only liable to do harm to the country. The position is obviously entirely different in the case of firms who only import and thus employ the capital in an almost entirely non-productive manner.

On the other hand any actions which allow profits or any other assets of such concerns to go to the enemy are traitorous actions. It is the duty of the Government to see that no such actions are possible, and I suggest, as a practical method of preventing this, that all capital held by persons or firms whose address or business is in the enemies' countries should be transferred to trustees appointed by the Government until a treaty of peace is signed. This would have a double advantage, especially in the case of those companies whose business is virtually controlled by the aliens' holdings:—

1. That it would be definitely assured that none of the assets or profits of the companies go to the alien enemies during the war.

2. That when terms of peace are being considered this country would be in a strong position to assure the proper treatment of English capital invested in the enemies' countries.

F. B. O. HAWES.

London, S.W., *Sept. 15th*.

WAR ITEMS.

WHAT CONSTITUTES A BRITISH FIRM?—The following letters on this subject have come to hand:—

With reference to the correspondence regarding the position of such firms as Messrs. Siemens, it really seems to me that we ought to give a preference to all-British firms. Although if all orders were at once withheld from Siemens it would cause hardship to their workmen; if a mere preference were given to others, it would surely mean Siemens's trade being partially and gradually absorbed by all-British makers, with little or no harm to anyone but the shareholders, and undoubted advantage to those who secured the trade. J. S.

In the last paragraph of Mr. Justus Eck's letter in reply to Mr. Evershed's, he states that the "British directors were elected by the British shareholders to protect their interests."

The British shareholders, according to the records, appear to be Francis Eck, of Chiswick, one share, L. Reincke, of London, 166 shares, and Justus Eck, of Chiswick, 502 shares.

As Mr. Justus Eck is a director of the company, and holds 502 shares, it would be interesting to know why Francis Eck and L. Reincke require the services of two further directors, Mr. Marshall, of Chiswick, and Mr. E. Moul, of Herne Hill, to look after their interests, which represent 167 shares out of a total of 24,250 shares.

For LANGDON-DAVIES MOTOR CO.,
P. F. BRITTAIN.

London, E.C., *September 11th*, 1914.

Now that the fact of German companies operating in England has been brought before the notice of the public, it is time that purchasers of electrical plant took steps to avoid buying their goods.

Is it not true that the Tudor Accumulator Co.'s shares are largely held by German shareholders, the large profits thus accruing both now and in the past having in a large part gone to assist the enemies of this country?

Is it not a fact also that this company employs a considerable number of both German and Austrian workmen?

Surely the time has arrived when Corporations, public bodies, contractors and the public should insist on buying goods made by British labour and capital, instead of, as hitherto, placing orders with alien firms, and thus contributing to the funds of the enemy, which has enabled him to amass such large armaments aimed at the destruction of our homes, and of the British people and Empire.

Your publication of my letter in your next issue, I am sure, would interest not a few

BRITISH INVESTORS.

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I notice in some of the electrical papers various letters which inquire into the composition of the British Thomson-Houston Co., Ltd.

Although the files of Somerset House tell the whole story, few take the trouble to make an examination, and, therefore, the following may be of interest, and I shall appreciate it if you will publish the information in full:—Our capital consists of 80,000 shares of the par value of £10 each, and £186,215 debentures. Our shares are held as follows:—

44 English shareholders	10,458
11 French ,, ...	3,109
1 Belgian ,, ...	83
9 American ,, ...	64,876
1 German shareholder resident in Cologne	333
1 German shareholder resident in England	1,141
	80,000

Neither of these last two shareholders, so far as we know, are in any way connected with electrical manufacturing companies either here or in Germany.

We have 106 debenture-holders, all of them resident in England, and all English, with the exception of one French lady, who holds £2,000 par value, and she resides in Folkestone. We have not a single German in our employ, or in any way connected with the company.

Our active board consists of the following:—J. F. Nauheim, who represents the shares held by Lord Rothschild in our company. He has resided here most of his life, and has been naturalised between 30 and 40 years; George Franklin, of Sheffield and London, who was at one time Lord Mayor of Sheffield, and who was chairman of the National Telephone Co.; Owen H. Smith, who came on originally to represent our debenture-holders. He is one of the partners of "The Proprietors of Hay's Wharf, Ltd."; F. Fraser, a Scotsman, who is also our secretary; W. C. Lusk, manager of our commercial departments; H. N. Sporborg, our chief engineer; and myself, the managing director. We (the latter three) are American born, and have been here from 10 to 12 years.

The other members of our board are, three Americans residing in New York, who represent large shareholders, and one of them for many years resided in London, namely, C. A. Coffin, E. W. Rice, jun., E. A. Carolan. The two former are chairman and president respectively of the General Electric Co., of New York, the patents of this company and its predecessor—the Thomson-Houston Co.—forming the original basis of our company.

C. Barrell, an Englishman, who has spent most of his life in France, now living in Paris; E. Thurnauer, who is an American citizen, also living in France. These two are managers of the Compagnie Française pour l'Exploitation des procédés Thomson-Houston, and represent on our board the French shareholders. The total number of our employés is about 5,600, a large number of whom are, of course, young women in the lamp factory. Our factories are at Rugby, Coventry and Willesden.

So far about 900 of our employés have joined the Colours, which is over 50 per cent. of those who are eligible, and all who have joined, both married and single, receive half wages or salaries while they are away, and their places will be kept open for them until their return, to the fullest possible extent. I might also add that no changes have been made in the salaries of those who remain in the company's employ.

H. C. Levis, *Managing Director*,
British Thomson-Houston Co., Ltd.

London, E.C., *September 14th*, 1914.

In my letter which appeared in your issue of the 11th inst., p. 362, I referred to rumours in circulation to the effect that the A.E.G., of Berlin, were transferring some of their British orders to the British Thomson-Houston Co. The only object in mentioning this was to give the B.T.H. an opportunity of publicly contradicting these rumours, and I have much pleasure in stating that I have received a letter from them in which it is stated that no orders have been transferred to them by the A.E.G., nor have they supplied any apparatus to this company, or to the subsidiary company in London or elsewhere since the outbreak of the war.

I have also, as a result of my letter, received the information that most British firms have been approached by the "A.E.G. Electrical Co." (that is the London house), who desired to place orders with them, and possibly this is the source of the rumours referred to.

Frank Broadbent.

London, E.C., *September 15th*, 1914.

May I add myself to the number of those who express agreement with Mr. Campbell Swinton's view that it is unpatriotic at the present time to give new orders to a firm like Siemens, the majority of whose shares are held by Germans, and which is controlled from Germany?

No doubt there is some truth in Mr. Hammond's contention that to boycott Siemens might in time lead to their reducing the number of their employés. Unemployment in the electrical trade, however, is bound to become prevalent while this war continues, as there will not be sufficient work to keep everyone busy. Is it not, however, the most patriotic thing to so distribute orders that the purely British concerns should be able to continue full employment the longest?

A.M.Inst.C.E.

London, *September 14th*, 1914.

As an old Siemensite, I would like to express an opinion on the recent criticism levelled at Mr. Alexander Siemens, and the English branch of the firm with which he is associated.

As a Britisher, I am in agreement with the suggestion that any profits now being made by the English branch of Siemens should, during the war, be switched off from the enemy's circuit. What I protest against is the unwarrantable attacks made by Mr. Campbell Swinton, Mr. E. J. Williams and "X" on Mr. Alexander Siemens and the English branch of the Siemens firm in general.

Anyone connected with the electrical industry during the past 25 years will, I think, admit that the firm of Siemens (also such firms as Crompton, Ferranti, Mather & Platt, Ediswan) worked to a higher ideal than the making of mere dividends. They did a great deal of pioneer and experimental work in which the question of dividends was a secondary consideration compared with the advancement of the electrical industry. To those gentlemen who have seen fit to criticise the firm of Siemens in this channel, I would like to refer them to a book entitled, "Get on or Get Out," written by Peter Keary, and published by C. Arthur Pearson, Ltd. On page 55 of this book will be found an absolutely impartial tribute to the work of the late Sir William Siemens. Keary's reference to Siemens shows that there was a higher object in the man and his firm, than the making of dividends, as suggested by Mr. E. J. Williams. Some years ago the L.B. & S.C. Railway Co. had one of their passenger locomotives named Sir William Siemens, and I believe the L. & N.W. Railway Co. also have recently named one of the main-line locomotives Alexander Siemens. I suggest that these little honours are in recognition of something more than the making of mere dividends.

With regard to Mr. Campbell Swinton's reference (in the Electrical Review of September 5th) to Mr. Alexander Siemens having at the present time sympathy with the land of his birth, this, I think, is a most unwarrantable and uncalled-for insinuation. Mr. Campbell Swinton can have but little conception of Mr. Alexander Siemens's honour and integrity, which I am pleased to see has been so ably defended by Mr. J. E. Kingsbury and Mr. Robert Hammond.

George Elliott Kerss.

Liverpool, *September 14th*, 1914.

Mr. Kingsbury, in to-day's issue, puts into moderate but deservedly definite terms sufficient condemnation of rushing into print without a sense of proportion. Even electrical men can afford to avoid "the easiest and most worthless sort of patriotism."

In all that I have read about Siemens's shareholders resident in Germany, no one has accused them of advancing to those employés of Stafford Works who are now fighting against us, the pay allowance given to those fighting for us.

There has been no mention of many concerns in Germany whose shares are owned by British subjects resident here.

Concerning Mr. Robert Hammond's proposed legislation against all foreigners, I think the first point to be investigated is to what extent British investments in Germany counter-balance German investments in England, and later other countries can be similarly dealt with.

It may prove to be true sense and economy, after this investigation, to say no more about Messrs. Siemens. I assume the agitation is free from the spite of a jealous competitor.

To limit a foreign shareholder's direct or indirect holding in an English company to 49 per cent. of that company's capital would be initially a simple matter on paper, but basing an opinion on necessities of existence which have arisen in more than one company with foreign shareholders in the recent past, such a limit could not reasonably be maintained.

I refer to companies whose existence has depended on additional money raised from time to time abroad, where "distance lends enchantment" to the investment, when the shareholders near at hand knew too much to put more good money where it demanded continuous patience awaiting dividends that failed to materialise.

The maintenance of a legal maximum 49 per cent. limit would have necessitated the death of such companies; the absence of a limit allowed them to keep alive. England might have gained more from more efficient management of such concerns; but large amounts of foreign capital spent in England on unremunerative work and subsequently written off, are losses to the foreigner and not to England or Englishmen.

If there is to be any maximum limit to the foreigner's holding in British companies it should be zero. If the foreigner builds up on foreign capital a business in England, he is entitled to his dividends, unless his country is at war with England.

My imagination does not picture Germany, after the war has been ended to our satisfaction, as populated only by retired capitalists with only foreign investments, nor with Krupp's and all other works razed beyond hope of resurrection.

Theodore Stevens.

London, E.C., *September 11th*, 1914.

In view of correspondence which has recently taken place in your paper, may we point out that our firm here is in every sense of the word a British business. We have been established here for close on 50 years, and this is our only works, and here are manufactured all the goods which we sell. All our directors, and all our shareholders are British citizens, with the exception of one small shareholder in Christiania, who is our agent in Norway, and no German or Austrian is in any way interested in a single penny piece of our capital.

We may say that close on 100 of our employés are now serving with the British forces.

I. Frankenburg & Sons, Ltd.
Hubert Standring, *Director*.

Salford, *September 14th*, 1914.

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As the bearer of a name of extremely Germanic origin, although it belongs to my family, who have held Government positions in Cape Colony for the last 130 years, I beg to be allowed to pour a little cold candour on the letters appearing in your "Correspondence" columns.

The telephone trade in this country is a typical instance of lost British opportunities. Do we not all remember Mr. Isidor Birnbaum's invasion of this country in conjunction with the Berliner Telephone Co.? Did he not set the pace as soon as he possibly could in trade conditions over here? Are we going to imagine that he changed his name and his firm's name to something essentially British merely out of passionate devotion to the country of his adoption? No. He found that by doing so he could climb to greater heights, and now with English names for himself and company, his achievements are all the greater, and the means, therefore, have justified the end. But what is the end from the present position? Soon after war broke out the Telephone Manufacturers' Association met, and what did they find? They found one of their principal members had been relying upon foreign factories for wood cases. Another member, who had a very large control of the mining telephone business, was cut off from Continental supplies, and so on, with the result that the trade has a happy instance of the "patriotism" of the T.M.A. in a formal announcement that discounts are from henceforth reduced by 13 per cent. This is the price that this country is now going to pay for not having provided more energy and capital within its own boundaries.

It is a notorious fact that there is, I think I am perfectly correct in saying, not a single firm cataloguing telephones in this country that can absolutely and truthfully declare that every part of the instruments displayed in their catalogues, and quoted for by them, is completely made in this country.

The same thing very much applies to the electric motor industry. One of the largest outlets for motors in this country of recent years has been the textile trade, and who can gainsay the fact, that one very well-known make of German motors has collared the cream of the trade at good prices, not cut prices, because of their splendid guaranteed factors of efficiency?

A few words as to Mr. Eck. It may interest Mr. Evershed to know that Mr. Eck has a connection with a "Birmingham" firm, and doubtless if Mr. Evershed will produce his pass-book for Mr. Eck's inspection, Mr. Eck will be quite willing to produce his agreements with the Birmingham firm.

What I plead for, Sir, is, do let us drop this hypocrisy about British-made goods, when only within the last two years a British battleship was fitted with foreign-made telephones, supplied by one of the British firms of oldest standing.

Instead of now trying to break up enterprising, clever, and energetic people, who have been building up business in this country for years, and, at any rate, providing money for a large number of the labouring class and higher classes, and paying rates and taxes and income-tax in proportion to the size of their undertakings, let us humbly sit down and acknowledge point-blank what we have been lacking in as Britishers in the past, and make up our minds now not to cry "sour grapes," but that such things shall not happen in the future.

We hear in the lay Press a lot about pipe lines of gold to the Continent. I think Mr. Burney could, provided with the aid of a micrometer gauge, give some very interesting particulars as to the size of his particular pipe line to the Continent since he started his works in this country.

Siemens, I take another very good example of the same condition of affairs, for in their development and progress in this country they must have spent money very lavishly, and in their treatment of the trade their name, surely, compares with any firm in this country, whether of British or foreign origin, or a mixture of the two.

May I conclude, Sir, with the hope that your columns will not again be disturbed with unnecessary protestations of patriotism on behalf of people whose clever business objects are thoroughly understood and admired, nor will you be asked to further display a series of petty and narrow views about the condition of affairs which has been plainly evident to all investigators of trading conditions in the electrical industry for the last seven years.

Yours faithfully,

H. S. HÖHNE.

May I briefly reply to some of my critics?

One of Mr. Robert Hammond's main points is that we must be careful what we do, or we may not in the future be able to attract foreign capital. So far as our foreign friends are concerned I quite agree; but with regard to our enemy, Germany, let us hope that when peace comes to be made it will be arranged on terms whereby Germany will be compelled to pay an annual indemnity for many years, so large that neither she nor any of her citizens will have any money to invest, either here or elsewhere, for at least a generation.

Then, with regard to Mr. Hammond's suggestion, that if new orders are not given to Siemens Bros. this will result in unemployment. Unemployment there is sure to be, for, as long as this war continues, there is bound to be a considerable restriction in the amount of work to be placed. Under these circumstances, surely it is best and most patriotic to give orders, as far as possible, to the concerns that are purely British, and thus keep their men fully employed, rather than those employed by aliens.

I am sorry that Mr. J. E. Kingsbury is so annoyed, but I can afford to disregard his strictures, as when he says that my letter will be read by my friends with much regret, I am sure he has made a great mistake. Some, of course—for example, Mr. Robert Hammond—have not agreed with the opinions that I have expressed, but I have so far not come across anyone, except Mr. Kingsbury himself, who has objected to my methods. Indeed many have congratulated me, while a number have even taken the trouble to write to me, specially to express their approval, and among these latter are several men well known in the electrical world, together with one of the most eminent engineers of the present day, who writes, "I read your letter in the ELECTRICAL REVIEW, with the greatest pleasure."

A. A. CAMPBELL SWINTON.

London, S.W., *September 15th*, 1914.

I have read with very much pleasure your leading article "Looking Ahead." It is certainly one of the most carefully written and considered articles on the subject which have appeared in any journal, and deserves a much larger number of readers than it probably will obtain.

I would like to offer, for the consideration of yourselves and your readers, one or two remarks on the question of what constitutes a British firm, especially with regard to the Siemens companies. It must be a matter of general opinion on the part of all quietly thinking men, that to oust a firm that has done so much good in every way for the electrical industry would be suicidal. At the same time it must not be forgotten that the Siemens companies in this country are conducted in quite a different manner to the Siemens companies in Germany. It should also not be overlooked that although a large proportion of the capital is supposed to be held in this country, yet there is not the slightest doubt that this capital is merely held as nominee for the German portion of the firm, whether individuals or otherwise. Therefore it follows as a matter of course that the ultimate direction or power of the company could be controlled by the German policy. Now, the German policy is totally different to the English policy, and anyone who has had dealings, on a large scale, with the German element, will bear me out when I state that that policy is like the military policy we have just had exhibited to us—perfectly ruthless. Moreover, it should be always borne in mind that the German Siemens & Halske, together with the heads of various other powerful corporations, were the top and tail of the scandalous Press Bureau recently exposed by our Government. This organisation was known to many others outside the Government, and long before the exposure was published. It does not need much imagination to believe that other things besides Press notices were included in the offices of this cabal, performed for the service of their Government. Consider for a moment the fact that all these English branches of these German corporations have had, in the past, perfectly free access to the plans and organisation, &c., of practically every large undertaking in this country, including docks, collieries, works engaged in shipbuilding, armaments, &c. It is quite probable that in most of these British branch business concerns a "German" department would be found wherefrom much information of a very valuable nature might be imparted to the parent Government—in any case it would be available. I do not suggest that Siemens or any other specific firm has, during the past, made a practice of sending plans of these works, docks, &c., to their Government, but nevertheless the information has been available. In my opinion the only thing to do in the case of companies like Siemens is to get rid entirely of the German influence and control, so that the general conduct of the business is absolutely in the hands of British interests. Under those circumstances, I consider it would be the greatest mistake to do anything detrimental to the welfare of these firms, otherwise I consider it the greatest danger to allow them to continue to work in the manner hitherto.

I do not write you on this subject without considerable knowledge and experience.

September 15th, 1914. CENSOR.

With regard to Mr. A. A. Campbell Swinton's letter in your issue of September 4th, and that of Mr. Sinclair in your issue of September 11th, I enclose a cutting* from the *Times* of September 12th.

The *Times* state to-day that they have investigated the identity of the writer, and any further comment on my part would be superfluous.

It only remains for me to add that I personally intend to boycott German goods, and that I have reason to assume that a similar course will be adopted by my company.

ROBERT C. PIERCE, *Manager and Engineer,*
Cambridge Electric Supply Co., Ltd.

Cambridge, *September 15th*, 1914.

We have received a circular letter from Mr. W. P. Maycock, in the course of which he appears to regard himself as an authority on how electrical journals should be conducted, but we regret that we have no room for circular letters.

MORE FALSE REPORTS.—The Record Electrical Co., Ltd., writes to say that a statement that is in circulation to the effect that the company is financed by capital of an alien enemy is entirely false. They add that "they will take immediate action in the Courts against any person who, to their knowledge, is party to the circulation of such libellous report."

THE ENEMY'S TRADE.—Your contemporary of September 11th—there is no need to say which it is. Having in the past cherished a distinct admiration for those who are now known as the "alien

[* The cutting relates to the terrible deeds of barbarism practised by the Germans, instances of which are vouched for by the writer. —EDS. E R]

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enemy," having admired their organisations, their thoroughness, their culture, their apparent goodfellowship and furthermore *having said so*, it came as a very nasty knock to me to see them as they really are "with the veneer off."

Only during the past month has the average Briton known what we are up against in deceit, barbarity and lawlessness, and realised what we have had prepared against us in the way of naval, military and trade attacks. How any man (other than an alien enemy), knowing the vile tactics employed by our opponents, can ask for quarter for the enemy's trade in the way that your contemporary begs electrical men to do is past my comprehension.

Fortunately your own vigorous leading article, which I read immediately after the other, came as a most effective antidote.

In view of my known appreciation of our quondam friends (*sic*), I did try to prevent myself letting go in print, but your contemporary has raised my bile. I do not believe any Briton could make himself stoop to the level of the enemy's methods, but the least we who remain safely at home can do is to second the work of those who are fighting for us, by making it our solemn business by fair means, and even to a discretionary extent by foul, to capture the enemy's trade and smash him industrially.

Give him no rest till he is broken commercially beyond repair, as he is undoubtedly going to be broken as a European military power.

A. Hugh Seabrook, *General Manager*,
Marylebone Electric Supply.

London, W., *September* 14*th*, 1914.

Not Paying at Present.—Referring to our letter addressed to you last week, in fairness to Messrs. Traun & Sons, we beg to enclose you copy of their reply to our letter, together with our answer.

Nalder Bros. & Thompson, Ltd.
Fras. H. Nalder, *Managing Director*.

London, N.E., *September* 14*th*, 1914.

[copy.]

Dear Sirs,—We are in receipt of your favour of the 8th inst., and we should like to call your attention to the following, and trust that this will satisfy you.

The managers of this London agency are both, and have been for many years, naturalised British subjects. They have through their solicitors made inquiries at the Board of Trade as to their position *re* further trading, and have been informed that there is no objection to their carrying on business.

In order to be able to do this, and to keep and pay their employés and their British creditors, they cannot do without customers' remittances. They undertake, and are bound, as British subjects, not to remit any money to Germany, and they trust, therefore, that you will send your cheque in due course, which please make payable to F. Winter.

H. Traun & Sons' London Agency.

25, Goswell Road, E.C.
September 9*th*, 1914.

[copy.]

Messrs. Traun & Sons' London Agency.

Dear Sirs,—We beg to acknowledge receipt of your communication of the 9th inst. *re* ours of the 8th inst., and we can only reiterate what we said in our last letter, that if the Courts consider that you are entitled to be paid, we shall be pleased to do it, but we would point out that, taking your address in the "Telephone Directory" and elsewhere, it appears to us that if we paid this account we should be breaking the laws recently amended and passed dealing with the question of assisting alien enemies.

Nalder Bros. & Thompson, Ltd.

September 14*th*, 1914.

American Trade and the War.—The attention which our cousins in the United States are giving to the present trading opportunity is shown by the amount of space which the *Electrical World* devotes to the subject. Dealing with credits in South America, it says:—"Many people have spoken and written about the need of granting long-time credits to South American buyers of electrical apparatus. Manufacturers have been cautioned that the South American buyer regards payment in three or four months as equivalent to cash. Carry the argument a little further, and it appears that a long-time payment, as that is known ordinarily in this country, would be postponed in South America to a month far distant on the calendar. This condition arises in part from a lack of capital, and it is strengthened by the lifetime practices of our neighbours on the south. Whatever terms are essential for our manufacturers to make they will make. In the past they have felt that they were handicapped by a lack of knowledge of South American customs, lack of banks and lack of American shipping facilities. In reality these obstacles seemed more serious than they were. Knowledge can be acquired, the National City Bank, of New York, is to start branches, and American shipping facilities are already in a fair way to be provided. Foreign banks have always been open in South America, and shipping facilities under flags of other nations have been plentiful. Bankers and manufacturers know that the question of credit is like any other business problem. It is answered by the same reasonable rules that are applied to all business problems. If long-time credit is a factor in a sale, it is a factor in the cost. The expense of financing the account is a part of the expense of producing and financing the goods. If the buyer gets long-time credit, he is not on the same basis with the buyer who pays cash. If the credit involves undue risk of principal, that is another factor to be reckoned with in the calculation of cost. No new market can be entered easily or without advance preparation and expense. To these difficulties South American countries add the problems of different language and customs and of long-established relations with European business men. Like the question of credit, these problems have a reasonable solution which it has now become the duty of manufacturers to discover."

A further article is couched in the philanthropic vein:—

"Producing centres in this country are ready to meet the demands thrown upon them at short notice. The war has created markets for many classes of products in European lands and in the countries formerly supplied from Europe. . . . The importance of electrical exports has been pointed out in the articles published in the *Electrical World*, not because 'one man's misfortune is another man's advantage,' but by reason of a world-wide demand unfilled. A situation without precedent has arisen in our industries. Neutral countries are crippled because they relied upon European sources of capital and materials and European markets. Commercial relations cultivated during many years are swept away in the torrent of war.

"No countries ever before deliberately sacrificed commercial life on the scale of the terrible exhibit in Europe. Trade between the countries directly engaged in the war is fatally hurt. Trade between each of those countries and other nations now at peace is interrupted, and, except in the event of an early conclusion of hostilities, it cannot be easily restored. Too much capital and too many trained workmen will have been sacrificed to enable European nations to resume quickly their banking and commercial relationships with the countries which heretofore depended largely on their assistance. If peoples wholly innocent of part in the war are to have the burdens lightened for them, it will be because a strong nation like ours is ready and willing to do its part toward that end. Only by time and patience can the needs created by the commercial inactivity of Europe be met. Where this country has been dependent on Europe for raw materials, other materials or substitutes, so far as they can be found, will be introduced. Temporarily crippled, some manufacturers in this country will learn how to use what is at hand to take the place of that which they cannot now import. For the nations involved the terrors of war will not be lessened, but our activities will protect other peoples against the dire consequences of a strife not of their making."

A Warrington Contract.—The wisdom or otherwise of accepting tenders for electrical goods of German or Austrian origin was discussed by the Warrington Board of Guardians at a special meeting last Friday. At an ordinary meeting of the Board held earlier in the week, the opinion was expressed by Mr. W. C. Brooks that the time had arrived when they, as a public body, ought, as a duty, to put a ban on German and Austrian goods. On the other hand, the Rev. A. M. Mitchell, another member, declared that he did not think that they ought to punish individuals and firms because of the attitude of the Imperial autocracy at Berlin. When the question came up for discussion on Friday, it arose on consideration being given to contracts for electrical goods and ironmongery. Mr. Brooks moved a resolution to the effect that the contracts so far as they related to goods of German or Austrian origin be not accepted. The resolution was seconded, but some objection was raised by certain members of the Board, who argued that the tenders were invited before the outbreak of war, and that wrong would be done to the contractors (who, no doubt, had the articles in stock), by the imposition of such a restriction as that proposed. Eventually, however, the resolution was adopted by five votes to two. Mr. A. J. Jolley (chairman) remarked that the resolution would apply to all contracts in which there were goods of German or Austrian origin, and the effect of it would be to find employment for British labour. After the meeting the clerk to the Board issued an amended advertisement, inviting tenders for electrical goods required at the workhouse, and the stipulation was made in bold type that no goods of German or Austrian origin would be accepted.

The Board of Trade Helps.—Further pamphlets forming part of the useful series issued by the Board of Trade Commercial Intelligence Department, bearing upon the special departments of the export trades of Germany and Austria, are as follows:—Screws, nails and bolts, and nuts of iron or steel; iron or steel plates and sheets (other than tinned and galvanised); railway material of iron and steel (except rolling stock and wheels, tires and axles); lubricating oils and grease.

The Department has received the following information by cable from H.M. Consul-General at Shanghai (September 8th):—"Business may be said to be more or less at a standstill. The situation is governed by the export trade, which is held up; and money is tight principally on account of this stagnation. The Germans are accepting export cargo which is being deposited in godowns, but Chinese sellers are at present without payment. This fact will undoubtedly react in favour of British interests."

The Board of Trade has received the following information by cable from H.M. Commercial Attaché in Japan:—

"Business is being very seriously hampered by international difficulties which have arisen. It is suggested that United Kingdom firms transacting business with Japan should consult exchange bankers with a view to having their shipments to the Far Eastern markets financed. The attitude of the Japanese banks is exceedingly cautious. It is estimated that at present the stocks of dyes in Japan are sufficient for six months' requirements. Large Australian contracts for wool and lead are being held up owing to difficulties of finance. As regards exports, shipments of silk continue to show a falling off, while copper shipments are at a standstill. Exports to China of cotton yarn for the manufacture gun-cotton have fallen off 50 per cent."

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The British Ambassador at Rome has cabled as follows :—"I am informed that the present moment would be a favourable one for a competent Italian commercial traveller or agent to go to Milan and obtain orders for goods hitherto supplied by Germany. Amongst such goods for which there would be a demand are carbons for arc lamps, magnesium, silica, bricks and special types of steel."

His Majesty's Consul at Milan telegraphs that the British Chamber of Commerce there has received inquiries from local firms who are desirous of purchasing the following classes of British goods, viz :—Tanned leathers, leather goods, hides and skins, glass tubes, glass gauges, chemicals, machinery, dynamos, bicycles, iron and steel, motors, carburetters, and motor-cyles.

Belfast Electricity Works.—The city electrical engineer reported on 7th inst., that up to that time 23 of his staff had joined the Colours, and that he was having the vacancies temporarily filled.

Westinghouse Brake Employes.—We are informed that, down to Friday last, 118 men from the works and offices of the Westinghouse Brake Co, Ltd., had joined the Colours, representing upwards of 28 per cent. of the normal establishment. The company is paying these men half-rate wages, and places are kept open for all who return to them on the expiration of such service.

Halifax.—Between 40 and 50 tramway employés have enrolled in one branch or other of the Army.

Hart Accumulator Relief Fund.—Over 40 employés of the Hart Accumulator Co., Ltd., have gone to the Front, and in order to relieve any distress in the families of these men, the whole of the remaining employés are contributing two hours' pay each week, so as to be able to grant to each family sums ranging from 15s. per week downwards, depending on the circumstances of each case. These subscriptions are entirely voluntary, and the fund is largely augmented by personal weekly contributions from the directors, and also by a weekly grant from the company. All places are kept open for the men on their return.

No Name.—"H. T. Gear" has omitted to send us his name and address. It should be remembered that we cannot publish letters which are not accompanied by that information.

Liverpool Tramwaymen.—Alderman F. Smith at Liverpool on Friday stated that 430 of the staff of the tramways in that city had joined the Colours, and that the Tramways Committee did not approve of the suggestions which had been made that all the employés under 35 should be compelled to either join the forces or retire, and that women should be substituted on the tramcars. At present, he added, it was not necessary to entertain the idea of displacing the men by women conductors.

Bolton.—The tramway workers of Bolton have decided to pay a levy of 1d. for each 5s. earned per week to the local relief fund during the war.

Danish, not German Origin.—United Water Softeners, Ltd., of Imperial House, Kingsway, London, W.C., request us to state that the company, who claim to be the largest manufacturers of water-softening and purifying plants in the United Kingdom, have no connection in any shape or form with Germany, German subjects or German products, and no interest or control, either financial or managerial, is held in this company by Germans. The concern is managed by three British directors, one Danish, and one Danish naturalised Briton. The water softening and purification plants, in which the company exclusively deal, are all manufactured in Great Britain by British workmen, and the technical and clerical staffs are entirely British. All rights in the "Permutit" patents are under the sole and exclusive control of the above British company.

Chloride Recruits.—At the works of the Chloride Electrical Storage Co., Clifton, last week, the employés, together with the workers at the Pilkington Tile and Pottery Co., attended a meeting called for the purpose of stimulating recruiting. Mr. W. Bannister, chairman of the Chloride Co., who presided, said it was essential for all who could to go forth to help in the battle for freedom and right, and he hoped the company's employés would respond to the call. It was announced that 19 of the firm's employés were already serving with the Colours, and that 14 more had volunteered, whilst at the close of the meeting several young men signified their willingness to enlist. An allowance of 10s. per week is being made to the wife of each married employé who enlists, together with further allowances for children, and dependants of single men employed by the firm are also being generously treated. To every employé accepted for service, the firm is making a grant of £5 to be paid in such a way and at such time as the manager thinks fit.

Salford Corporation Contracts.—At a meeting of the chairmen and deputy-chairmen of the Corporation Committees at Salford, it was decided to bring the following resolution before the next meeting of the Council : "That the Council be recommended to direct that all contracts entered into with the Corporation be adhered to, with the exception of such contracts, or parts thereof, as involve trading with alien enemies ; to rescind all resolutions to the contrary ; and to inform the various Committees accordingly."

Messrs. Drake & Gorham, electrical engineers, of Manchester, are paying 12s. 6d. per week to the wives of their married employés who have joined the colours.

Mr. T. Haughton has been co-opted a member of the Dukinfield Relief Committee as representing the Tudor Accumulator Works.

Sydney Cancels German Order and Places it at Rugby.—We learn that Messrs. Willans & Robinson, Ltd., of Rugby, have secured an order from the Sydney Corporation for a 5,000 kw. turbo-alternator with condensing plant, the plant consisting of a standard Willans "disk and drum" turbine, to be coupled to a Dick, Kerr alternator, and the turbine exhausting into a Willans surface condensing plant with rotary air pumps. This plant is to take the place of a German plant ordered a short time ago. The municipality has given the firm terms of payment embodying monthly instalments, as the work proceeds, up to a total of 80 per cent. of the value of the contract on shipment. It is very gratifying to receive this further evidence of Australia's assistance in the struggle. The granting of favourable terms just now will be a boon to our industries. Messrs. Preece, Cardew & Snell are acting as engineers in this country for the Corporation.

Joined the Colours.—Seven members of the staff of Messrs. W. F. Dennis & Co. have gone on active service.

W. Geipel & Co.—This firm write to contradict rumours that they are aliens, and to explain that they are absolutely British, having been established here close on half a century. The firm has a works in London.

German Turbo Plant not Re-Ordered.—The *Leeds Mercury* states that there is considerable uneasiness in the engineering trade over the fact that business relations with German firms have not been completely broken off. "The case of a colliery company, which ordered three large turbine generators from Berlin some months ago, is being widely discussed. One of the machines is said to be on board ship at Hamburg, the second completed at the Berlin works, and the third in an advanced stage of construction, and it is felt as a hardship by British firms who make similar plant that the colliery company has not given the replacement orders to them, but is apparently waiting for the end of the war to release the German machinery. In the engineering trade, as in others, it was hoped that orders of this character would have helped to keep their men employed during the present difficult period."

The Brighton Railway Contract.—In the House of Commons last week, Mr. J. M. Henderson urged that the Trading with the Enemy Bill should provide for the stopping of the business in this country of limited companies, the vast bulk of the shares in which were held by companies in enemy countries. The large German electrical company which obtained the contract for electrification of the Brighton Railway registered as a company in England, with 30,000 shares, 29,993 of which were held by the parent company. If the Dresdner and Deutsche Banks were to be prevented from doing fresh business this company should be treated similarly.

According to the *Daily Telegraph* report, Mr. Duke said that the adoption of Mr. Henderson's proposals would inflict a tremendous blow on industry and employment here. There was one company which was engaged in the electrical industry which employed over 2,000 workmen. If the alien interest in it were destroyed, the sole result would be to put out of existence an industry in regard to which the sole concern of this country was that it should be carried on and provide employment here. In the case of another company, the business of which had been acquired by German capital, 1,400 skilled workmen would be thrown out of employment. He pointed out that the proclamations issued would prevent communication between those who conducted such businesses in this country and those who, beyond the sea and down to the beginning of the war, controlled them.

Mr. Joynson-Hicks said there was reason to suppose that some large electrical engineering firms which were thinly-veiled German firms were doing work for the Admiralty, and were in touch with the secrets and insides of the ships.

Sir J. Simon remarked that what they wanted was to prevent the enemy profiting by transactions carried on here. On the other hand, they did not want to take any steps which would interfere with British interests, including commerce and employment. He would see that the suggestion made by Mr. J. M. Henderson was carefully considered, but there was an advantage in treating a company the shares of which might be largely held abroad as a British company, because if it entered into operations with the parent foreign company it would be committing a crime. That he thought was the best way of approaching the subject, and power had been taken to examine the books and documents of any enterprise in this country against which suspicion might arise.

Messrs. Siemens and Government Contracts.—In the House of Commons on Tuesday, Mr. Tyson Wilson asked the Postmaster-General whether the firm of Messrs. Siemens, of Woolwich, was still executing work for the Post Office ; and, if so, if he was aware that 65 per cent. of the shares in this company were held by Germans, that the firm had employed German workmen in the place of English workmen, who refused to work contrary to the rules and customs of the trade ; and whether, under these circumstances, he would cancel any contracts that this firm may hold.

According to the *Morning Post* report, Captain Norton (Assistant Postmaster-General) replied : "Messrs. Siemens Bros., of Woolwich, are still executing work for the Post Office as well as for other Government departments. My right hon. friend understands that, although the company is a British company, a large proportion of the share capital is held by Germans, and that the firm has employed a small number of German workmen, but he does not think that these considerations outweigh the inconvenience to the public service and the adverse effect on a large staff of English workpeople which would result from the withdrawal of Post Office contract work. My right hon. friend is not aware of any such cases as are mentioned in the question, but if the hon. member will furnish particulars of the circumstances in which Messrs. Siemens are alleged to have infringed the rules and customs of the trade he will have inquiry made into the matter."

During the two weeks ending on Saturday over £930 was collected on the Manchester tramcars by means of the disused ticket boxes. The money is for the war relief fund.

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BUSINESS NOTES.

Lamps for Canada.—A Montreal company desiring to purchase supplies of tungsten lamps, invites offers from United Kingdom manufacturers of such lamps of 10, 15, 25, 40, 60, 100, 105, 250 watts and 110 and 115 volts. The lamps should be made of continuous drawn-wire tungsten with screw socket suitable for the Canadian market. Apply to Board of Trade Commercial Intelligence Department, London.—*Board of Trade Journal.*

Permanent Magnets.—The Esterline Co., of Indianapolis, U.S.A., notifies that it is prepared to furnish permanent magnets on short notice, having a complete department for manufacturing these for electric lighting generators for automobiles, tachometer generators, and graphic instruments.

Mr. Lionel Robinson, of 3, Staple Inn, Holborn, W.C., is making arrangements for the manufacture of permanent magnets of all kinds in this country, and he invites inquiries.

Catalogues and Lists.—Messrs. Townshend's Art Metal Co., Ltd., Ernest Street, Holloway Head, Birmingham.—28-page catalogue illustrating and giving prices of a number of excellent lines in electric light fittings. These include a variety of neat bracket fittings (polished brass and other finishes), single and double arm, and for lamps or electric candles; hall lanterns, table standards, electroliers, with either ordinary shades or large bowls and reflectors, bedroom pendants, cord and shade pendants. The catalogue should be of additional interest now that most imports of foreign electric light fittings are stopped.

The Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.—24-page well-illustrated pamphlet very fully describing the Sturtevant system of drying. Copies can be obtained on application.

The New Lighthouse Radiator Co., 4, St. Mary Axe, London, E.C.—Illustrated price leaflets relating to their electric kettles, stoves, radiators, saucepans, and cookers.

Messrs. British Insulated & Helsby Cables, Ltd., Prescot.—Illustrated circular describing the Prescot pillars fitted with H.T. porcelain-insulated cable units.

The Consolidated Pneumatic Tool Co., Ltd., 9, Bridge Street, Westminster, S.W.—48-page illustrated catalogue of electric tools—drills of various kinds, portable tool post, twist drill grinders, coal and ore boring machine, electric hammers, electric blowers and sand shakers, couplings for connecting cables, &c. These tools are made at the company's factory at Fraserburgh, Scotland, an inside view of which appears in the pamphlet.

Messrs. Pooley & Austin, 25, Victoria Street, London, S.W.—Illustrated leaflet giving prices and particulars of their "Panda" electric light generating sets (British-made) for use on board yachts and in bungalows or small country houses.

The Langdon-Davies Motor Co., 110, Cannon Street, London, E.C.—16-page illustrated pamphlet fully describing their standard A.C. motors of short-circuited rotor and slip-ring types; also a 16-page price list of single-phase (40 to 125 periods) and polyphase (25 and 50 periods) motors.

Norway.—H.M. Consul at Christiania (Mr. E. F. Gray) reports that an electrical engineer in that city wishes to secure the agency for Norway of United Kingdom manufacturers of general electrical goods. Apply to Commercial Intelligence Branch of the Board of Trade, London, E.C., for name and address. Further communications to the British Consulate, Christiania.

Grinding Paste.—Messrs. Weston & Co., of 47, Minories, E.C., have sent us a sample of their grinding paste, for grinding in leaky valves, &c., a British-made article, for which exceptional qualities and saving in time and labour are claimed. The makers are willing to send a sample tin to any firm that is interested.

Commutators with Moulded Insulation.—Referring to the note in our issue of the 11th instant, the United States Light and Heating Co., of 17, Conduit Street, W., inform us that they control the rights for manufacturing this class of commutator in European countries, the construction being covered by several patents. If any British firms are interested in this commutator, the company will be glad to supply particulars and to show them samples of commutators so made. They say that they not only obtain 100 per cent. good commutators with this construction, as against 89 per cent. with the old style of manufacturing, but obtain this result with practically 40 per cent. reduction of the cost of the old method, and the commutator is both lighter and in every way superior to the old type. The full benefits of this construction of commutator can only be obtained with quantity production.

Bankruptcy Proceedings.—Archibald Atkinson, 30, Great George Street, Leeds, cycle and electrical engineer.—The first meeting of creditors herein was held last week at the Official Receiver's office, 24, Bond Street, Leeds, when the statement of affairs showed ranking liabilities of £57, to meet which there were assets of £10. The failure was ascribed to lack of business experience and bad trade. No resolutions were passed.

Trubie Moore, electrical engineer, 75, Headingley Mount, Kirkstall Lane, Headingley, Leeds.—The public examination of this debtor took place at the County Court House, Albion Place, Leeds, last week, when Mr. Registrar Gillespie ordered the case to stand adjourned.

Dissolutions and Liquidations.—Electric Flashlights, Ltd.—A meeting of creditors will be held at 20, John Street, Adelphi, on October 16th, to hear an account of the winding up from the liquidator, Mr. R. G. Sidford.

Lumen Fittings Co., Ltd.—A meeting of creditors will be held at Messrs. Flint & Thompson's offices, 71, Temple Row, Birmingham, on October 15th, to hear an account of the winding up from the liquidator, Mr. G. W. L. Thompson.

Mordey-Fricker Electricity Meter Co., Ltd.—Referring to a previous notice which has been published, we are informed that this company, having sold its patents and business to the British Insulated and Helsby Cables, Ltd., has gone into voluntary liquidation, simply to wind up the business. The advertised meeting of creditors was called only to comply with a legal formality, there being no creditors.

Trade Announcement.—The new name of the Schniewindt Electric Co. is the Cressall Manufacturing Co., not the Cressall Electric Co., as already announced.

LIGHTING and POWER NOTES.

Ashton-under-Lyne.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £42,000 for extensions to the electricity works.

In connection with the extension of the Cavendish Street mills for Messrs. Reyners, Ltd., the blowing-room machinery is to be driven by electric motors.

Aylesbury.—Cables.—The U.D.C. has postponed the acceptance of the tenders for cables and the erection of the E.L. station owing to difficulties in obtaining a loan on favourable terms.

Barrow.—The borough electrical engineer has been authorised to obtain an electrically-driven air compressor for the purpose of keeping the electrical machinery free from dust.

Bolton.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £1,463 by the Corporation Electricity Committee in connection with the new Back-o'-th'-Bank power station.

Brymbo.—L.G.B. Inquiry.—The application for a loan of £300 for the provision of lamp-posts, &c., for public lighting by electricity will shortly form the subject of an inquiry.

Chippenham.—Overhead Lines.—The T.C. has granted an application by the E.L. Co. to use overhead lines to give an immediate supply of current to the signal works of Messrs. Saxby & Farmer, Ltd. The company has also been granted permission to erect an experimental light in the town.

Cleckheaton.—L.G.B. Inquiry.—An inquiry was held last week into the application of the Council to borrow £2,200 for the purposes of the electricity works. The loan was required for the provision of a storage reservoir and a new switchboard. There was no opposition.

Dewsbury.—Annual Report.—The annual accounts of the Corporation electricity undertaking for the year ended March 31st last, show a gross profit of £5,781, out of which £4,300 was placed to the sinking fund, &c., £500 to the renewals fund, and a similar amount to the relief of the rates, leaving a balance of £984, as compared with £536 in the previous year.

Dover.—Bulk Supply.—The Electricity Committee last week considered the offer of the S.E. Electricity Supply Co. to supply power in bulk from the power station at Tilmanstone Colliery. The price quoted was ¾d. per unit for a million units, with reductions for larger quantities to ·74d. and ·72d. The Committee decided that it did not at present see its way to incur the capital expenditure which an alteration of the system would entail.

Droylsden.—Street Lighting.—A Sub-Committee has been appointed to consider the question of lighting the public streets on Fairfield Estate by electricity.

Dundee.—Bulk Supply.—The Electricity Committee has refused the application of the Tayside Electricity and Gas Co. for a bulk supply of electricity for distribution in Wormit, as it would involve an expenditure of £3,000 for cables. The Committee decided to offer a supply of current in Dundee, leaving it to the company to convey it across the River Tay.

Greenock.—Annual Report.—There is a credit balance of £3,473 in the Corporation electricity department, and this has been placed to the reserve fund, which now amounts to £16,000.

Hemsworth.—Prov. Order.—The R.D.C. has decided to support the application of the Yorkshire Electric Power Co. for E.L. powers for the district.

(*Continued on page* 404.)

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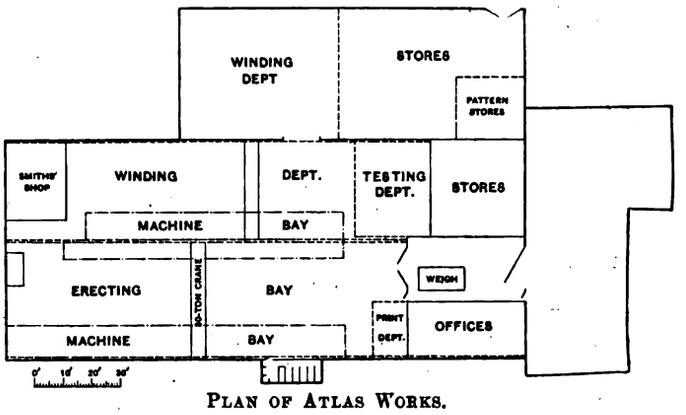
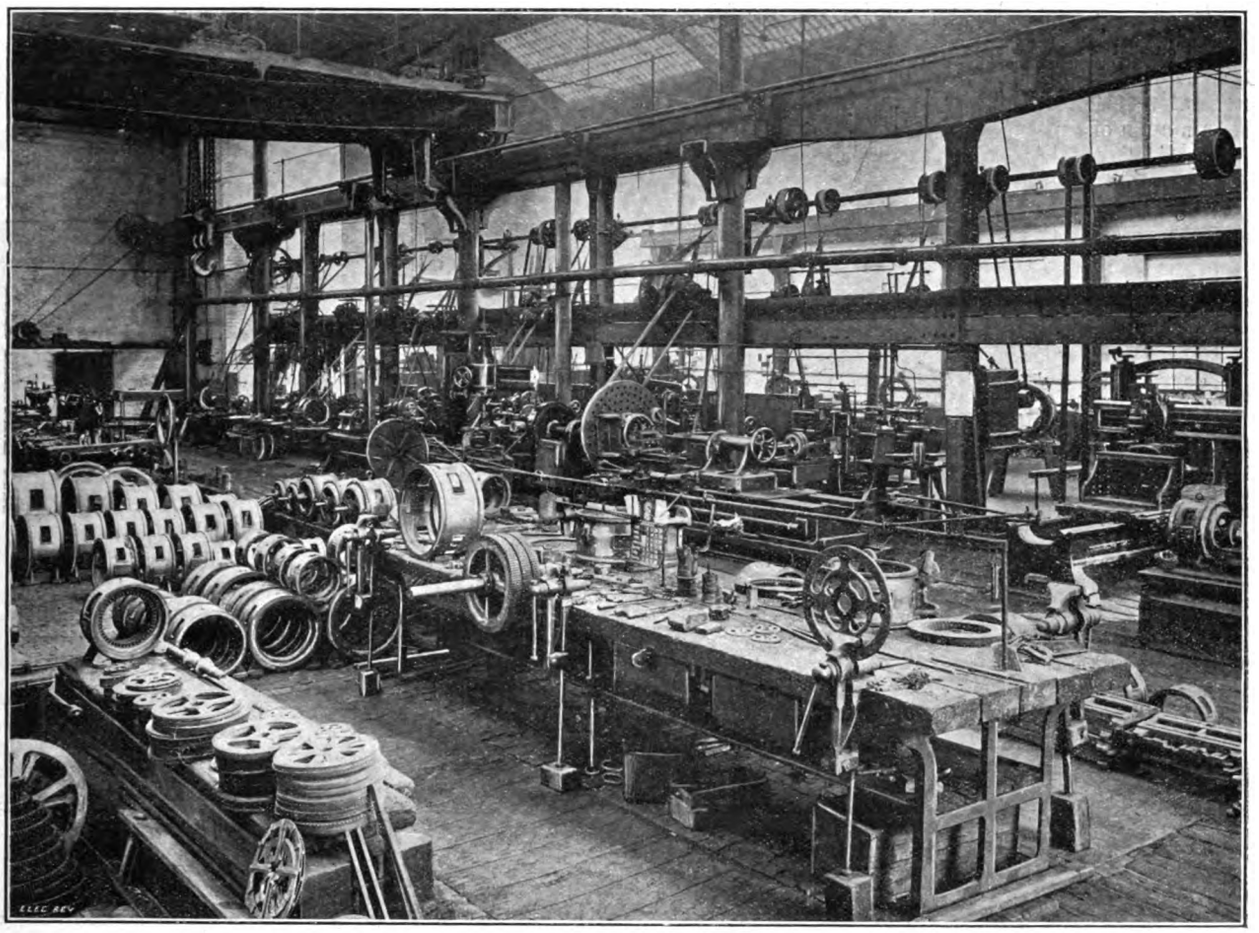
THE WORKS OF MESSRS. T. HARDING CHURTON & CO., LTD., LEEDS.

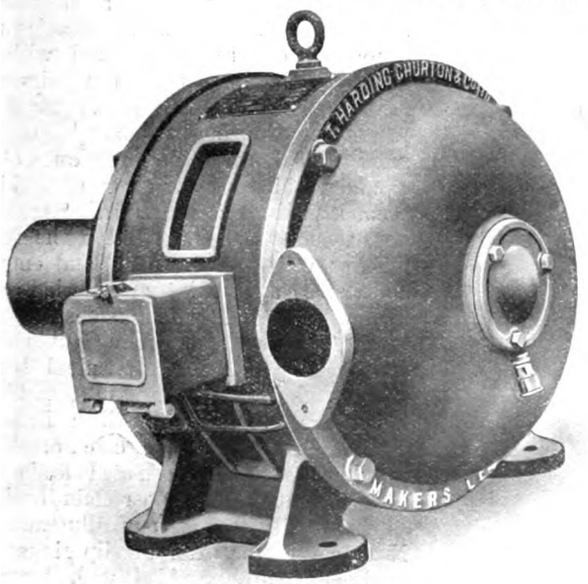
The virtues of specialisation are well exemplified by the history of the manufacturing business established by Mr. T. Harding Churton at Leeds in 1897. Commencing with direct-current generators and motors, Mr. Churton saw his opportunity when the master-patent of the induction motor expired—and seized it. Thus, in 1902 he began the manufacture of A.C. induction motors, and soon devoted almost his whole attention to this subject; the Corporation of Leeds at that time was just about to commence the supply of two-phase current, and Mr. Churton was already building the motors before the new system was inaugurated. Some of his earliest machines are running in Leeds to-day, and giving satisfaction. About eight years ago, the business having prospered, it was transferred to the Atlas Works in Water Lane; the site is conveniently situated near the centre of the city, and affords ample facilities for



Plan of Atlas Works.



Erecting and Machine Shops in Messrs. Churton's Works.



Pipe-Ventilated Motor, with Ball Bearings.

extensions. In 1912 the conversion of the firm into a limited company marked a further stage in the development of the concern. The company has a London office at 52, Queen Victoria Street, E.C. Mr. Churton for some time has devoted much attention to Canadian trade, and has traversed the Dominion from end to end on three occasions during recent years; by personal investigation he was thus enabled to cultivate the Canadian market, in which his motors have proved very successful, being able to compete with and beat the American-made motors as regards both efficiency and power factor.

The Atlas Works, as altered and adapted by Mr. Churton, lend themselves admirably to the purposes of motor manufacture; as shown in the accompanying plan, the material undergoes little unnecessary handling in its progress through the shops, the general trend of motion being from the stores through the erecting and machine bays, returning through the winding department, and so arriving at the test bed, whence the machines pass into the finished stores or the shipping department. The erecting bay is served by a travelling crane capable of lifting 30 tons, and a smaller crane serves the winding department. A railway runs from the erecting bay through the testing department.

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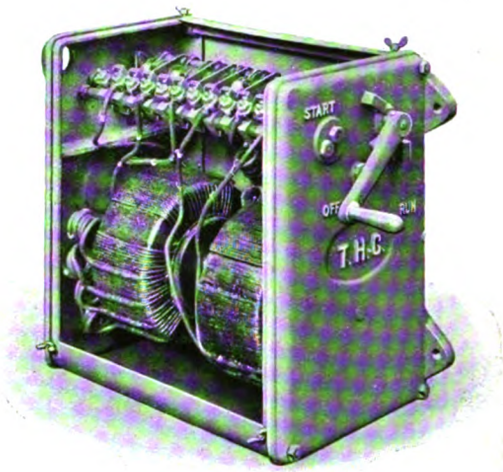
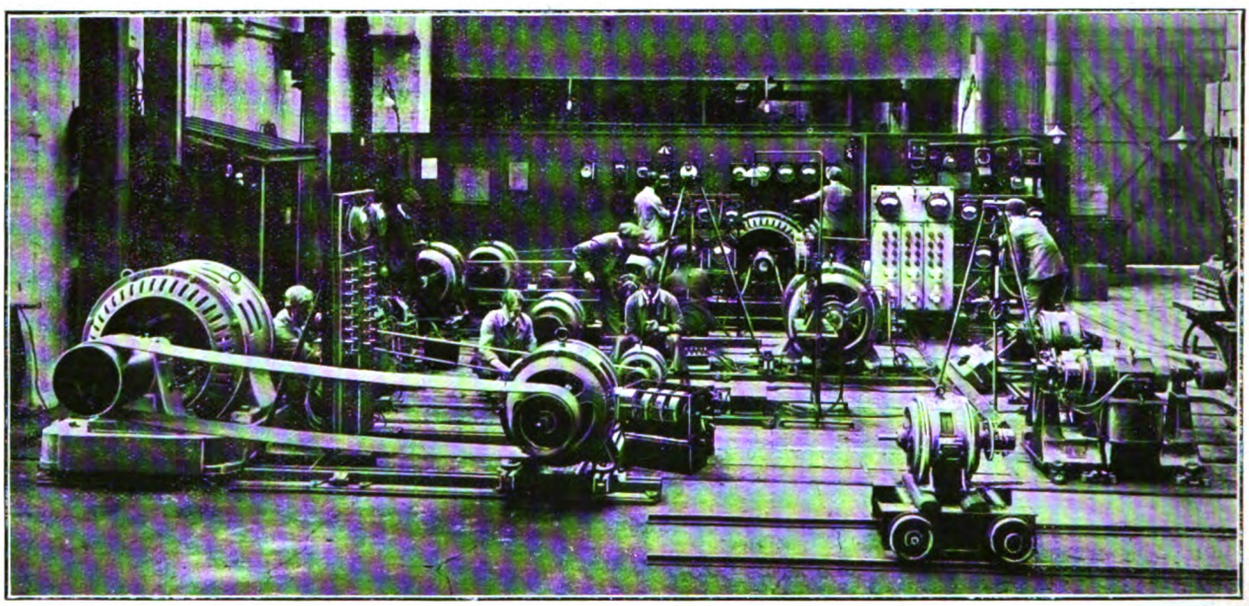
Power is obtained from the Leeds Corporation mains, both for driving the shafting and for the operations of the testing department. The equipment of the latter, comprising motor-generators and exciters, and a variety of switchgear and instruments, enables a supply of one, two or three-phase current to be obtained, at any frequency from 25 to 60 cycles per second, for two-phase or three-phase, and up to 100 cycles, single-phase, and any pressure up to 4,000 volts. In view of the difficulty of getting steady readings of speed with a Prony brake, an ingenious method is employed, resembling the method of "double weighing"; simultaneous readings are taken of torque and current with the Prony brake, an easy matter, and then the motor is belted to a generator which is used to provide a steady load. The same current readings as before are then reproduced, and the corresponding speeds are observed, which can then be plotted against the brake loads observed in the first series of tests.

A severe test is applied to the motors by running them on a circuit at double their normal pressure, whereby they are quickly heated up to or beyond their normal full-load temperature; the motors are then run for a time on full load, and the temperature is observed at intervals. Obviously it is easy by this means to ascertain the final temperature attained on continuous running at full load, in the minimum of time.

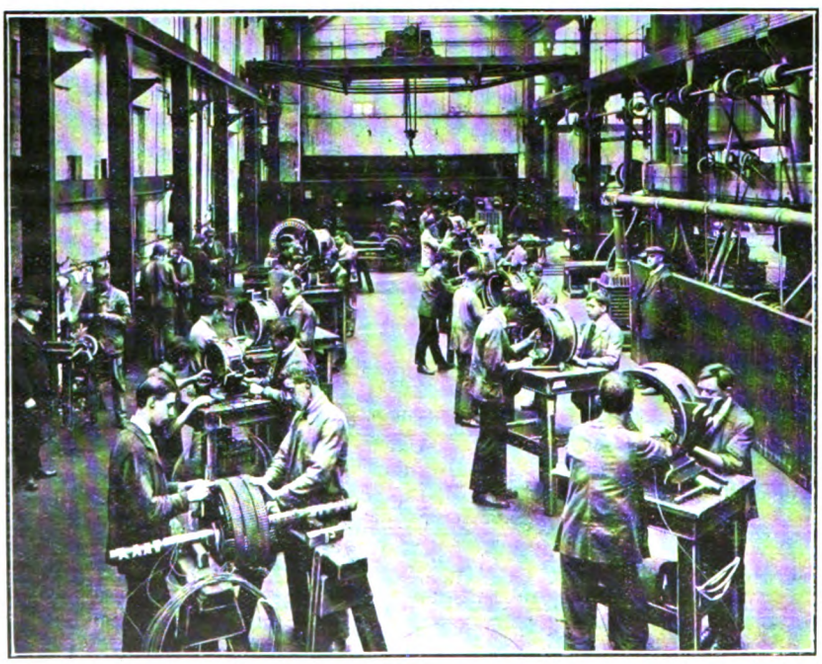
A special feature of the motors is the high efficiency and power factor obtained over a large range of load, due to the use of partially-closed slots on both stator and rotor. This necessitates hand winding, which is carried out with great care, with a view to ensuring reliability in service. The d.c.c. wire is impregnated with varnish in a special oven and



Drum-Type Auto-Transfobmer Starter.



Test Bed at Atlas Works.



No. 1 Winding Bay.

waxed before use, to facilitate the winding process, and the end connections of the coils are afterwards carefully taped and varnished. This system enables any individual coil to be repaired without affecting the rest, though repairs are rarely called for, and partly for this reason the company has not adopted the practice of impregnating the coils after winding, which has the effect of making them a solid mass and rendering rewinding extremely difficult. Inside the slots, for low voltages, presspahn and empire cloth tubes are used for insulation; for high voltages and for motors destined for tropical climates micanite tubes are employed. Convenient terminal boxes are provided on the machines, and the mains are brought into them in steel conduit, except in the case of high pressures, when the insulated leads are brought out through porcelain bushes, as shown in one of our illustrations. Neat covers for external slip rings are used, which are provided with bayonet joint fastenings, and can be quickly

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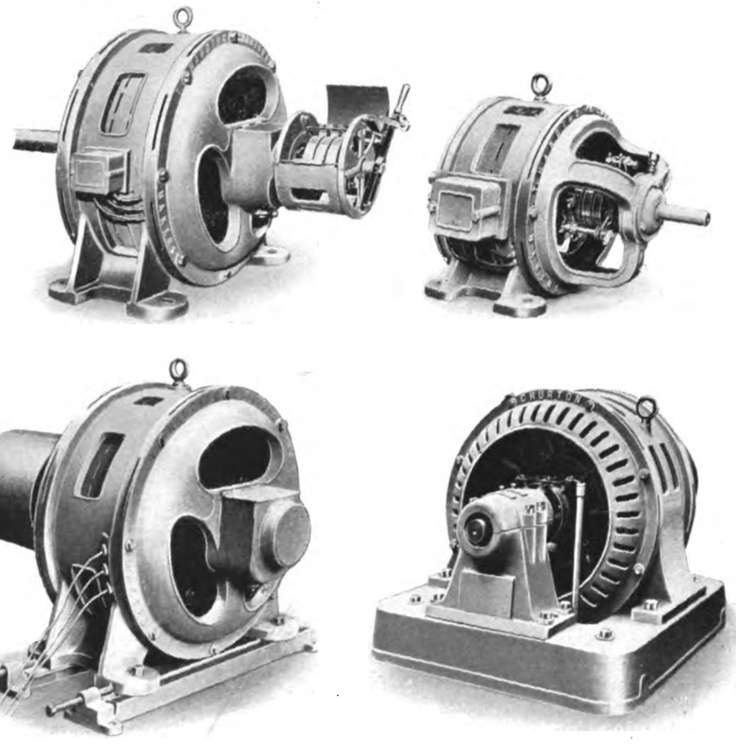
removed. The slip rings are either internal or external as ordered, both types being here illustrated ; a neat device for short-circuiting the rings and lifting the brushes by means of a lever on the end of the machine is also shown.

Ball bearings are very freely used and often recommended, but sleeve bearings with oil-ring lubrication are also fitted ; no trouble has been experienced with the ball bearings, mainly because special care is taken to apply them in the proper way. All parts are made interchangeable, jigs and limit gauges being used to ensure accuracy of workmanship.

Amongst recent additions to the apparatus made by Messrs. Harding Churton's works are pipe-ventilated motors, and totally-enclosed auto-transformer starters for motors with short-circuited rotors. The former, which we illustrate, are fitted with ball bearings, and fan blades on the rotor, which are equally effective in either direction of rotation. The terminal boxes have hinged covers, and are arranged for screwed-conduit connections. The starters are of the drum type, with renewable contact fingers and tips, and the insulation is of micanite throughout. The starters are mistake-proof ; the operating handle cannot be left in the starting position, nor can it be moved to the running position except by being quickly thrown over from the starting position. The transformer connections are conveniently accessible, and the coils are provided with a series of tappings giving from 40 to 75 per cent. of the line voltage for starting. We illustrate one with the cover removed on p. 400. A similar starter is made with the drum below the transformer, and immersed in oil in a tank which is easily removed.

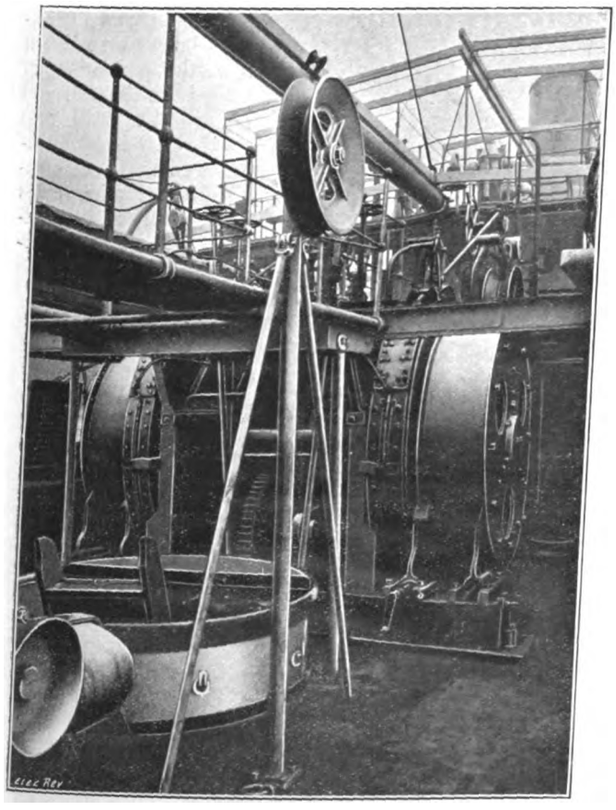
The progress of work through the shops is controlled by a simple system of cost cards, which involves no superfluous work, and is easily operated by one clerk, who also works out the costs, time sheets and wages, and analyses the data so as to show at a glance the cost of each item. By this means any excess of expenditure on a particular part or type of machine is readily detected and remedied, and scope for improvement in design is made apparent.

Amongst the larger customers of the company are various Government departments, as well as Sir W. G. Armstrong, Whitworth & Co., the Great Western Railway, Leeds Corporation and other public bodies. Mr. Churton's American tours have also brought large orders from Canada and the United States, and the company has agents in several of the over-sea Dominions and in Mexico.



100-h.p. Motor with Short-Circuiting Device.
High-Voltage 150-h.p. Squirrel-Cage Motor.
Three-Phase Motor with Internal Slip-Rings and Ball Bearings.
Three-Phase Synchronous Motor, 150-h.p.

Some Churton Motors.



Cable Gear of the c.s. "Transmitter" looking Aft.

A NEW CABLE-REPAIRING STEAMSHIP.

Although not by any means the largest, undoubtedly one of the most interesting ships specially designed and equipped for the laying and repairing of submarine cables is the single-screw steamer *Transmitter*, which has recently been added to the fleet of the Eastern Telegraph Co., Ltd.

The *Transmitter*, built by the Goole Shipbuilding and Repairing Co., Ltd., is 221 ft. 4 in. in length overall, 30 ft. in breadth, moulded, 17 ft. 6 in. in depth, moulded, and has a gross tonnage of 903 tons. The vessel is classed in Lloyds' Registry 100 A1 with special survey, but many of the scantlings and parts exceed Lloyds' requirements.

The *Transmitter* is designed to carry a crew of 55 ; the captain's quarters are on the bridge deck, and comfortable well-fitted accommodation for the officers, electricians and engineers is provided on the main deck. On the lower deck aft of the engine room is the engineers' workshop. On the forecastle bridge and main deck the most modern appliances are provided for the delicate and difficult services of laying and repairing submarine telegraph cables. This equipment comprises a steam cable machine, two dynamometers, turning-over gear and bow sheaves and a Lucas sounding machine.

The cable gear, constructed and installed by Messrs. Johnson & Phillips, Ltd., is claimed to be the most highly-finished machinery of its class fitted on any cable steamer. Every gear wheel, even the large gears on the main drums which have 70 teeth of 3¼-in. pitch, is machine-cut from

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the solid, all the larger wheels being of cast-steel, while the pinions are of Immadium bronze.

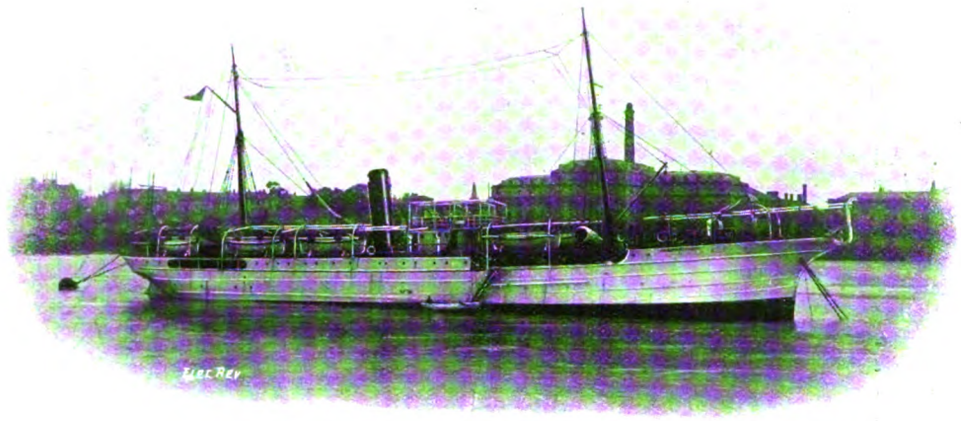
Several of the steel wheels were "muffled" in accordance with a suggestion of Messrs. Johnson and Phillips, so as to eliminate the "ring," the result being that the gear works with a minimum of noise and rattle. The cable gear is a combined picking-up and paying-out machine having two drums, but with one engine, the drums being independent of one another, so that while one is picking up the other can be paying out under control of the brake. The drums run loose on the drum-shaft, which is a fixture in the frames, making a very rigid job. They are internally geared, and are connected to the second-motion shaft by machine-cut bronze pinions which are carried on a shaft in special pocket bearings attached to the main frame, and so constructed that the pinions can slide into gear through large holes in the frames, making a very compact job.

The engine is coupled to the first-motion shaft by means of machine-cut bevel gear. The drum pinions and the speed wheels are slid into gear by means of wipers actuated by worm gearing and hand-wheels from the platform deck above. All the controlling mechanism is arranged on the top deck, the steam stop valve, reversing lever, main brakes, and holding-back gear brakes, all being within arm's reach of the attendant.

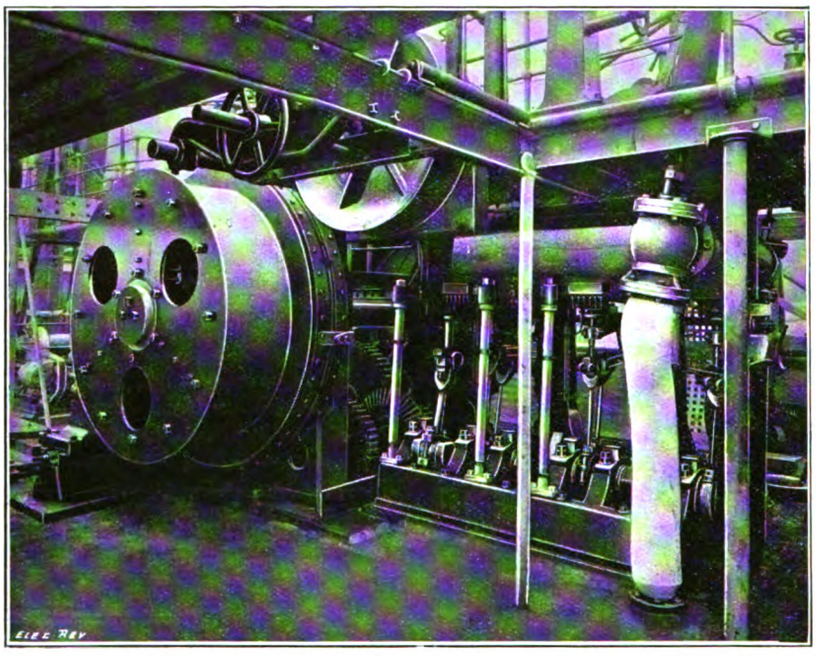
The drums are 5 ft. 8½ in. in diameter on tread by 1 ft. 7 in. wide between the flanges, and they are geared for two speeds, for nominal lifts of 15 tons at one knot, and 6 tons at three knots, but the engine is a very powerful one, having three cylinders 11½ in. in diameter by 13 in. stroke, thus enabling the gear to deal with any lift that it may be called upon to do. Evidence of this was given while the lift tests were being made, the load of 15 tons being picked up with great ease, and the valve gear is so adjusted that it is possible to haul up quite steadily even a few inches.

Each drum is provided with a large brake ring, encircled by a brake band consisting of steel straps fitted with elm blocks, and on the back of each strap a water service pipe is attached having small nozzles at intervals to allow the water to be delivered equally all round the brake ring, so as to permit of paying out fairly long lengths of cable.

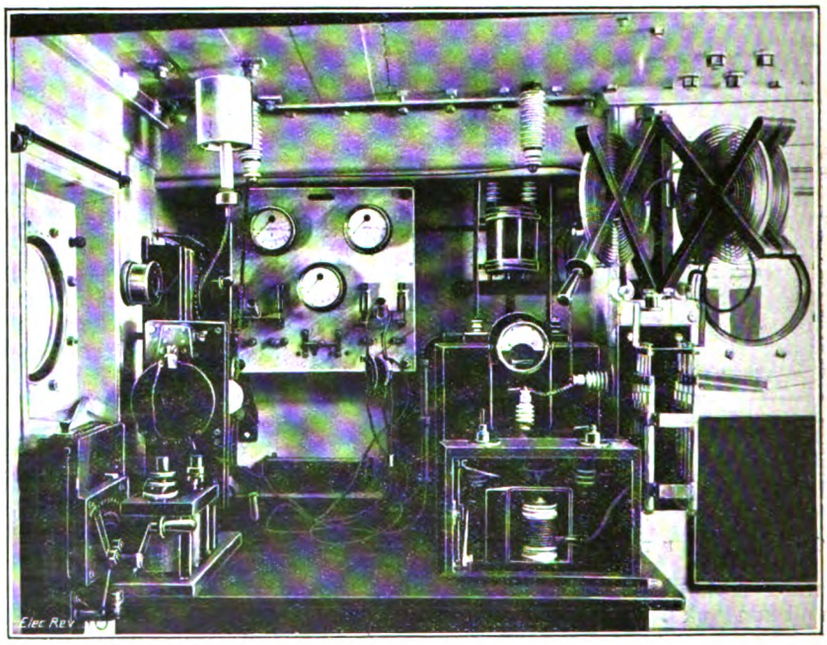
Some brief outline of the *modus operandi* pursued in repairing submarine cables, for which the *Transmitter* has been specially designed, may not be without interest. First, the electrician determines, by means of careful electrical measurements taken from the shore, the position of the fault in the cable. The ship then proceeds to the spot and places a mark-buoy as nearly in that position as can be estimated, and whilst waiting to verify it by astronomical observations, she takes a series of soundings so as to deter-



The New C.S. "Transmitter."



Cable Gear, Looking Forward.



Wireless Telegraph Installation.

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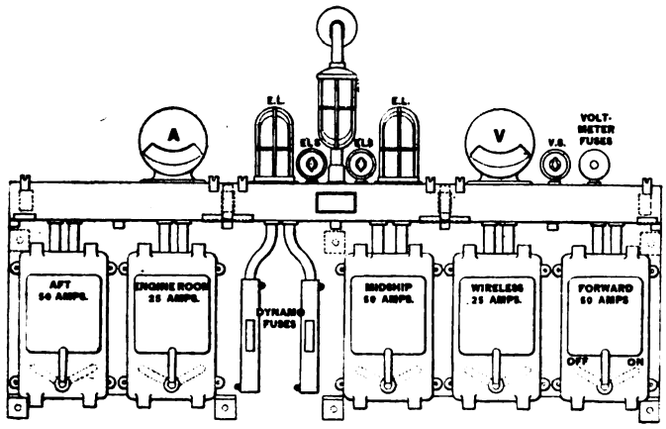
mine accurately the depth and nature of the bottom in the neighbourhood of the buoy, where the grappling work will have to be done.

The soundings are taken with a wire sounding machine. The Lucas machine, for depths up to 5,000 fathoms, is fitted with a grooved wheel for driving by a rope from a steam winch or other engine. The wire of the sounding machine is on a cast-steel drum, and as it is paid out passes over a measuring wheel, the revolutions of which record on a dial the number of fathoms out; when the sinker strikes the bottom the loss of tension allows a brake to spring back and stop the reel, and the depth can then be read off on the dial.

On obtaining the latitude and longitude by observation, it may be found that the mark buoy is some distance from the line of cable, in which case a second buoy is placed exactly on the line, and the bearings of both buoys are used in order to determine the courses made whilst grappling. The ship now proceeds to the position for lowering the grapnel, which is usually about a mile from the line of cable, and she then steams very slowly across the cable. The speed of grappling should never exceed one mile per hour, and in deep water it is often advantageous not to go at more than half this speed. The ship is sometimes allowed to drift with the wind or current when these are favourable and across the line. After the cable has been hooked and raised to the surface, it is cut, and the ends are taken on board the repairing ship. Electrical tests are then made to ascertain towards which shore the fault lies, and how far from the ship it is. As soon as this is known, a chain is attached to the good end, and it is left hung up to a buoy, whilst the ship proceeds to pick up the cable towards the fault, cutting it and testing from time to time in order to see whether the fault has come on board. As soon as this proves to be the case, new cable, which has been stored in one of the cable tanks on board the ship, is spliced on to the end of the cable which is being picked up. This is then paid out over the bow sheave in the direction of the buoy. This operation completed, the end of the cable hung up is taken on board, the two ends are spliced together, and the bight is carefully lowered to the bottom.

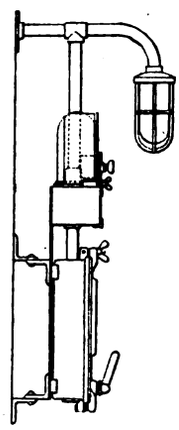


Ironclad Main Switchboard, c.s. "Transmitter."

Several types of grapnels are used, according to the varied conditions of the bottom, but, perhaps, that most frequently used is the centipede pattern. The grapnel is made in two sizes—the larger weighing about 2 cwt., and the smaller 1¼ cwt.—and it has the advantage of being of strong construction and not easily broken on rough ground. It hooks the cable securely, and if a prong does get broken through hooking a rock, the damaged prong is easily replaced. The grapnels are regularly kept very clean, and painted grey, as a speck of tar on the grapnel affords the most important evidence that a cable has been broken.

In the lifting of an old cable which is in a very weak condition, it sometimes becomes necessary to hang it half way up on a bight buoy, and then to hook the cable a second time between this buoy and the broken end, so that the cable may be lifted to the surface without putting the whole weight of it on one grapnel. It is, however, more usual to utilise the Lucas cutting and holding grapnel, which is designed to hook the bight of a cable, to cut and drop one end, and to grip and raise the other end to the surface. It is dragged over the bottom, and when the cable has been hooked the bight is raised until it becomes tight; the strain then breaks the bolts which keep the arms extended, and the tension on the wire rope causes the arms to fold down on to the shank, gripping the cable on one side and cutting off the other.

The refrigerating machine was supplied by Messrs. J. and E. Hall, Ltd., of Dartford; it is one of their steam-driven combined CO_2 type, and forms a very compact and complete unit. There are two large refrigerating chambers, for the preservation of meat and vegetables, in the after-hold, with a complete system of brine piping carried from the ice machine. The electric light installation is a very comprehensive one, and was carried out by Messrs. Clarke, Chapman & Co. The engine is of the open marine type, coupled to a compound-wound dynamo, with an output of 100 amperes, 100-105 volts, when running at a speed of about 350 R.P.M. The contract also included the supply and erection of the main switchboard, cables, wiring, &c., for 235 points and 226 lights, and 15 fans, as well as the masthead light, three cable lanterns, and one Morse signalling lantern on the masthead, the last being of Wightman's patent type.



The deck machinery includes a powerful windlass, manufactured by Messrs. Emerson, Walker & Thompson, which is fitted on the forecastle deck. There is a combined steam and hand steering gear, manufactured by Messrs. R. Roger and Co., Ltd., which is fitted within the poop, and is controlled by a system of rods and a wheel from the navigating bridge.

Inclusive of a steam launch, there are eight boats. The launch is designed for towing cable lighters, &c., and other hard work at sea.

The wireless telegraph installation was manufactured and erected by Messrs. Siemens Bros. & Co., Ltd., Woolwich, upon the quenched-spark system. The adoption of this system has made the building of a special cabin and spark gap chamber unnecessary upon the *Transmitter*, the quenched-spark installation being practically noiseless. Another advantage claimed is that, the note emitted being musical in character, the station can be heard even when natural electrical discharges are as much as 10 times as intense. The source of energy of the installation is a motor-generator set consisting of a direct-current motor of about 1½ H.P., driving an alternating-current generator of 1-KW. output at 220 volts, 500 frequency. The speed of this motor can be adjusted over a range of about 30 per cent. of the normal speed for the purpose of adjusting the pitch of the note transmitted.

This motor-generator set is installed in a "spark room," and the necessary leads run from there to the wireless telegraph apparatus proper, which is situated in the cable testing room. The alternating current from the generator is stepped up from 220 volts to 8,000 volts by means of an iron-core transformer. A choking coil is provided in the low-tension circuit in order to obtain the necessary resonance between the low-tension and excitation circuit. The excitation circuit consists of an iron-cased condenser with glass dielectric and oil insulation, an inductance of copper strip and a quenched spark gap. The latter consists of a number of silver faced copper plates separated by mica rings. The whole excitation circuit is enclosed in a wooden case, upon the back of which is provided a hot-wire ammeter. Slots are cut in the top of this case through which plugs are fixed in sockets corresponding to the positions required upon the inductance for the 300 and 600-m. wave lengths. Connections are made from these plugs to an inductance of the variometer type which serves to obtain the correct resonance between the excitation circuit and the aerial. The receiver is of the Siemens Telefunken type; the detectors, two of which are mounted upon the receiver, are of the contact type. The coupling of the primary and secondary coils of this receiver is capable of very large variation; the wave length of the receiver is from 200 to 2,000 m.

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In order to prevent damage to the detectors and receiving apparatus during transmission a special form of switch is provided at the back of the receiver, which ensures that transmission cannot take place until all the receiving circuits are broken by means of this switch. The ranges over which this station will work have been guaranteed as 150 nautical miles by day and about 250 miles by night, but from the previous experience of Messrs. Siemens it is expected that the actual working range will be greatly in excess of these figures.

The testing room, which is of large dimensions, is, of course, the principal apartment in the vessel, for it not only contains the delicate instruments by which the condition of the cable in the vessel's tanks is tested from time to time, but also it is the speaking and sending place of service messages to the head office and the station on whose cable the vessel may be working at the time.

As the *Transmitter* will be required to work in tropical climates, special consideration was given to the lighting and ventilation of the various apartments and machinery spaces. Two sidelights and separate ventilator cowls are fitted to each cabin, whilst the workshop, lower deck and crew space are all well lighted and fitted with large ventilator cowls, and all of the ventilators are carried well above the weather deck. Double canvas awnings are fitted from stem head to stern.

The propelling machinery consists of triple-expansion engines supplied by Messrs. Richardsons, Westgarth & Co., Ltd., and on the official trials, which took place off the Humber, a mean speed of 11·2 knots was obtained. The hull and machinery of the *Transmitter* were built to the specification, and under the direct supervision, of Mr. P. L. Isaac, the superintending engineer of the Eastern Telegraph Co., Ltd.

After having completed four repairs to cables between Porthcurnow (Cornwall) and Vigo, the *Transmitter* left the Thames for the West Coast of Africa on May 23rd last.

LIGHTING and POWER NOTES.

(*Continued from page* 398.)

Hexham.—The 1906 electric light extension order has been revoked.

Keighley.—L.G.B. Inquiry.—An inquiry was held recently into the application of the Corporation to borrow £16,700 for the electricity undertaking.

Kelso.—Proposed E.L.—Negotiations are in progress between the T.C. and the local gas company regarding a proposed electric lighting scheme for the town.

Little Crosby.—New Power Station.—The Hightown Gas and Electricity Co. has applied to the B. of T. for consent to erect a generating station in St. George's Road, Hightown.

London.—St. Pancras.—Reserve Fund, Loans, &c.—The B.C. is recommended to write off, out of the electricity reserve fund, the sum of £1,422 from the electricity capital account, being the outstanding balance of the cost of copper strip mains removed from three streets. Application is to be made for sanction to borrow £8,969 in respect of expenditure on the electricity capital account to March 31st next. The County Council has sanctioned the borrowing of £22,530 for the provision of four boilers at the King's Road station. The Finance Committee recommends the utilisation of £13,000 from the electricity profits towards the relief of the rates during the winter half-year.

Stepney.—Bulk Supply.—The B.C., owing to the war, has been unable to obtain delivery of turbo-generators, upon the installation of which the bulk supply of current to Shoreditch depended. Under the circumstances, and as a temporary expedient, the Shoreditch B.C. is recommended to approve the offer of the Stepney Council for a limited supply up to 600 or 700 kw. at an increased price per unit during the four hours of peak load, the contract price being chargeable during the rest of the 24 hours.

Shoreditch.—Year's Working.—The accounts of the electricity undertaking show an increased revenue over the previous year of £4 836. The expenditure has increased by £3,588. The surplus for the year, after meeting all charges, &c., is £4,715, which, with the balance brought forward (£54), makes a total of £4,769. The Lighting Committee proposes to dispose of this balance in the following manner:—In relief of rates, £1,500; to reserve fund, £2,500; to change of pressure account, £133; to conversion of gas lamps, £515; balance carried forward, £120. The current generated from destructor steam during the period under review amounted to 781,016 units, for which the department has paid £1,592, in addition to £400 for standby.

Penistone.—Workhouse Lighting.—With reference to the E.L. scheme for the Workhouse, the L.G.B. has informed the B. of G. that it will send an engineering inspector to visit the institution.

Pontefract.—Prov. Order.—The R.D.C. has decided to take no action regarding the application for E.L. powers by the Yorkshire Electric Power Co.

Sheffield.—At the last week's meeting of the City Council it was agreed to appoint Mr. Fedden manager, and Mr. Yerbury deputy manager, of the combined electric supply and tramways power stations. The arrangement reduces the staff by one, and saves £400 a year in salaries.

Shepley.—Prov. Order.—The U.D.C. has decided to support the Yorkshire Electric Power Co.'s application for lighting powers, provided it does not create a monopoly.

Southampton.—The T.C. has received permission to supply energy in South Stoneham, outside the area of supply. The electrical engineer reports that the self-contained electrical installation at the baths, shows considerable signs of wear, and that the wiring installation is defective; the Baths Committee has decided to in future take the current for the lighting of the building direct from the town supply, and has directed the engineer to carry out the overhauling and renewal work.

South Wales.—Power Co.'s Progress.—In connection with the bulk supply scheme for Merthyr, which was inaugurated early this year, it may be of interest to note that the South Wales Power Co. is also giving bulk supplies to the Mountain Ash U.D.C., at Ynysybwl, to the Llandaff and Dinas Powis R.D.C., at Whitchurch, to the Radyr Electric Co., at Radyr, to the Mardy Electric Light Co., at Mardy, and to the Rhymney Valley and General Electric Supply Co., at Bargoed, and that a special agreement has been entered into with the Rhondda Council under which supplies of electricity will be taken from the Power Co.'s mains in bulk by the Council for lighting and general purposes, and under which the Council supplies electricity in bulk from refuse destructors to the Power Co. In addition to these supplies, the Power Co. itself holds a prov. order in the Caerphilly Urban District, covering Abertridwr, Senghenydd, Llanbradach, Taffs Well and Nelson. The supply is already being given in the four first-named places, and arrangements are in progress for giving a supply at Nelson, which, it is hoped, will be in operation during the present year. The Power Co. is also supplying electricity under a prov. order in the parish of Llantwit Fardre, and holds a prov. order for the Urban District of Abercarn, &c. The company has already installed and working two 6,000-H.P. turbo-alternators, and has in process of erection another set capable of developing 10,000 H.P. Two large new Babcock & Wilcox boilers, with special induced draught arrangements, Green economisers, and superheaters have also recently been installed, and are at work, and the total equivalent in I.H.P. available in the power station is about 30,000. The greater part of the Power Co.'s business at present consists of supplies to collieries and other industrial enterprises, some of the principal among which are the following:—Great Western Colliery Co., Ltd., at Penrhiw and Maritime, Tymawr, Gyfeillon, and Cwm new sinkings; Albion Steam Coal Co., Pontypridd; Windsor Steam Coal Co., Abertridwr; Lewis Merthyr Collieries, at Trehafod, Lady Lewis and Senghenydd; Locket's Merthyr Collieries, at Mardy; Newport Abercarn Steam Coal Co., at Celynon; Rhymney Iron Co., Ltd., at Pengam and Groesfaen Pits; D. Davis and Sons, Ltd., Bodringant; Duffryn Llantwit Colliery, Elled Colliery, Pontypool; Mynydd Maen Colliery, Pontypool; Baldwin's Albion Road Colliery, Pontypool; Mr. Thomas Taylor's Pit at Darranddu, and the new sinkings at Nantgarw; Redbrook Tinplate Works, Pontnewydd; Melingriffith Steel Works, Whitchurch; and Baldwin's Steel Works, Panteg.

Sutton.—The U.D.C. has sent to the B. of T. formal objection to the application of the County of London Electric Supply Co. for an order authorising it to supply current in bulk to the South Metropolitan Electric Tramway and Lighting Co., Ltd.

Swansea.—The Education Committee has decided to have the work at the Training College Hostel laundry done by electrical power, and has instructed the borough electrical engineer to provide the necessary plant, &c. Two main feeder cables are to be laid to the centre of the town at a cost of £600. The Electric Lighting Committee is prepared to wire the first hundred municipal houses to be erected at Town Hill at a charge of 7d. per week each house, exclusive of renewals, each house to include four lighting points.

Torquay.—L.G.B. Inquiry.—An inquiry was held on the 8th inst. into the application of the T.C. for a loan of £16,000 for electricity purposes; a further proposal to expend £500 for illuminating Princess Gardens, was deferred for the present.

Tynemouth.—The T.C. has been recommended to instruct the electrical engineer to wire the new premises of the local rifle club free of cost, and to make a net charge of ½d. per unit for current supplied. The Electricity Committee has empowered a sub-committee to make all necessary arrangements in connection with a communication received from the Newcastle Electric Supply Co., Ltd., advising the Council that it might be necessary for the Corporation to run the generating plant at the works during the coming winter.

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Walsall.—NEW LOANS.—The T.C. is applying to the L.G.B. for sanction to the borrowing of £23,595 for the electricity undertaking. The tariffs for all classes of supply are to be revised, and new charges will come into force in October.

Wolverhampton. — The Corporation Sewerage Committee has decided to undertake the electrification of the Hordern Road ejector station and the outfall works at a cost of £730.

York.—OVERHEAD WIRES.—The T.C. has applied to the B. of T. for permission to use overhead lines for the transmission of current in the areas of the Escrick, Flaxton and Great Ouseburn R.D.C.'s, at a pressure of 3,000 volts.

CABLE CONTRACTS.—The Electricity Committee reports that there has been a difficulty in obtaining quotations from certain firms for the supply of cables, and it has authorised the engineer to order the same, paying for them on delivery.

TRAMWAY and RAILWAY NOTES.

Astley.—It is stated that the South Lancashire Tramways Co. is to be approached with a view to inducing it to construct tramways through Astley, where extensive new coalfields are now being opened out. Connections could be formed with the company's existing lines at Leigh and Boothstown.

Coventry.—The tramways department's 'buses have been requisitioned by the Government for military purposes, and are to be sent to Aldershot.

Croydon.—The T.C. has approved an estimate (of £2,550) as the cost of constructing a short double line of tramway track in Selhurst Road.

Keighley.—The Tramways Committee has recommended the purchase of land in Utley, as a site for a trolley vehicle shed, and has decided to purchase two more trolley vehicles from the Cedes Electric Traction, Ltd., at a cost of £806 each.

Marsden. — The U.D.C. has decided to ask the Huddersfield Tramways Committee to meet a deputation relative to the latter's decision not to go beyond the New Inn with the tramway.

Oldham.—During the recent holiday week the tramway manager ran motor-'buses to Denshaw, and the receipts amounted to about 2s. 2d. per 'bus-mile. It is now intended to try a motor-'bus on this route to ascertain whether it will be profitable to run it in normal times.

Pontefract.—The T.C. has accorded its support to an application which is to be made to the West Riding Tramway Co. in connection with reduced tramway fares for workmen between Normanton, Castleford and Pontefract. The present system is said to discriminate in favour of the colliers.

South Africa.—GERMISTON (TRANSVAAL) TRACTION SCHEME.—The official opening of the Germiston railless traction system took place on August 19th without much ceremony. It was originally intended to have some kind of gala, similar to that which took place when the Boksburg system was inaugurated, but owing to the war the opening was very quiet, the Mayoress of Germiston performing the ceremony in front of the municipal offices, and a general invitation was extended to the townspeople to attend a reception at the Hotel Alexander. There are at present six cars available, and four are yet to arrive, but the South African Railway Administration has been unable to guarantee delivery of these in consequence of extensive military movements. The system adopted is the Cedes-Stoll, the special feature being a flexible trolley which is kept automatically taut. The cars, painted grey, are fairly long, and the interior is neatly, though not luxuriously, furnished. The motormen had had ample opportunities to familiarise themselves with the routes, &c., and all passed off quite smoothly. The power is delivered from a sub-station containing two Peebles motor-converters, the A.C. supply being received from the mains of the Victoria Falls and Transvaal Power Co. There is much rivalry between Germiston and Boksburg—the latter's railless system not having proved a brilliant success.

York.—TRAMWAY EXTENSIONS.—The Tramways Committee has given instructions for tenders to be obtained for the construction of the light railway on the Hull Road route as soon as the necessary plans and specifications have been prepared. The tramway manager has been instructed to report as to the equipment of the trolley vehicle routes authorised by the York Corporation Act, 1914, and to obtain quotations for the supply of motor-omnibuses. He has also been instructed to prepare a specification and obtain quotations for two electric 'buses, and to report on the equipment of the new tramway routes authorised by the same Act.

TELEGRAPH and TELEPHONE NOTES.

Cable Tariffs.—In reply to a question in the House of Commons, the P.M.G. stated that the Government were considering proposals which had been made by certain important cable companies for the reduction of cable rates during the continuance of the present prohibition of code messages.

Corea.—According to the latest returns, there are now 11,072 miles of telegraph wires and 29,577 miles of telephone wires in operation in Corea, an increase for the past 12 months, taking in both branches, of 2,352 miles.

Japan.—A wireless telephone service is shortly to be established between Kamishima, an island in the entrance to Ise Bay, and the adjacent port of Toba, to report the arrival of steamers bound for Yokkaichi and other ports in the bay.

Pacific Cable. — The Pacific Cable Board states that, as a result of the war, the cable is interrupted. As mentioned in our last issue, one of the German cruisers in the Pacific appeared at Fanning Island, under French colours, on the morning of September 9th, took possession of the cable station there, and cut off all communication. Every effort is being made to restore the ordinary service with as little delay as possible. In the meantime traffic for Australasia is being dealt with by the Eastern Telegraph Co.

Wireless Station Captured.—The Australian Naval Reserve forces captured the wireless telegraph station at Herbertshöhe, on the island of Neu Pommern, in the Bismarck Archipelago, on Saturday. The wireless tower and station were damaged by the enemy, and will be out of action for some time.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. — SYDNEY. — September 30th. Telephone instruments and parts, for the Postmaster-General. See "Official Notices" August 21st.

October 7th. Telegraph instruments, measuring instruments, incandescent electric lamps, switchboard parts, for the Postmaster-General. See "Official Notices" August 28th.

October 12th. Vacuum cleaning plant and motor-driven air compressor, for the Sydney Municipal Council.

MELBOURNE.—Victorian Railways Department. October 7th. Motors and switchgear, cables and motor-driven air compressors for the Ballarat and Bendigo workshops.

October 12th. Three-phase motors for workshop machinery, for Melbourne Suburban Railways. See "Official Notices" September 4th.

October 27th. Measuring instruments for the Postmaster-General.

ADELAIDE. — October 28th. Telephones and flexiphones, telephone instruments and parts, for the Postmaster-General. See "Official Notices" to-day.

November 4th. Telephone instruments and parts, for Postmaster-General. See "Official Notices" to-day.

PERTH. — November 18th. P.M.G.'s Dept. 249 accumulators with assorted apparatus, for telegraph office, Norseman.—*Tenders.*

October 14th. Cable terminals for the Postmaster-General.

BRISBANE. — December 15th. Switchboard, common battery, automatic or semi-automatic, for the Postmaster-General. See "Official Notices" to-day.

Birkenhead.—September 26th. E.L. plant, gas suction plant with dynamo and additional battery, &c., for the Clatterbridge Infectious Diseases Hospital, for the Wirral Joint Hospital Board. Mr. J. E. S. Ollive, Clerk, 54, Hamilton Street, Birkenhead.

Bolton.—September 28th. Telephone installation, Townley's Hospitals, Farnworth, for the B.G. Mr. John Ward, Architect, 24, Mawdsley Street, Bolton.

Burnley. — September 21st. Guardians. Electrical goods and the performance of electrical work during the next half-year.

Eccles.—September 21st. Coal elevator and conveyer at the electricity works, Cawdor Street, Patricroft. Specifications, &c. (£1 1s.), from the Borough Electrical Engineer.

Hornsey.—October 9th. Two rotary or motor converter sets, &c., for the T.C. See "Official Notices" to-day.

Limerick.—September 18th. Corporation. One three-cylinder Diesel oil-engine coupled to a 160-KW. D.C. generator; one motor-driven air compressor. See "Official Notices" September 4th.

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London.—L.C.C.—September 28th. Installation, 215 wiring points, 285 lighting points, at Gifford Street Elementary School, Caledonian Road, N. See "Official Notices" September 11th.

September 22nd. Induced-draught fans, motors, spare parts and dampers, also alteration of flues and moving of dampers at the generating station, Greenwich. See "Official Notices" August 28th.

St. Pancras.—September 21st. Electric lift for heavy vehicles, for the B.C. See "Official Notices" September 11th.

Manchester.—October 6th. Supply of a car-wheel tire boring mill. Specifications, Mr. J.M. McElroy, General Manager.

South Africa.—Johannesburg.—October 9th. Ten single-truck double-decked electric tramcars, for Municipal Council. Specifications, &c., may be seen at Commercial Intelligence Branch of Board of Trade.

Spain.—Tenders have just been invited by the municipal authorities of Villalonga (Province of Valencia) for the concession for the electric lighting of the town during a period of 10 years.

Sunderland.—The T.C. has authorised the purchase of a motor-generator plant for the electric welding of the tramway track.

Wakefield.—One year's supply of rough slack (135 tons per week) for the Yorks. (West Riding) Electric Tramways Co., Ltd., Belle Isle.

Walsall.—September 29th. Corporation. Extra H.T. switchgear, static transformers, L.T. switchgear. See "Official Notices" September 11th.

Warrington.—September 22nd. The B. of G. invites tenders for six months' requirements of electrical goods, stipulating that no goods of German or Austrian origin will be accepted. Tender forms, Mr. Arthur Bottomley, Clerk, Bewsey Chambers.

September 29th. H.T. cable for the Electricity Department. See "Official Notices" to-day.

Whitby.—September 30th. U.D.C. Construction of cliff tramway or lift. Particulars from the Clerk to the Council.

Whitefield.—September 28th. Electric motors, centrifugal pumps, sewage ejector, sewage disposal works. Specifications, &c., one guinea. Mr. G. M. Denton, Engineer and Surveyor, Council Offices, Whitefield.

CLOSED.

Australia.—Sydney. The Corporation has placed with Messrs. Willans & Robinson, Ltd., a contract for a 5,000-kw. turbo-alternator set, with Dick, Kerr alternator. This is to take the place of a cancelled German contract. The matter is referred to in our "War Items" to-day.

With reference to the placing of a Council's contract for time switches with the British General Electric Co., Ltd, mentioned here last week, we understand that Venner time switches were specified.

Barnsley.—The T.C. has accepted the tender of the Manvers Main Colliery Co. for coal (nuts or small coal) for the electricity works, at 8s. per ton, a large decrease on last year's contract.

Bristol.—The Corporation Docks Committee has accepted the tender of Messrs. Troup, Curtis & Co. for electric cargo light fittings.

High Wycombe.—The Governors of the Royal Grammar School have accepted the tender for the Electric Light Co., at £170, for installing the electric light at the new schools.

Hounslow.—The following tenders have been received by the Heston and Isleworth Education Committee for an electrical installation at the new Alexandra Schools:—

S. N. Virgo	(accepted)	£102
R. Langston-Jones & Co.		110
D. J. Macdonald		128
G. Weston & Sons, Ltd.		155
W. Lacey		160
J. C. Grant & Taylor		175

Ilford.—Two tenders have been received by the U.D.C. for a supply of tram-rails, and that of Messrs. A. McBean & Son (agents for the North-Eastern Steel Co.) has been accepted, at £8 2s. 6d. per ton for rails, and £9 7s. 6d. for fishplates. The other tender was from Messrs. Walter Scott & Co., at £8 10s. for rails, and £10 5s. for fishplates. Since the acceptance of the tender Mr. Sandberg has, under the special circumstances, reduced his usual fee on the rails by one half, and it will include the supervision and passing of the rails at the maker's works.

Keighley.—The Tramways Committee has provisionally accepted the tender of the Cedes Electric Traction, Ltd., for two more trolley vehicles, at £806 10s. each.

London.—Shoreditch.—The Electricity Committee has accepted the following tenders:—

Davidson & Co., Ltd.—Sirocco fan for induced draught capable of dealing with 120,000 cb. ft. of waste gases, complete with all apparatus, £200.
Electric Construction Co., Ltd.—85-B.H.P. continuous-current shunt-wound motor, £278.

Manchester.—The Corporation has placed with Messrs. Ferranti, Ltd., a contract for a two years' supply of D.C. and A.C. meters.

Southampton.—The tender of Messrs. Siemens Bros. and Co., Ltd., has been accepted by the T.C. for the supply of 100 iron insulator brackets for 2s. 1d. each, together with the necessary insulators, &c., at £2 12s. 6d per 100. A tender was also received from the General Electric Co., at 5s. 3d. each bracket, complete.

Sunderland.—The Electricity and Lighting Committee has conditionally accepted the tender of the General Electric Co., Ltd., for two rotary converters.

Swansea.—The tender of the British Thomson-Houston Co, Ltd., has been accepted by the T.C., at £216, for three feeder panels. The tender of Messrs. Herbert Morris, Ltd., has also been accepted, at £76, for a crane at the Uplands sub-station.

Walsall.—The Corporation Tramways Committee has accepted the tender of the Daimler Co., Ltd., for supplying four double-deck and two single-deck motor 'buses for £4,595, the Corporation purchasing the six sets of tires direct from the Dunlop Company, at £321 11s.

The following tenders have been accepted by the Electricity Committee:—

Babcock & Wilcox, Ltd.—Coal weigher, conveyer and boiler house bunkers and jib crane, £4,355.
Herbert Morris, Ltd.—Travelling crane, £652.
Underfeed Stoker Co.—Feed water heater and oil separator, £60.

West Ham.—The Education Committee has received the following tenders for arranging the electric lighting at the Clarkson Street School:—

Lund Bros. & Co.	£76
West Ham Electricity Department	70
T. G. Steel & Co.	65
Simmons & Co.	64
Troup, Curtis & Co.	60
J. T. Halsey	58

The tender of Mr. J. T. Halsey is recommended for acceptance.

The Education Committee is recommending the Town Council, owing to the changed conditions due to the war, to make an allowance to Mr. J. T. Halsey, whose tender was recently accepted at £538 for installing electric light at the Rosetta Road School, of the difference between the prices upon which the tender was based, and the actual cost to the contractor as shown by the invoices for materials supplied.

Whitby.—The B. of G. on Saturday accepted the tender of Messrs. Manlove, Alliott & Co., Ltd., for laundry plant, &c., for electric power, at £404.

Wolverhampton.—The T.C. is recommended to accept the tender of Messrs. Willans & Robinson, Ltd., for reconstructing the 2,000-kw. turbo-alternator at the generating station.

The Corporation Electricity Committee has accepted the tender of the Davenport Engineering Co., of Bradford, at £2,620, for water-cooling towers at the generating station.

York.—The Electricity Committee recommends the acceptance of the tender of the British Westinghouse Co., at £542 10s., for the supply of transformers, also that of Messrs. G. Robson and Co., of Sheffield, for a rail grinder for £65.

NOTES.

Light Railway Acts.—The Board of Trade have issued an additional Rule with respect to applications to the Light Railway Commissioners under the Light Railway Acts, 1896 and 1912. Copies of the Rule can be purchased, either directly or through the usual agents, from Messrs. Wyman & Sons, Ltd., Fetter Lane, Fleet Street, London, E.C.

Accident.—Whilst inspecting an electric fan at the Palladium Picture Hall, Oldham, last Wednesday, James Mawdesley, 38, electrical engineer, employed by Messrs. John Hall & Sons, Oldham, came into contact with the fan and received severe cuts on the head. He was removed to the Infirmary, where it was found necessary to put in about a dozen stitches.

Appointments Vacant.—Test room assistant (35s.), for Leith Corporation; generating engineer (£120), for Hackney B.C.; engineer (35s.), for County Hospital, Lincoln; senior engineer-in-charge (£104), junior engineer-in-charge (30s.), switchboard attendant (25s.), mains foreman (£2 10s.), for Newport Electricity and Tramways Department; jointer (42s.) for Rhondda U.D.C.; charge engineer (during war) for Wakefield Corporation (£2). Particulars are given in our advertisement pages.

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Turbo-Generator Tests.—The two 3,000-KW., 3,000-R.P.M. turbo-generators installed at the Richmond Street generating station of the St. Marylebone electricity supply undertaking have recently been officially tested. These machines were fully described in our issue of December 5th, 1913; it will be remembered that up to the end of last year the St. Marylebone electricity supply generated for their mains direct current only by means of direct-current turbo-generators. The new Oerlikon turbo-generators generate three-phase current, which is transformed into direct current by means of rotary converters.

It will be seen from the accompanying table that during the week ending August 27th of this year the units generated by the direct-current plant were 1,264, whilst last year, during the same week, they amounted to 253,718; also, whilst last year, during the same week, no alternating current was generated, the A.C. units during the same week this year were 297,200. This shows that the manager gives preference to the running of the Oerlikon three-phase turbo-generators, and the reason why is obvious when the economy of these machines is appreciated. The makers believe that these figures have not been attained by any other machine in existence designed for the same conditions.

The Oerlikon Co. have allowed the electricity undertaking to increase the superheat beyond the value for which the turbines were designed (and at which they were tested) by an additional 100° F., and they also agree to a largely-increased overload capacity in view of the fact that the generators are running remarkably cool. In a letter addressed to the makers, Mr. A. Hugh Seabrook, general manager, congratulates them on the results obtained and on the manner in which the contract has been carried out; he had been sceptical as to their being able to improve upon the remarkable figure of 13·27 lb. steam consumption guaranteed at full load, and considers the low consumption actually attained a splendid achievement. The economy obtained, which is augmented by the increased superheat, and the increased overload capacity allowed, he says, "makes the cost of these plants ridiculous as compared with the value of them" to his department. Mr. Seabrook adds that the National Physical Laboratory has calibrated the instruments and checked the corrections and readings.

OFFICIAL TEST FIGURES.

Current:—Three-phase, 50 periods, 6,660 volts.
Normal Load:—3,000 KW. with temperature rise on generator not exceeding 54° F. after six hours.
Overload:—4,200 KW. with a temperature rise of 81° F. after six hours.
Speed:—3,000 R.P.M.
Steam:—190 lb. per sq. in. at 485° F.
Vacuum:—95 per cent.
Steam consumption under the above conditions:—

	Turbo No. 1.	*Turbo No. 2.*	*Guarantee.*
At full load (lb. per KW.-hour)	12·88	12·92	13·27
At ¾ load " "	13·04	13·21	13·73
At ½ load " "	14·00	14·05	14·70

WEEKLY STATEMENT ENDING WITH AUGUST 27TH, 1914, OF RICHMOND STREET GENERATING STATION OF THE ST. MARYLEBONE ELECTRICITY UNDERTAKING.

	This week			To date		
	1914.	1913.	1912.	1914.	1913.	1912
Coal consumed (tons)	386	419	431	9,565	10,486	8,723
Per cent. inc. ...	−7·87	−2·79	13·42	−8·79	20·21	10·31
Aver. price per ton	14/0·24	15/1·86	14/2·04	14/6·12	14/10·37	15/11·52
Per cent. inc. ...	−7·49	6·95	32·70	−2·38	−6·87	48·01
Cost (£) ...	271	317	305	6,939	7,792	6,961
Per cent. inc. ...	−14·51	3·93	50·25	−10·95	11·94	63·25
Pence per unit sold	·306	·387	·375	·298	·365	·406
Per cent. inc. ...	−20·93	3·20	25·83	−18·36	−10·10	47·09
Units gener. D.C.	1,264	253,718	247,357	383,275	6,684,410	5,347,210
Do. gener. A.C....	297,200	—	—	7,206,450	—	—
Total ...	298,464	253,718	247,357	7,589,725	6,684,410	5,347,210
Units sold ...	212,100	196,800	195,300	5,594,000	5,120,275	4,114,850
Per cent. inc. ...	7·77	·768	19·54	9·25	21·42	10·95

The London branch of the Oerlikon company has recently received information from the works in Switzerland to the effect that the men are gradually returning from the front, where they were engaged in guarding the neutrality of the country, and that the factories are now working with, approximately, half the men and staff on half-time. All the contracts, and particularly those for British clients, are making good progress, considering the circumstances, and the transit and export routes are still kept open from Switzerland to this country and others.

Inquiries.—A correspondent asks us to recommend a good practical book on overhead lines, giving the calculations of stress on poles and wires, and the sizes of three-wire D.C. and A.C. mains. The subject is dealt with more or less fully in various books written to suit American conditions, but we know of none that meets the requirements in English units.

Another correspondent asks for names and addresses of British manufacturers of "chucks for radial drilling machines."

A further inquiry is for the address of "manufacturers of brass and iron ornamental castings suitable for fittings and radiators," &c.

For Sale.—The Postmaster-General invites tenders for the purchase of electrical power plant and machinery at the Head Post Office, Manchester. Particulars are given in our advt. pages.

Fatalities.—The circumstances of the death of George Foster (58), telephone wireman, Oldham, were inquired into last Friday. Deceased had been a telephone wireman for about 30 years. Foster put a ladder against a pole, and ascended until he was about 24 ft. from the ground. The pole cracked at the bottom, and then swayed over for about a yard, and, after stopping momentarily, crashed to the ground. Foster fell clear of the pole. Mr. Hinchliffe, electrical engineer, of Oldham, said there was no sign of weakness or decay about the pole as far as could be seen outwardly. "Accidental death" was the verdict.

At the Maritime and Peurhiw Collieries, Pontypridd, near Cardiff, where the machinery is all electrically driven, a fatal accident occurred on September 10th, to one of the electricians in charge of two pumps. From the evidence given at the inquest on Saturday, it appeared that one of the pumps failed to work, and an electrician of 10 years' experience, named Edmund Davies, together with a mate, set to work to find out the cause of the stoppage. Davies went to a switch box and examined the fuses, and on finding no defect, he went away to another pump, leaving the iron lid of the switch box off. Returning he picked up the lid to replace it, and he immediately shouted out, "Oh, God!" turned round once or twice, and fell down. As his mate went towards him, he jumped up again, and said, "All right, Ted," but soon afterwards fell down again. Some ambulance men hearing the mate's call for assistance, ran to the deceased, who was picked up insensible, and although the men tried for two hours to restore respiration, they were unsuccessful. It was discovered that the cause of the pump not working was that one of the wires at a terminal had become oxidised all the way through. The voltage was 290. A verdict of "Accidental Death" was returned.

Electric Pumping at Oilfields.—In the course of their annual report the directors of the Kern River Oilfields of California, Ltd., state that the gross profit in California from the Kern River Field (section 33) amounted to £24,692, as against £23,642 for the previous year. This increase was obtained (notwithstanding a natural decrease in production) by the more extensive use of electric pumping and by the exercise of rigid economy in the operation of the property. The following comparative statement shows the number of oil wells operating and the gross production of section 33 Kern River Field:—

	May 31st, 1913.	May 31st, 1914.	Aug. 31st, 1914.
Number of wells pumped electrically	181	197	230
Number of wells pumped by steam	59	43	11
	240	240	241
Gross production in barrels ...	984,175	883,268	209,660

The Rights of Alien Enemies to Sue.—An important case bearing upon the rights of alien enemies to sue British subjects in the Courts during the war, was before Mr. Justice Sankey, in Chambers, on Tuesday. The matter is fully reported in Wednesday's *Daily Telegraph*. It appears that Sir John Macdonnell, Master of the Supreme Court, recently heard an application in a case in which the plaintiffs were the Fabrik Elastischer Gluckkoerper, G.m.b H., and the defendants the Imperial Lamp Works (Brimsdown), Ltd. It was argued on that occasion that as the plaintiffs (who claimed for about £900 for goods supplied) were alien enemies, they could not be heard in our Courts; but, on the other hand, it was contended that an alien enemy had been allowed to prove a debt under bankruptcy; and that if the action was now dismissed, a fresh action could not be brought. Sir John Macdonnell granted an order to stay, with liberty to apply. This order was on Tuesday appealed against by Mr. J. Scarlett, on behalf of the defendants, who urged that the action should be dismissed, so that the plaintiffs, who were alien enemies, would be barred from further maintaining and continuing it. He objected to the appearance of Mr. A. H. Spokes for the plaintiffs, on the ground that he represented an alien enemy.

Mr. Justice Sankey, in giving judgment, said it was admitted that the plaintiffs were alien enemies. There had been a number of cases where counsel had been heard by the Courts on behalf of alien enemies. His Lordship did not think it was the duty of a Judge to lay down any decision on public policy. As he understood it, paramount public policy was not to allow an enemy to get any money during a war, and that public policy seemed to him to be amply secured by making a stay which would prevent him from going on with a remedy which might result in his getting money. Whether it was public policy to say that a debt which was certainly owing before the beginning of the war should be entirely barred he begged leave to doubt. What had been said by other Judges was that the remedy which enabled him to obtain the payment of that debt from a citizen of this country was suspended till the war was concluded. Under these circumstances he thought that the order made by Master Macdonnell was perfectly right. It was, he thought, perfectly open for the defendants to go on with their counterclaim. The simple order that he made was this—an order to stay the claim—by which he meant a distinction between the claim and the counterclaim—with liberty to apply, counsels' costs reserved. Leave to appeal was granted.

Educational Notes.—ROYAL COLLEGE OF SCIENCE FOR IRELAND, Dublin.—Faculty of Engineering. Particulars of courses in Mechanical, Electrical Engineering are obtainable from the Registrar, Royal College of Science, Upper Merrion Street, Dublin. See also our advertisement pages to-day.

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Airships over London.—During the past week the military authorities have been making observations from airships over London, and in compliance with police orders a large proportion of the street lamps and of the shop-window lighting has been cut off, the illumination of railway stations with glass roofs has been lowered, and prominent electric signs have not been in operation. The effect of the reduction of lighting on the streets was remarkable. In some cases arc lamp globes were painted so as to screen their rays in certain directions. An electric searchlight at Charing Cross swept the sky. It is understood that the observations are intended to enable precautions to be taken against the identification of important buildings, &c, by hostile airships, which are quite capable of visiting the metropolis and dropping bombs upon it. London, being an "open" city, and therefore by international law immune from bombardment, is, of course, just the sort of place that the apostles of German "culture" would seek to attack.

400-Mile Transmission Completed.—With the closure of the tie-line switch at San Bernardino, Cal., on August 13th, energy was transmitted from Bishop Creek to El Centro, Cal., a distance of 400 miles, completing the longest transmission circuit in the world. The new line brings electric service into the Imperial and Coachella valleys.—*Electrical World.*

Late Correspondence.—Carbons.—My letter of the 9th inst., appearing in your issue of the 11th inst., asked Mr. Alwood two questions, which I hope may be answered in your next number.

Your Editorial comments on my letter, however, make it essential for me to amplify my second question, and ask whether the Witton carbon undertaking, or the G E C., have handled any other carbons than those actually manufactured in England?

Inquirer.

London.

Malicious Damage to Railway Signals.—In revenge, because the L.B. & S.C. Railway Co. would not let him work overtime, R. Hamper, a foreman, cut electrical signalling wires on the line at Battersea when soldiers were being conveyed to the South. He was sentenced to 12 months' hard labour.

Wireless Operators Wanted.—The Admiralty still wants wireless operators for enrolment in the Royal Naval Reserve, for service in the Royal Navy during the period of hostilities. Particulars can be had from the Secretary of the Admiralty (N.), London, S.W.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Dublin Electricity Committee last week brought up recommendations for increases in the salaries of Mr. Mark Ruddle, the city electrical engineer, and Mr. G. Archer, chief engineer of the distribution department, such increases not to take effect until after the war. The Lord Mayor said that it would do no harm to have the report sent back for six months at least, and this course was agreed to. Perhaps at that date, when justice is being meted out generally, gallant little Belgium and the hope-deferred Belfast electricity works staff will alike receive their due share of compensation.

On the occasion of his marriage to Miss Nini E Threlfall, B.A., of Southport, Mr. Thos. Cleaton Ball, mains inspector at the Mersey Railway Power Station, Birkenhead, has been presented by the employés with a case of cutlery, and with a silver cigarette case by the men of his department.

Messrs T. Nutter and J. Bolton, chief assistant and assistant respectively at the Burnley electricity works, have withdrawn their applications for an increase in their respective salaries because of the present situation.

Mr. H. Hopkinson has been appointed canvasser at the Walsall electricity works; Mr. A. E. Smith has been appointed substation mechanical assistant.

Tramway Officials.—Mr. W. T. D. Grundy, of Morecambe, has been appointed general manager of the Derwent Valley Light Railway.

General.—On Saturday last, the 12th inst., Mr. W. L. Topple, superintendent of the Electric and Ordnance Accessories Co., Ltd., Aston, presented, on behalf of the staff, to Mr. C. Brittlebank, chief of the sales department, a case of table cutlery, on the occasion of his marriage with Miss Rawlinson, of Manchester. Mr. Topple referred to the high esteem in which Mr. Brittlebank was held, and Mr. J. D. Morrison, secretary of the company, spoke in similar terms. Mr. Brittlebank suitably responded.

Sir Andrew McDonald is to contribute £500 to meet the cost of the improvements which have recently been carried out by the managers of the Edinburgh Royal Infirmary in the medical electrical departments of the Institution.

Mr. D. Furniss, who is leaving to become chief electrical engineer at the Collieries at Thorncliffe of Newton, Chambers and Co., Ltd., has been presented with a fitted gladstone bag by the officials at Shirebrook Colliery, where he has been on the electrical staff.

Mr. Theodore Schontheil, engineer, who is a British subject, residing at Silbrook Heoldon, Whitchurch, Glamorgan, announces in the *London Gazette* that on September 14th, 1914, he renounced the surname of Schontheil, and then adopted the name of Theodore Stretton.

Mr. Philip Augustus Lang (heretofore known as Mr. P. A. Lange), managing director of the British Westinghouse Electric and Manufacturing Co., Ltd., of Trafford Park, who is a naturalised British subject, and formerly an American citizen, has given notice that on Saturday he renounced the use of the surname Lange, and adopted the name of Lang.

NEW COMPANIES REGISTERED.

United Kingdom Manufacturers' Representative Association, Ltd. (137,625).—This company was registered on September 9th, with a capital of £10,000 in £1 shares (5,000 6 per cent. participating preferred), to carry on the business of providing manufacturers' representatives and agents in all parts of the world, merchants, traders, forwarding and general agents, contractors or sub-contractors for the purchase or supply of British products and commodities, general merchandise and all classes of English goods, either in the United Kingdom or elsewhere, and to bring to bear diplomatic and other pressure with regard to tariff restrictions and infringements under the Merchandise Marks Acts. The subscribers (with one share each) are:—E. H. Burton, 16, St. Helen's Place, E.C., F.I.C.A.; E. J. Howell, Gorselands, Southbourne, Hants, gentleman; J. Molenkamp, 24, King's Avenue, Clapham Park, S.W., gentleman; C. T. B. Jayne, 95, High Road, Streatham, S.W., director; G. Prosser, 19, Elgin Court, Maida Vale, W., gentleman; J. R. P. Jackman, 2, Hugh Street, S.W., gentleman; C. Burton, 87, Surrey Street, W.C., advertising contractor. Minimum cash subscription, seven shares; the number of directors is not to be less than two or more than seven; the first are J. Molenkamp, C. T. B. Jayne, G. Prosser and C. Burton; qualification of first directors £1, of other directors £50 shares or stock; remuneration as fixed by the company. Registered by Lloyd, Richardson & Co., 8, Howard Street, Norfolk Street, W.C.

Anti-German League, Ltd. (137,638).—This company was registered on September 11th, with a capital of £500 in £1 shares, to take over the business carried on at 97B, Regent Street, London, as the Anti-German League, formed to assist British trade, to carry on business as warehousemen, agents, importers, exporters, and general merchants, and to enter into an agreement with C. Clarke. The subscribers (with one share each) are:—C. Clarke, Cranleigh, Egham, Surrey, merchant; M. B. Pizzey, Heath Villa, Ascot, Berks., accountant. Private company. The number of directors is not to be less than two or more than three; the first are C. Clarke and M. B. Pizzey; remuneration as fixed by the company. Secretary, J. Myers, 65, London Wall, E.C.

A. V. Gifkins & Co., Ltd. (137,615).—This company was registered on September 9th, with a capital of £10,000 in £1 shares, to carry on the business of electricians, suppliers of electricity for light, heat, motive power or otherwise, &c., and to enter into an agreement with A. V. Gifkins and D. Goad. The subscribers (with one share each) are:—A. V. Gifkins, Crescent Lodge, Hertford, engineer; H. S. Watson, 9, Purley Park Road, Purley, engineer. Private company. The number of directors is not to be less than two or more than five; the first are A. V. Gifkins, D. Goad and H. S. Watson (all permanent, subject to holding £1,000 shares each). The said A. V. Gifkins, while holding office as permanent director, may appoint two additional permanent directors, whose holding must be £1,800 shares each. Remuneration as fixed by the company. Registered office, 68, Victoria Street, S.W.

Stonebridge Electrical Co., Ltd. (137,652).—This company was registered on September 11th, with a capital of £1,000 in £1 shares, to carry on the business of electrical and general engineers, contractors for, manufacturers of, and dealers in, plant, machinery, engines and implements used in connection with the generation, supply, distribution, accumulation and use of electricity for heat and power, &c. The subscribers are:—K. H. Gyr, Zug, Switzerland, manufacturer of electrical apparatus, 100 shares; L. R. Lester, 1, Stonebridge Park, Willesden, N.W., engineer, 50 shares. Private company. The first directors are K. H. Gyr, L. R. Lester and H. Landis. Registered office, 1, Stonebridge Park, Willesden, N.W.

Electropathic Institute, Ltd. (137,626).—This company was registered on September 9th, with a capital of £3,000 in £1 shares (2,500 participating preference) to take over the business of electrical treatment and the manufacture and sale of electrical appliances carried on by E. T. Braarup, at 18, Old Quebec Street, London, as E. Braarup. The subscribers (with one preference share each) are:—C. Philip, 4, Bertram Road, Enfield, clerk; W. H. Hayles, 3, Manchester Street, W.C., company secretary. Private company. The number of directors is not to be less than two or more than seven; the first are not named; remuneration not more than £100 each per annum. Registered office, 18, Old Quebec Street, Marble Arch, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Henley's (South Africa) Telegraph Works Co., Ltd.—Capital, £2,000 in £1 shares. Return dated June 5th, 1914; all shares taken up; £1 per share called up; £2,000 paid. Mortgages and charges: Nil.

Chilian Electric Tramway and Light Co., Ltd. (57,203).—Capital, £1,150,000 in 500,000 ord. and 650,000 pref. shares of £1 each. Return dated July 16th, 1914; all shares taken up; £1 per share called up on the pref.; £650,000 paid; £500,000 considered as paid on the ord. Mortgages and charges: £367,000.

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Chemico Electric Co., Ltd.—Particulars of £50,000 debs., created August 13th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: the company's undertaking and property, present and future, including uncalled capital, if any. No trustees.

James Keith & Blackman Co., Ltd.—A memorandum of satisfaction in full on August 24th, of second debs., dated February 9th, 1914, securing £1,900, has been notified. Issue on September 8th, 1914, of £600, part of a series of which particulars have already been filed.

Lester B. Betts & Co., Ltd.—Debenture dated September 2nd, 1914, to secure £100 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. E. Robinson, 80, Whitefriars Crescent, Westcliff-on-Sea.

Sutcliffe (of Crumpsall), Ltd.—Particulars of £4,000 debentures created April 15th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Automatic Telephones (Australia), Ltd.

According to Australian newspapers to hand by the last mail, this company was to hold its annual meeting on August 5th. The directors in their report stated that the year ended June 30th had been satisfactory. The net profits available for distribution was £4,167, out of which £417 was absorbed by managing directors' remuneration, £3,750 was required for the proposed dividend of 7½ per cent., and £1,181 was to be carried forward. The directors stated that the contracts referred to last year were not quite completed, although two automatic exchanges, viz., Brighton and Newtown (and since June 30th, a third, viz, Balmain), had been "cut over" to the entire satisfaction of the department. While in Chicago Mr. Nicholson made arrangements which enabled the company to submit a favourable price to the Federal Government for a further group of seven exchanges in Sydney, and just before the year closed this price (£100,318) was accepted. The current year should, therefore, be a busy one, affording profitable employment for the company's capital, the bulk of which was lying at call. Under a new agency agreement with Automatic Electric Co., Chicago, no cash deposit had been required, better terms had been arranged, and a much longer period granted upon reasonable conditions.

Dumbarton Burgh and County Tramways, Ltd.

Mr. George Balfour, chairman of directors, in moving the adoption of the report at the annual meeting, said the total receipts for the year amounted to £23,563, being an increase of £611 in traffic receipts and advertising, notwithstanding a reduction of £250 in advertising receipts. Expenses had increased by £1,250, the increase in traffic expenses being £235, and in general expenses £380, which was largely accounted for by increase in third party insurance and rates and taxes. The most gratifying feature was the continuing increase in traffic receipts during the last three years. The company's cars ran 549,993 miles during the year, and carried 3,634,632 passengers. Mr. Balfour moved that the following dividends be paid:—A dividend on the preference shares at the rate of 6 per cent. per annum for the half-year to July 31st, 1914, and a dividend on the ordinary shares at the rate of 1½ per cent. for the year. The motion was unanimously carried.

Electric Supply Co. of Victoria, Ltd.—The report for the year ended March 31st, 1914, states, says the *Financial Times*, that the net profit has again improved, notwithstanding the heavily increased wages payable under various Trade Board determinations, &c. A further trouble has been the prevalence of bad trade in Bendigo. To meet additional capital expenditure incurred, to the amount of £8,898, chiefly in the extension of the lighting undertakings, necessitated by the increasing business of the company in those departments, a further issue of preference shares has been made. The balance to the credit of profit and loss account, including £7,569 brought forward from the previous year, and after deducting debenture interest paid and amount transferred to debenture stock redemption account, is £23,011, which the directors propose dealing with as follows:—To pay on account of arrears of preference dividend, thus extinguishing all arrears to March 31st, 1913, £16,211; to place to depreciation of stores £1,000, to write off "Discount and commission on debenture stock account" £2,174, and to carry forward £3,625.

South Metropolitan Electric Light and Power Co., Ltd.—The books will be closed from 17th to 30th inst. (inclusive) for preparation of warrants for interest on the 4½ per cent. first mortgage debenture stock payable on 1st prox. for the half-year to that date.

Brazilian Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent. for the three months ending September 30th on the 6 per cent. cumulative preference shares, payable October 1st.

Direct Spanish Telegraph Co., Ltd.—The board has decided to pay, in addition to the dividend at the rate of 10 per cent. per annum on the preference shares, a dividend at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares, both for the half-year ended June 30th, 1914, and payable on October 1st next.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors have declared an interim dividend for the quarter ended June 30th last of 2s. 6d. per share, free of income-tax, payable October 15th.

Eastern Telegraph Co., Ltd.—The directors announce the payment on October 15th of a dividend at the rate of 3½ per cent. per annum, less income-tax, on the preference stock for the quarter ending September 30th, and the second quarterly interim dividend of 1½ per cent. on the ordinary stock, free of income-tax, in respect of profits for the year ending December 31st next.

Bromley (Kent) Electric Light and Power Co., Ltd.—The directors have declared a dividend at the rate of 4 per cent. per annum (2s. per share), less income-tax, on the ordinary shares for the past half-year (interim).

Halifax and Bermudas Cable Co., Ltd.—The directors have declared a dividend of 3 per cent. (3s. per share), free of income-tax, for the half-year, payable September 16th, making 6 per cent. for the year.

Direct West India Cable Co., Ltd.—Dividend 3 per cent. (1s. 6d. per share), free of income-tax, for the half-year, payable September 16th, making 6 per cent. for the year.

Canada.—According to a Reuter dispatch, the Civic Board of Control has decided to purchase the property of the Montreal Water and Power Co. for $7,500,000.

Globe Telegraph and Trust Co., Ltd.—The directors announce a quarterly interim dividend of 2s. per share on the ordinary shares.

British Insulated and Helsby Cables, Ltd.—An interim dividend at the rate of 8 per cent. per annum, less income-tax, on the ordinary shares for the past half-year, is announced.

Mather & Platt, Ltd.—The *Financial Times* states that the payment of the dividend of 1s. per share on the ordinary shares announced for distribution on September 1st, has been postponed, but the dividend on the preference shares was duly paid.

British Aluminium Co., Ltd.—The directors announce a six months' interim dividend at the rate of 6 per cent. on preference shares. Warrants will be posted on September 30th.

STOCKS AND SHARES.

Tuesday Evening.

The much more satisfactory character of the news from the front produced an instantaneous effect in Stock Exchange circles. It was felt that continuance of such intelligence would hasten the reopening of the Stock Exchange; and Consols, which had changed hands at 65½, rose to 68¾. A number of Home Railway stocks, hitherto practically unsaleable, suddenly found supporters. It was almost amusing to notice how those who had been pathetic sellers, when they could not obtain bids, became converted into ready buyers as soon as the enemy's advance had been changed into retreat.

While general recognition admits that there is plenty of stubborn fighting to be done before the end arrives, the reaction, from what we may call the courageous despondency of the end of August, has produced a marked effect upon quotations, to such an extent that the daily crowd in Throgmorton Street swelled to several times its previous proportions, and practically every broker is able to report inquiries amongst his clients for stocks offered at bargain prices. The movement has not been confined to London; from the provincial centres the same earnest of bargain-hunting is reported. It is wonderful—and yet perhaps less wonderful than it appears—what a different sentiment has been diffused by receipt of the more cheery news.

Several of the West End electric lighting companies are amongst those to whom the ill wind has blown unexpected profit. Instead of mansions and Government offices being closed during August and the first half of September, with consequent falling-off of electric lighting requirements, the war has kept people in town to such an extent that, in the case of at least one company, the load for the past six weeks has been heavier than ever before in the history of the concern, and to supply the "juice" has imposed an unlooked-for strain upon the company's resources.

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The City companies are in a position not so enviable as that of the West End undertakings, but, August and September both being very slack months in the ordinary way, they have suffered no perceptible diminution in revenue up to the present.

Stock is not so readily offered as it was when we last wrote, but there is still a certain amount which can be picked up cheaply. Pursuing our tables of last week, showing various prices at which stocks and shares would give certain yields, we now set out a few examples in the Telegraph and Manufacturing sections, with the same object. These will enable the prospective purchaser to judge at what prices he considers securities are cheap :—

Name.	Dividend.	Present price.	Yield. £ s. d.
Anglo-American Telegraph Pref. ..	6	108¾	5 10 6
		105	5 14 8
		102½	5 17 1
Eastern Telegraph Ordinary ..	7	132	5 6 8
		127	5 10 8
		123	5 14 9
Globe Ordinary	6	11½	5 4 6
		11	5 9 1
		10½	5 14 8
Western Telegraph	7	13¾	5 1 0
		13¼	5 5 8
		12⅝	5 9 10
Babcock & Wilcox	16	2⅝	5 11 6
		2⅝	6 1 11
		2¼	7 2 3
Callenders	15	12¼	6 2 6
		11⅜	6 7 8
		11¼	6 10 5
India-Rubber	7½	9½	7 18 0
		9	8 6 8
		8½	8 16 6

The Stock Exchange Committee have taken a definite step towards re-opening the House by the issue of a list of prices fixed in accordance with their order, dated September 14th. This is regarded on all hands as an indication that the House may get to work sooner than was expected by those who talked about "after Christmas" as the probable date of re-opening. The list consists of four pages, which are about one-third of the size of the regular 16-page sheet. We set out those connected with the electric markets :—

Stock.	Present price.
Central London 4 per cent. Debenture	96
,, 4½ per cent. Preference	108
London Electric 4 per cent. Debenture	88½
Metropolitan 3½ per cent. Debenture	86
,, 5½ per cent. "A" Debenture	85
,, 3½ per cent. Preference	80½
,, 3½ per cent. "A" Preference	77½
,, 3½ per cent. Conv. Pref.	77½
Met. District 4 per cent. Prior Lien Deb.	95½

These prices are unchanged from those of July 30th, but in several instances the stocks can be bought below the levels given. Metropolitan "A" Preference, for example, is offered at 76, London Electric Debenture at 87½, free of stamp duty, and so on.

More interest attaches to the prices at which Miscellaneous securities are actually on offer, and to those at which they can be sold. There is a much greater variety in the former than there is in the latter list, and some examples may be set out :—

Stock offered.	Price.	Yield. £ s. d.	Dividends.
Anglo-Argentine Trams 5 per cent. Debenture stock	93¼	5 7 0	June 1st and Dec.
Anglo-Argentine Trams 5½ per cent. First Preference	4½	5 17 0	Jan. 1st and July
British Columbia Electric Railway 5 per cent. Preference	96	5 4 0	Jan. 15th and July
British Electric Traction 4½ per cent. Second Debenture stock	75	6 0 0	May 1st and Nov.
City of London Electric 6 per cent. Preference shares	12¾ xd	4 11 0	March and Sept.
London Electric Supply 6 per cent. Preference shares	4⅞ xd	6 3 0	March and Sept.
Metropolitan Trams 5 per cent. Debenture stock	86	5 16 0	April 1st and Oct.
Rio de Janeiro Trams 5 per cent. Second Mortgage bonds	88½	5 13 0	April 1st and Oct.
Urban Electric Supply 4½ per cent. Debenture stock	84½	5 6 6	April 1st and Oct.

Amongst the stocks which are wanted for cash we may mention the following :—

STOCKS WANTED.

Anglo-Argentine Trams 4½ per cent. Debenture.
Calcutta Electric Supply Ordinary.
Calcutta Electric Supply Preference.
Calcutta Tramways Ordinary.
Central Electric Supply 4 per cent. Debentures.
Charing Cross Electric Preference.
City of Buenos Ayres Trams Ordinary.
Consolidated Gas, Electric Light and Power of Baltimore 5 per cent. Debenture.
Metropolitan Electric Supply Ordinary.
Melbourne Electric Supply First Debenture.
Mexico Tramways First Mortgage 5 per cent. Bonds.
Mexican Light and Power First Mortgage 5 per cent. Bonds.
Sao Paulo Tramways 5 per cent. Debenture Stock.
St. James' Electric Light Preference.
South Metropolitan Electric First Preference.
United Electric Trams of Monte Video 5 per cent. Debenture.

The Home Railway market has taken on a much cheerfuller aspect; in fact, it is more easy to sell many stocks than it is to buy them at present figures. If the news continues to advance in the same direction as everybody's hopes, there will be a rush to buy everything of the investment character. The demand, it may be noticed, has not yet extended to speculative issues. Rubber shares are on the rise, the theory being that rubber-tired motor vehicles will become universally used for commercial purposes after the war, owing to the scarcity of horses, and to the fact that the Army had made such heavy inroads upon the horses used by Trade prior to the outbreak.

MARKET QUOTATIONS.

OWING to the war, the prices given below are, of course, only nominal.

Wednesday, September 16th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	Nom.	..
a ,, Nitric	,,	,,	..
a ,, Oxalic	per lb.	,,	..
a ,, Sulphuric	per cwt.	,,	..
a Ammoniac Sal	,,	,,	..
a Ammonia, Muriate (large crystal)	per ton	,,	..
a Bleaching powder	,,	,,	..
a Bisulphide of Carbon	,,	,,	..
a Borax	,,	,,	..
a Copper Sulphate	,,	,,	..
a Lead, Nitrate	,,	,,	..
a ,, White Sugar	,,	,,	..
a ,, Peroxide	,,	,,	..
a Methylated Spirit	per gal.	,,	..
a Potassium, Bichromate, in casks	per lb.	,,	..
a Potash, Caustic (88/90 %) ..	per ton	,,	..
a ,, Chlorate	per lb.	,,	..
a ,, Perchlorate	,,	,,	..
a Potassium, Cyanide (98/100 %) (for mining purposes only) ..	,,	,,	..
a Shellac	per cwt.	,,	..
a Sulphate of Magnesia	per ton	,,	..
a Sulphur, Sublimed Flowers ..	,,	,,	..
a ,, Recovered	,,	,,	..
a ,, Lump	,,	,,	..
a Soda, Caustic (white 70/72 %) ..	,,	,,	..
a ,, Chlorate	per lb.	,,	..
a ,, Crystals	per ton	..	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£88	..
b ,, Wire, in ton lots (1 to 14 S.W.G.)	,,	£112	..
b ,, Sheet, in ton lots ..	,,	£119	..
g Babbitt's metal ingots	,,	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8d.	½d. dec.
c ,, Tube (brazed)	,,	10d.	..
c ,, ,, (solid drawn)	,,	8½d.	½d. dec.
c ,, Wire, basis	,,	8d.	½d. dec.
c Copper Tubes (brazed)	,,	9½d.	½d. dec.
c ,, ,, (solid drawn)	,,	9½d.	½d. dec.
g ,, Bars (best selected) ..	per ton	Nom.	..
g ,, Sheet	,,	Nom.	..
g ,, Rod	,,	Nom.	..
d ,, (Electrolytic) Bars	,,	£59	£6 dec.
d ,, ,, Sheets	,,	£77	£6 dec.
d ,, ,, Rods	,,	£65	£6 dec.
d ,, ,, H.C. Wire	per lb.	8.1.	½d. dec.
f Ebonite Rod	,,	8/6	1/- dec.
f ,, Sheet	,,	8/-	1/- dec.
a German Silver Wire	,,	1/7	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	2/8½	1½d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	52/11	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£16	..
g Lead, English Pig	,,	Nom.	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7	..
e Mica (in original cases) small ..	per lb.	4d. to 2/6	..
e ,, ,, ,, medium	,,	5/- to 5/-	..
e ,, ,, ,, large ..	,,	6/6 to 10.6 & up.	..
o Nickel, sheet, wire, &c.	,,	Nom.	..
p Phosphor Bronze, plain castings	,,	1/1 to 1/3½	..
p ,, ,, rolled bars & rods	,,	1/0½ to 1/3	..
p ,, ,, rolled strip & sheet	,,	1/3½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	£141	..
g Tin, Block (English)	,,	Nom.	..
a ,, Wire, Nos. 1 to 16	per lb.	2/3	..
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh'ts (Vieille Montagne bnd.)	,,	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Dundee, Broughty Ferry and District Tramways Co., Ltd.—The profits for the year ending July 31st, including sum brought forward from last year, after providing for interest on debenture stock, amount to £4,824. From this there falls to be deducted interim dividend paid on preference shares for half-year to January 31st, 1914, at the rate of 6 per cent. per annum, less tax, leaving a balance of £3,411. The directors propose to pay final dividend on preference shares at the rate of 6 per cent. per annum for half-year ending July 31st, 1914, less tax; to renewals fund, £600; to sinking fund for redemption of debenture stock, £600; to pay dividend on ordinary shares at the rate of 2½ per cent. for year ending July 31st, 1914, less tax; to carry forward £127. The receipts for the year have been very well maintained.

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THE RATING OF BARE COPPER CONDUCTORS.

By W. A. COATES.

Apparently but few engineers have concrete ideas with regard to the carrying capacity of bare copper conductors. With a view to filling up the gap, the figures employed by some of the foremost switchboard firms on both sides of the Atlantic have been studied, and the tables below are therefore fully representative of first-class practice.

German and American firms have mostly adopted a temperature rise of 30° C. as standard for switchboard connections. British builders are usually more conservative, and work to a limit of 20° C. The tables have consequently been based on the latter figure. The safe load to give any desired temperature rise is easily determined from the formula :—

$$A_x = A_{20} \sqrt{x/20}$$

where A = total current in conductor and x = new temperature rise in °C.

The actual capacity of a conductor depends not only on its cross-sectional area, but also on its effective radiating surface. A single strip standing on edge is the ideal conductor from this point of view. If it lies flat, the upper surface only is of full value for convection, as the heated air will tend to "pocket" against the under side. The fact that on nearly all switchboards some portion of the conductors must of necessity be flat, has been considered in fixing the figures given below, and it is also necessary to make some allowance for poor joints. If these two factors could be eliminated, the ratings given might be increased fully 10 per cent.

When carrying heavy currents through several strips in parallel the spacing between each is important, as affecting the heat-dissipating value of the inner surfaces. Experiment has shown that the strips must be spaced at least $\frac{3}{8}$ in. apart, if both surfaces of each conductor are to give 100 per cent. efficiency as dissipators. The reduced capacities with the spacings more commonly used are shown on Table II.

TABLE I.—Maximum Permissible D.C. Load in Amperes. Single Copper Strips.

Size.	Section sq. in.	Maximum guaranteed temperature rise. 20° C.	30° C.	40° C.
1 in. × $\frac{1}{16}$ in.	·0625	130	160	185
1 ,, × $\frac{1}{8}$,,	·125	185	230	260
1 ,, × $\frac{1}{4}$,,	·25	265	325	375
1½ ,, × $\frac{1}{4}$,,	·1875	275	340	390
1½ ,, × $\frac{1}{4}$,,	·375	390	480	550
2 ,, × $\frac{1}{8}$,,	·25	360	445	510
2 ,, × $\frac{1}{4}$,,	·50	515	630	730
3 ,, × $\frac{1}{8}$,,	·375	490	600	690
3 ,, × $\frac{1}{4}$,,	·75	690	850	975
4 ,, × $\frac{1}{8}$,,	·5	610	750	860
4 ,, × $\frac{1}{4}$,,	1·0	870	1,060	1,230
6 ,, × $\frac{1}{8}$,,	·75	940	1,150	1,320
6 ,, × $\frac{1}{4}$,,	1·50	1,330	1,630	1,880

TABLE II.—Maximum Permissible D.C. Load in Amperes. Copper Strips in Parallel.

Guaranteed temperature rise not exceeding 20° C.

No. of strips.	Size each strip.	Total section sq. in.	Strips spaced apart, ⅜ in.	½ in.	⅝ in.
2	2 in. × ⅛ in.	·5	620	640	700
	3 in. ,, ,,	·75	820	840	930
	4 in. ,, ,,	1·0	1,040	1,080	1,180
	6 in. ,, ,,	1·5	1,600	1,650	1,810
3	2 in. ,, ,,	·75	720	860	1,020
	3 in. ,, ,,	1·125	980	1,170	1,370
	4 in. ,, ,,	1·5	1,220	1,470	1,710
	6 in. ,, ,,	2·25	1,900	2,260	2,640
4	3 in. ,, ,,	1·5	1,080	1,390	1,610
	4 in. ,, ,,	2·0	1,350	1,730	2,000
	6 in. ,, ,,	3·0	2,060	2,660	3,060
5	3 in. ,, ,,	1·875	1,270	1,680	1,980
	4 in. ,, ,,	2·5	1,590	2,100	2,480
	6 in. ,, ,,	3·75	2,450	3,240	3,800
6	3 in. ,, ,,	2·25	1,470	1,980	2,340
	4 in. ,, ,,	3·0	1,840	2,480	2,940
	6 in. ,, ,,	4·5	2,800	3,800	4,500
7	3 in. ,, ,,	2·625	1,670	2,380	2,700
	4 in. ,, ,,	3·5	2,080	2,860	3,400
	6 in. ,, ,,	5·25	3,180	4,370	5,230
8	3 in. ,, ,,	3·0	1,860	2,580	3,080
	4 in. ,, ,,	4·0	2,320	3,200	3,860
	6 in. ,, ,,	6·0	3,560	4,940	5,920
9	3 in. ,, ,,	3·375	2,050	2,880	3,460
	4 in. ,, ,,	4·5	2,570	3,600	4,330
	6 in. ,, ,,	6·75	3,940	5,500	6,650
10	3 in. ,, ,,	3·75	2,250	3,180	3,840
	4 in. ,, ,,	5·0	2,800	3,970	4,800
	6 in. ,, ,,	7·5	4,330	6,100	7,350
11	4 in. ,, ,,	5·5	3,060	4,350	5,270
	6 in. ,, ,,	8·25	4,700	6,670	8,100
12	4 in. ,, ,,	6·0	3,300	4,700	5,730
	6 in. ,, ,,	9·0	5,060	7,250	8,800

TABLE III.—Maximum Permissible D.C. Load in Amps. Round Copper Rod.

Diameter. Inches.	Section sq. in.	Maximum guaranteed temperature rise. 20° C.	30° C.	40° C.
$\frac{3}{16}$ in.	·0276	58	70	80
$\frac{5}{16}$,,	·0767	124	150	175
$\frac{7}{16}$,,	·1104	164	200	230
½ ,,	·196	250	305	350
$\frac{9}{16}$,,	·307	350	425	490
¾ ,,	·442	462	565	650
1 ,,	·785	712	870	1,000
1¼ ,,	·994	850	1,040	1,200
1⅜ ,,	1·485	1,146	1,400	1,600
1½ ,,	2·074	1,475	1,800	2,080
1¾ ,,	2·76	1,825	2,220	2,580
2 ,,	3·14	2,010	2,460	2,840
2¼ ,,	3·97	2,400	2,830	3,400
2½ ,,	4·90	2,800	3,400	3,950

It will be noted that all the above figures apply to direct-current work only. On alternating-current circuits, skin effects and mutual induction between conductors must be considered. The latter is so large a factor that on 50-cycle circuits it is scarcely practicable to handle much over 1,000 or 1,500 amperes in the usual manner. The most economical scheme is to interleave the phases in the manner made familiar by furnace practice. Clearly, conditions on A.C. are so complex as to prevent the computation of useful tables, and it must be left to the designer to calculate the ratings to suit each particular lay-out.

A Useful Warning Device.—An interesting bit of "Safety First" work has been put in practice by the proprietor of a garage in Louisville, Kentucky, whose example might well be followed in other places.

Motor vehicles leaving this garage are obliged to cross the sidewalk of a busy street along which pedestrians are passing at all hours of the day and night, and as a warning a lamp has been installed in front of the exit in a large globe, on each side of which the word "Danger" is painted in large letters.

This lamp is lighted from sunset to sunrise, and in itself forms an effective cautionary signal. It is, however, supplemented by a loud-ringing gong, which is automatically operated whenever a vehicle approaches the exit door, a steel plate being so placed that it automatically closes a contact and rings the bell whenever the wheels pass over it.

Our informant writes that it is interesting to note how pedestrians passing along the sidewalk intuitively "stop, look and listen" at the instant the bell begins to ring, and wait until the automobile has crossed the sidewalk into the street. It has been suggested that local authorities would do well to enforce the installation of such a device at the entrance to every garage located on a busy thoroughfare.

Electrical System of Dust Deposition.—It was known as early as 1824 that finely divided solid particles carried in suspension in the air could be deposited on a plate by means of a brush discharge from an electrostatic machine.

In 1905-6, Prof. F. G. Cottrell, of the University of California, abandoned the static machine as a source of high-pressure direct current, and arranged to tap off the peak of the voltage wave from a high-pressure alternating-current circuit, thus securing a high-pressure unidirectional source of energy. This permitted the practical application of the process to sulphuric acid plants, powder works, cement plants, and smelters.

At Riverside, Cal., 90 tons of cement dust per day are recovered from the flues of the Riverside Portland Cement Works by this process, with a power expenditure of only 35 KW. It is reported that the waste product recovered practically pays for the cost of operating the system.—*Electrical Review and Western Electrician.*

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COSTING.

By "SURPLUS."

(*Concluded from page* 383.)

The Costs Book is made up of 52 weekly sheets, 12 monthly sheets, four quarter-ending sheets, two half-year-ending sheets, one three-quarter-ending sheet, and one year-ending sheet; the rulings for the quarter, half-years, &c., are the same.

The posting should be done weekly from the Wages Analysis Book and the Stores Book to the weekly sheets in the Costs Book, and, if desired, the accounts can be further analysed to wages and material as shown. It is not necessary

WEEK ENDING.....

——	Equivalent in kilowatts connected						Units generated	Works units	Loss in distribution	Units sold	Record load	kw.	Date
	Public lighting	Private lighting	Heating apparatus, &c.	Motors	Traction	Total							
Current week ...											Max. load for week		
Corresponding week previous year...											,, ,,		

——	Current week	Per unit sold	Corresponding week, previous year	Per unit sold
1. *Generating*—	Double cash		Double cash	
Coals, 1·1				
Oils, waste, &c., 1·2 ...				
Wages, 1·3				
Maintenance and repairs :—				
2. *Boilers*—				
Boiler No. 1, 2·1 ...				
Wages				
Material				
Boiler No. 2, 2·2 ...				
Wages				
Material				
Boiler No. 3, 2·3 ...				
Wages...				
Material				
3. *Engines*—				
3·1				
3·2				
4. *Generators*				
5. *Pumps and Pipes* ...				
6. *Buildings*...				
7. *Electrical Instruments* ...				
8. *Distributing*				
10. *Management Charges* ...				
13. *Public Lamps*				

Remarks. ——	Current week	Corresponding week previous year
Public Lighting—		
Total number of arc lamps		
Total number of incandescents		
Private Lighting—		
Total number of ledger a/c's opened		
Total number of premises vacant, &c.		
Actual number of consumers		
Applications received during week		
New consumers connected during week		
Coal—		
Quantity		
Lb. per unit generated ...		
Lb. per unit sold ...		

NOTE.—On this and the following sheets, with the exception of 1 and 2, subsidiary accounts have been omitted, as the actual subsidiary accounts opened will be governed by local conditions.

MONTH ENDING .....

——	Equivalent in kilowatts connected.						Units generated	Works units	Loss in distribution	Units sold	Record load	kw.	Date
	Public lighting	Private lighting	Heating apparatus, &c.	Motors	Traction	Total							
Current month ...											Max. load for month		
Corresp'ding month previous year ...											,, ,,		
Totals to date, current year ...											,, for year		
Totals to date, previous year ...											,, ,,		

——	Current Month	Per unit sold	Corresponding month, previous year	Per unit sold	Totals to date, current year	Per unit sold	Totals to date, previous year	Per unit sold
1. *Generating*—								
Coals, 1·1								
Oils, waste, &c., 1·2								
Wages, 1·3								
Maintenance and repairs:								
2. *Boilers*—								
Boiler No. 1, 2·1 ...								
,, ,, 2, 2·2 ...								
,, ,, 3, 2·3 ...								
3. *Engines*								
4. *Generators*								
5. *Pumps and Pipes* ...								
6. *Buildings*								
7. *Electrical Instruments*								
8. *Distributing*								
9. *Rents, Rates & Taxes*								
10. *Management Charges*								
11. *Law Expenses* ...								
12. *Insurances*								
13. *Public Lamps* ...								

Remarks. ——	Current month	Corresponding month, previous year
Public Lighting—		
Total number of arc lamps		
Total number of incandescents ...		
Private Lighting—		
Total number of ledger a/c's opened		
Total number of premises vacant, &c.		
Actual number of consumers ...		
Applications rec'ved during month ...		
New consumers connected dur'g m'th		
Coal—Quantity ...		
Lb. per unit gen't'd		
Lb. per unit sold ...		
	Current year	Previous year
Totals to date:		
Coal—Quantity ...		
Lb. per unit gen't'd		
,, ,, sold...		

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to post weekly into the ledger. For the month the postings should be taken from the Wages Analysis Book summary, Stores Book summary, and Invoice Book, and posted to the ledger, and from the ledger to the monthly costs sheets, and in the same manner to the quarterly and other costs sheets.

The ledger should be of the loose-leaf kind, the index arranged in numerical order according to the number of main accounts, and the subsidiary accounts should be opened under the main headings numbered 1·1, 1·2, 1·3, as the case may be.

It will also be found to be an advantage to have an alphabetical index arranged after the numerical index for accounts other than costs accounts.

In conclusion, it may be said that with this system it is possible not only to obtain the cost of repairs and maintenance of every individual set, but also of any other machinery or apparatus if the separate costing of the same is desired.

A NEW ELECTRIC TRACTOR.

A NEW design of electric tractor for attachment to, and the hauling of, ordinary lorries and wagons from which the front wheels are removed, has recently been introduced by the Eldridge Manufacturing Co., of 541, Tremont Street, Boston, U.S.A.; it is designed to haul loads of 3 tons at speeds ranging from 6 to 8 miles per hour, and 5 tons at 5 to 7 miles per hour.

QUARTER ENDING.....

——	Equivalent in kilowatts connected: Public lighting	Private lighting	Heating apparatus, &c.	Motors	Traction	Total	Units generated	Works units	Loss in distribution	Units sold	Record load	kw.	Date.
Current quarter ...											Max. load for qr.		
Corresp'ding quarter previous year ...											Max. load for qr.		

——	Current quarter	Per unit sold	Corresponding quarter, previous year	Per unit sold
1. *Generating*—				
Coals, 1·1	Double cash	Double column	Double cash	Double column
Oils, waste, &c., 1·2				
Wages, 1·3				
Maintenance and repairs:—				
2. *Boilers*—				
Boiler No. 1, 2·1 ...				
„ „ 2, 2·2 ...				
„ „ 3, 2·3 ...				
3. *Engines*				
4. *Generators*				
5. *Pumps and Pipes* ...				
6. *Buildings*				
7. *Electrical Instruments*				
8. *Distributing*				
9. *Rents, Rates and Taxes*				
10. *Management Charges*...				
11. *Law Expenses* ...				
12. *Insurances*				
13. *Public Lamps* ...				

RECEIPTS.

Units sold: Corresponding quarter	Units sold: Current quarter	——	Current quarter	Per unit sold	Corresponding quarter	Per unit sold
Treble column	Treble column	Public lighting	Double cash		Double cash	
		Private lighting... ...				
		@ @ @ } M.D.				
		@ flat				
		Power—				
		@ @ @ } heating, &c. ...				
		power ...				
		Less discounts on private lighting, heating and power				
		Other items				
		Traction—				
		@ d.				
		@ d.				
		@ d.				
		Total revenue				
		Total cost				
		Gross profit				
		Interest and sinking fund				
		Surplus				

CAPITAL EXPENDITURE.

——	Brought forward	Expended during quarter	Total to date
Lands ...			
Buildings ...			
Machinery ...			
Mains... ...			
Meters ...			
Transformers..			
Electrical Instruments			

REMARKS.

——	Current quarter	Corresponding quarter, previous year
Public Lighting—		
Total number of arc lamps ...		
Total number of incandescents ...		
Private Lighting—		
Total number of ledger accounts opened		
Total number of premises vacant, &c.		
Actual number of consumers ...		
Applications received during quarter... ...		
New consumers connected during quarter		
Coal—		
Quantity... ...		
Lb. per unit generated ...		
Lb. per unit sold		

The special feature of the tractor, which consists of two Couple-Gear driving and steering wheels, each having an electric motor within the wheel, driving at a single 25-to-1 reduction in balanced action at the periphery of the wheel, is that it is equipped with a pair of auxiliary balance wheels mounted upon a special hinged carriage, which enables the tractor to be driven without the trailer. When the latter is not attached to the tractor, the frame upon which the balance wheels are mounted is swung downwards and locked in position in such a manner that the small wheels bear on

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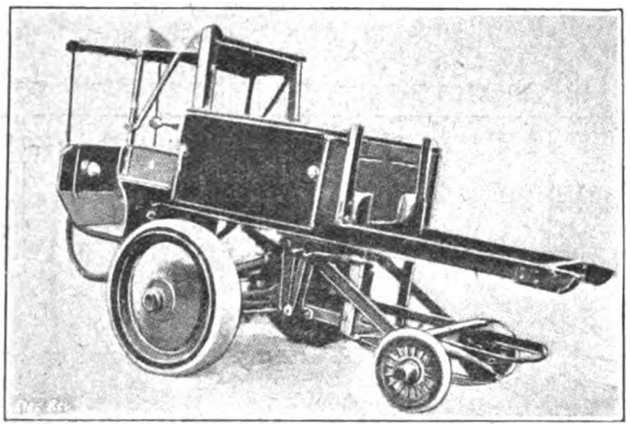
the ground and carry a proportion of the weight of the tractor. When the trailer is attached, the frame and the balance wheels are swung up from the ground, in which position they carry none of the weight of the tractor, trailer or load, these being carried entirely by the tractor and the trailer wheels.

The steering and driving wheels are 36 in. in diameter, while the balance wheels are only 15 in., and are carried on elliptic springs mounted on a special steel carriage attached to the frame. The latter is constructed of two horizontally-placed channels and two channel braces pivoted to two vertical lugs extending downwards from the frame. In one position of the pivoted members the wheels touch the ground, and in the other they are about 6 in. above it. The tractor frame, which is of channel section braced with cross-



The Eldridge 3-ton Electric Tractor.

members at the front and rear ends, extends behind the battery box about 5 ft., and the two ends of this frame are bevelled upwards. Including the driver's cab, the overall length of the frame is 11 ft. 9 in. What are known as metal pockets are attached underneath the floor of the trailer body, having end openings flared both downwards and horizontally. When the bevelled ends of the tractor frame strike the lower part of the front incline of the pockets, the tractive power of the front driving wheels pushes the rear frame extension up the incline of the pockets and back into position. An ordinary hook coupling with turn-buckle is used on each side to couple the tractor and trailer firmly together. It is claimed that the pockets can be readily applied to almost any type of wagon-body. The trailer wagons retain the upper half of the original fifth wheel. During the operation of loading the ordinary front axle construction is used with the horses hauling the load, the lower half of the fifth wheel being used in conjunction with the horses to drag the wagon to and fro. After loading, the wagon is placed in some convenient spot, a jack is put underneath the perch, and the front axle is removed. The wagon is then ready to be coupled on to the tractor.

The battery is carried in a special wooden box mounted on top of the frame at the rear of the driver's cab. The box is held in position by means of four vertical angle-irons, two at the front of the box and two at the rear, these being riveted to the frame. Two batteries are furnished with each tractor, it being intended that they should be changed at the middle of each working day. The cells are readily removable by means of an overhead chain hoist and rail.

The tractor illustrated has been purchased by the Curtis and Pope Lumber Co., timber merchants, of Boston, Mass., and is at present being used in conjunction with three wagons; three more are, however, being got ready, as it has been found in practice that the tractor can readily serve six trailer wagons on short journeys to and from the railway yard, the tractor thus being kept steadily at work instead of standing idle while the wagons are being loaded and unloaded.

THE FARADAY SOCIETY.

Presidential Address by Sir Robert Hadfield, F.R.S.

The subject of Sir Robert Hadfield's presidential address to the Faraday Society, delivered on June 11th at the Institution of Electrical Engineers, was "Advances in the Metallurgy of Iron and Steel."

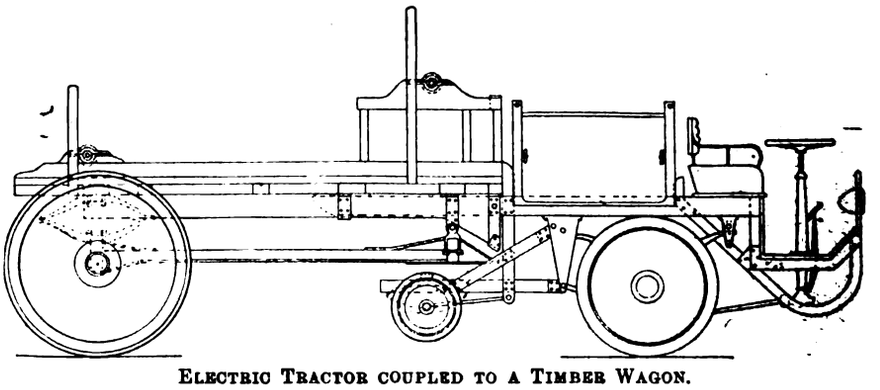
The retiring president, Dr. R. T. Glazebrook, who was in the chair, opened the proceedings by referring to the great loss the Society had sustained in the death of Sir Joseph Swan, who had been its first president, and who had continued to take the keenest interest in its welfare. A vote of condolence with Lady Swan and her family was adopted.

The address dealt more particularly with the progress that had been made in our knowledge of the remarkable properties of the numerous alloys of iron and steel with other metals, a study in which Faraday himself was one of the pioneers, for in 1822 we find him, in conjunction with Stodart, making experiments and publishing papers on the alloys of steel. Sir Robert Hadfield pointed out that the investigation of this subject has a supreme economic as well as a technical value, for the world's resources of iron ore are anything but inexhaustible, and any combination therefore which enables one to use one pound of iron where formerly two would have been necessary, is directly helping to conserve the world's natural supplies. It is possible to make a pound of alloy steel go as far as many pounds of ordinary steel.

In an interesting aside Sir Robert explained how it was that Sheffield became in the eighteenth century the centre of the special steel trade of the world, a position which she still holds. This pre-eminence would in all probability have passed to France had it not been for the mistaken idea of French metallurgists, based largely on the researches of Réaumur, that their own bar iron would make as good steel as high-class Swedish iron. The French Government would only assist the infant industry if they used home-made iron, and over this mistaken policy British common-sense and practical grasp (stimulated perhaps by the economic doctrines of Adam Smith) triumphed, with the result which everybody knows.

Coming to the main part of the address, one is struck by the fact that so little was known about the alloys of iron even as late as the eighties of last century, when Sir Robert Hadfield himself began his now famous work on manganese and silicon steels, work forming the foundation of the entire modern knowledge of alloys of iron. For example, Kohn's "Iron and Steel Manufacturing," which was issued in 1867, and remained the standard text-book for twenty years, contained not a trace of that side of metallurgy which was afterwards to develop into the now great branch of alloy steels. Again, in the year 1886 indifferent ferro-manganese, containing some 60 per cent. manganese, cost £120 per ton; to-day a ton of the high-grade 80-84 per cent. alloy can be obtained for less than £10.

There has been a tendency of recent years in considering the wonderful effects of adding to iron such metals as manganese, nickel, tungsten, and the rest, to minimise, if not to ignore altogether, the action of the carbon present. Sir Robert Hadfield belongs to the school of metallurgists once numerous, and now again growing in numbers, who regard the presence of carbon as one of the necessary conditions for obtaining alloys of the required properties, and who are satisfied with no explanation of these qualities which ignores the action of the carbon. It is well known, but often forgotten, that the cutting properties of a modern high-speed tool steel, containing usually



Electric Tractor coupled to a Timber Wagon.

15 to 20 per cent. tungsten and 2 to 4 per cent. chromium, will not be attained unless there be sufficient carbon, some 0.70 per cent., present. In an example given, two alloys of the following compositions were experimented upon by the lecturer:—

	C.	Si.	S.	P.	Mn.	Cr.	W.
(1) ...	0.74	0.10	0.04	0.03	0.28	2.84	18.00
(2) ...	0.35	0.10	0.03	0.03	0.33	2.82	18.95

It will be observed that but for the carbon content these two alloys were practically identical in composition, and the heat treatment in each case was also the same. Yet the former was found by all the usual tests to be an immeasurably superior metal; indeed, the low-carbon alloy was useless for

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tools. There was practically no hardenite or hardening carbon present in this steel; the carbon was almost entirely in the form of carbide.

It is facts such as these that tend, in the opinion of Sir Robert Hadfield, to throw doubt on the accuracy of the allotropic theory of iron which of late years has found so much favour in the eyes of metallographists, and which postulates the existence of an adamantine β form of iron. Sir Robert himself is so impressed with the importance of the part played by carbon in the various transformations of iron and its alloys that he is offering a prize of £200 (through the Iron and Steel Institute) for the best paper on the forms of carbon in iron and steel. His presidential address to the Faraday Society will have achieved its purpose if it succeeds in attracting attention once again to this most promising field of research in the great subject of iron and steel manufacture.

BRITISH BULBS FOR ELECTRIC LAMPS.

The outbreak of war has brought into prominence the dependence of many industries and undertakings upon supplies from the Continent. It has also made conspicuous—though in a much happier way—those enterprises whose products have been wholly manufactured in Great Britain.

The guiding policy of the General Electric Co., Ltd., has been to undertake the manufacture of every article, and every part of every article, in this country, and, in fact, it has acted generally as though it had foreseen and deliberately prepared for a crisis like the present.

A striking example of its strong position in this respect is afforded by the Lemington Glass Works, to which we referred in our last issue. Many makers of electric lamps in Great Britain have imported the bulbs from Germany or Austria. Ten years ago, however, the General Electric Co. took steps to secure an independent British supply of lamp bulbs, by acquiring glass works of its own. An opportunity presented itself in connection with glass works at Lemington, Newcastle-on-Tyne. In taking over these works the General Electric Co. adopted its characteristic plan of forming a subsidiary company—the Lemington Glassworks, Ltd.—in which it holds a controlling interest. At the time of purchase, the works possessed two glass houses, but the equipment has been gradually extended until the number of glass houses has reached six. This development was not achieved without overcoming many difficulties. Glass-blowing is a highly skilled trade, and the company found it necessary to train the labour it required for the special work of blowing the various bulbs required for incandescent lamps. Nevertheless, the works grew steadily, and are now giving continuous employment to about 250 workpeople.

The main purpose of the works has been, of course, to supply bulbs to the Robertson Lamp Works, Ltd. (and, later on, the Osram Lamp Works, Ltd.)—two other subsidiary undertakings of the company; but the G.E.C. does not hesitate to go to the assistance of other electric lamp makers in this country in case of need, and on several occasions when there has been a shortage of importation from the Continent there would have been a serious famine in bulbs if a supply had not been

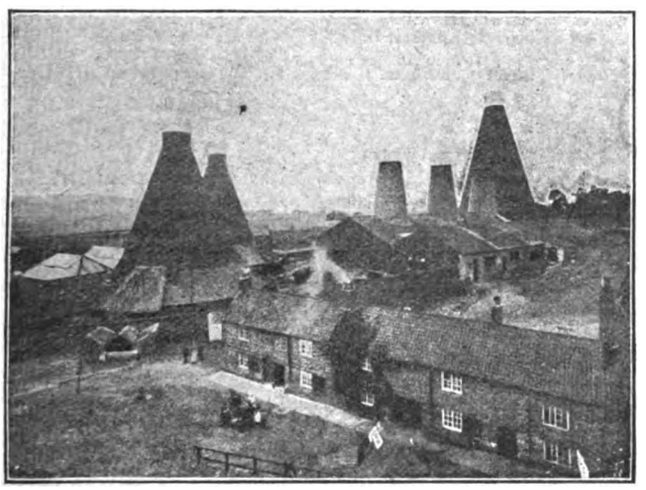

Fig. 1.—Lemington Glass Works.

available from the Lemington Glass Works. In the present critical state of things, with importation absolutely stopped, the G.E.C. has decided to continue this broad-minded policy. So far as the capacity of the works will permit—and subject, of course, to the demands of the Government—the needs of all electric lamp makers will be met. Moreover, arrangements are being made to extend the works as rapidly as possible. In this development the G.E.C. regards the glass works in the light of a national asset, which will be utilised to the full in maintaining an industry employing many thousands of hands and of vital importance to the Admiralty and the War Office, as well as to the public generally.

A specific instance of the value of the works during the war crisis may be mentioned here. Soon after the outbreak of hostilities an urgent Government order was received by the Robertson Lamp Works, Ltd., for a special type of electric lamp. The glass for this type had previously been obtained from the Continent, but the Lemington Glass Works were

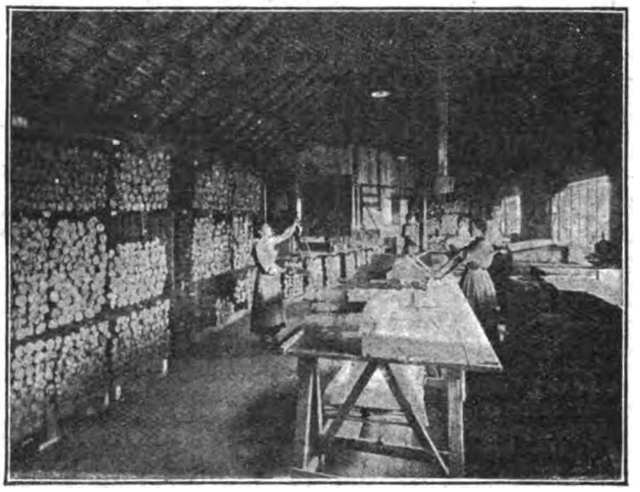

Fig. 2.—Tube-Shop.

able to produce the necessary bulbs so quickly that within three days of the receipt of the order complete samples of the lamps were in the hands of the Government department concerned. These samples were approved, and the order to manufacture in quantities was at once put in hand.

Even under normal conditions, the execution of such an order would have occupied six weeks, if Continental sources had been chosen.

We reproduce herewith some photographs of the Lemington Glass Works which were taken at the end of last month. The works are open to inspection by anyone who is sufficiently interested to write for permission to visit them.

The cessation of the foreign importation of glass offers an opportunity for the employment of from four to five times the number of people at present engaged in this section of the British glass industry.

LEGAL.

Electric Light Arrears.

At North London Police Court, on Friday, Mr. A. M. Bramall, solicitor, applied for summonses against Islington ratepayers due on electric lighting, and referred to the Act of Parliament, passed in August last, which came into operation forthwith. It was the Courts Emergency Powers Act, which provided that no execution for any debt incurred either before or after the passing of the Act should be issued without previous application to, and sanction of, the Court.

Mr. Hedderwick: I have not yet read the Act, but is any useful purpose served in issuing process which cannot be acted upon?

Mr. Bramall: It will be for you to decide, after hearing the whole circumstances, whether execution should issue. There may be cases where the provisions of this Act will afford a great relief to debtors, and rightly so, but there may be others where people can, but will not, pay; and then it will be for you to permit execution to issue.

Mr. Hedderwick: You may take your summonses; meanwhile I will look up the Act of Parliament.

Stealing Magnetos.

Before Judge Atherley Jones at the Central Criminal Court on Tuesday, Frank Edward Pullen, 39, Alfred John White, 40, Thomas Alfred Williams, 35, and Frederick George Cox, 47, were charged with stealing and receiving a number of magnetos and carburetters, valued at £171 17s., on February 1st last, the property of the Associated Equipment Co., Ltd. Pullen pleaded guilty, but the other defendants denied the charges.

The jury acquitted Cox, but found White and Williams "Guilty." Pullen was sentenced to four months' imprisonment in the second division, and Williams and White each to six months in the second division. Cox was discharged.

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The Disputed Carbons.

Before the Common Serjeant (Sir F. Bosanquet, K.C.) at the Central Criminal Court, on Friday, George Kirtland, 28, electrician, Thomas Alfred Thornton, 20, secretary, and Arthur Marston Billington, 50, company director, surrendered to their bail to answer a charge of breaking and entering the premises of the Foster Engineering Co., at Merton Road, Wimbledon, on August 15th last. They all pleaded not guilty.

Mr. George Elliott, K.C., and Mr. Walter Frampton appeared for the prosecution, while the defendants were represented by Sir Frederick Low, K.C., and Mr. H. Dobb.

Mr. Elliott said that the premises of the prosecutors were entered on August 15th, and some 213,000 carbons were removed. The defendants claimed that they were entitled to the carbons to use in an arc lamp of which they were the patentees, and which had been made by a German firm. The premises of the prosecutors were broken into under a "claim of right." Counsel said he had carefully considered the case, and was satisfied that it would be impossible to ask the Court and jury to find that the defendants had any felonious intent. What they did they did honestly in the belief that they had a claim of right to the possession of the articles. It was not necessary at the present time to go further into the matters, which were forming the subject of proceedings in the Chancery and King's Bench Divisions of the High Court. Counsel added that it would be quite hopeless and impossible, and also unjust to the defendants, for the prosecution to be proceeded with. After reading the papers in the case, he was surprised that the local justices committed the defendants for trial. Under the circumstances, he proposed to offer no evidence against the defendants. The goods were taken in the middle of the night, and, therefore, the prosecution thought that, *primâ facie*, they had been stolen. The matter was put in the hands of the police, who at once found that the goods had been removed through the instrumentality of the defendants. The prosecution then had to go on in the ordinary way.

Sir Frederick Low said that the defendants were men of the highest respectability. It was important that no one should think that there was the slightest justification for the criminal proceedings. He was amazed that the justices had ever committed the defendants.

The Common Serjeant said it was quite clear that there was some civil dispute between the parties. As the property was removed the prosecutors very naturally put the matter in the hands of the police. It was clear that the matter was really a civil dispute between the parties, and was not a case for a criminal court. It might be unfortunate that the magistrates thought fit to commit the defendants, but they left the Court as if no one had ever thought fit to prosecute them.

At the direction of the Judge, the jury returned a verdict of not guilty against the defendants, and they were discharged.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

The Customs Department of the Commonwealth of Australia announce the following decisions in respect to import duties under the United Kingdom preferential tariff :—

Multipliers, used with electrical measuring instruments	Free
Exciters for electric generators :	
Imported separately	20% ad val.
Imported with generator, according to capacity of generator	20 or 12½% ad val.
Locking bolts	15% ad val.
Galvanised steel channels	12½% ad val.

Magneto Manufacture in Great Britain.—The name of another British firm—that of Messrs. Morris & Lister, of Lockhurst Lane, Coventry—has now to be added to the list of those who are commencing to cater for the demand for ignition magnetos for British motor-cars. At present only magnetos for single-cylinder engines are being made, but as soon as the necessary tools are ready, a four-cylinder model, and possibly one or two other types will be introduced. The design of the machines is stated to follow closely the lines of the Bosch.

New Electric Vehicle.—A new electric motor delivery van, of British construction, has lately been put on the market by Opel Cars, Ltd., of Halkin Street, Grosvenor Place, London, W. The motor is carried towards the rear of the frame, its power being transmitted by chain to a geared-down countershaft with which the differential gear is embodied, and thence by side chains to the rear road wheels. The controller is adapted to give four forward and two reverse speeds.

Patent Restoration.—An order has been made for the restoration of patent No. 1,751 of 1909 for "Improvements in calculating machines," granted to Mr. W. C. Cordingley.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

19,254. "Devices for separating magnetic materials from materials in which they may be present as impurities or foreign matter." H. H. Thompson and A. E. Davies. August 31st.

19,255. "Electric fluid-heaters." W. P. Perry. August 31st.

19,257. "Electric-conduit fitting." T. Longmore and J. E. Masefield. August 31st.

19,261. "Apparatus for use in transmitting telegraphic messages." G. S. Cheshire. August 31st.

19,290. "Solenoid switches." T. G. Nyborg. September 1st.

19,300. "Electrical railway signalling." J. Gardner. September 1st.

19,312. "Anode for electric osmotic processes." G. B. Schwerin. September 1st. (Complete.)

19,313. "Magnetic separation of ores." G. B. Schwerin. September 1st. (Complete.)

19,316. "Aerial strainers or the like and manufacture thereof." T. Sloper. September 1st.

19,319. "Electric connexions and the like." S. F. Tyler and W. J. E. Beere. September 1st.

19,322. "Translating device." J. W. Mackenzie. September 1st. (International Electric Tool Co., United States.) (Complete.)

19,324. "Process for the electro-deposition of zinc." S. O. Cowper-Coles. September 1st.

19,325. "Process for the removal of tin from tinned iron and the like." S. O. Cowper-Coles. September 1st.

19,339. "Unspillable gas outlet for miners' lamp and other accumulators. J. H. Rothwell and J. Roberts (trading as J. H. Rothwell & Co.). September 2nd.

19,344. "Electrical connections." H. Lucas and W. H. Edwards. September 2nd.

19,394. "Manufacture of depolarizing material for use in primary galvanic batteries." T. W. F. Clark. September 3rd.

19,425. "Automatic electro-dynamic brake system for feed-reels and the like." H. V. James. September 4th.

19,433. "Means for producing oscillating currents of high frequency." A. H. Cohen. September 4th. (Complete.)

19,441. "Electric staff-exchangers." A. Douglas and H. H. Hodgson. September 4th. (Convention date, October 28th, 1913, Australia.) (Complete.)

19,443. "Electric lighting systems." G. J. Duckett. September 4th.

19,446. "Protective devices." British Thomson-Houston Co., Ltd. September 4th. (General Electric Co., United States.)

19,480. "Electrical-operated slide-projecting machine for advertising and other purposes." I. G. Butler. September 5th.

19,483. "Electric telegraphy." W. Judd and Eastern Telegraph Co., Ltd. September 5th.

19,484. "Device for supporting and insulating conductors." P. Good and A. E. Woodhouse. September 5th. (Complete.)

19,492. "Internal-combustion engine with electrically-driven charging pump." Allgemeine Elektricitats Ges. September 5th. (Convention date, September 6th, 1913, Germany.) (Complete.)

19,494. "Internal-combustion engines particularly adapted for use in motor vehicles." P. M. Justice. September 5th. (North-East Electric Co., United States.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

14,125. Plastic Material. A. Chanard. June 18th. (July 6th, 1912.)

15,733. Electrically-operated Piano Players. C. Youldon & C. A. Youldon. July 8th. (January 8th, 1914.)

16,208. Controllers for Electrical Apparatus. A. Mond. (Maschinenfabrik Oerlikon.) July 14th.

18,448. Incandescent Electric Lamps. British Thomson-Houston Co. (General Electric Co.) August 13th.

18,500. Liquid Resistances. Akt. Ges. Brown, Boveri, et Cie. August 14th. (January 11th, 1913. Addition to 18,000/13.)

18,609. Lockout Telephones for Party Lines. A. W. Mathys (C. R. Miller). August 15th.

18,727. Spark Plugs. M. G. Kopf. August 18th. (November 8th, 1912.)

18,983. Burglar Alarms. I. Shenker. August 21st.

19,141. Switch-actuating Apparatus of Electrically-driven Machines. A. Prior, and Butterworth & Dickinson, Ltd. August 23rd.

19,305. Telephone Exchange Systems. E. R. Corwin. August 26th.

19,443. Starting and Controlling Mechanism for Electric Motors. British Thomson-Houston Co. and R. D. Given. August 27th.

20,122. Manufacture of Drawn Wires from Tungsten and the like Metals. C. Gladitz. September 5th.

21,050. Electric Locks for Lift Gates and Doors. C. G. Major, P. H. Stevens & Smith, Major & Stevens, Ltd. September 17th.

21,070. Contact Surfaces of Electrical Coupling Devices. G. St. J. Day. September 18th.

21,779. Apparatus for producing Ozone. British Thomson-Houston Co. (General Electric Co.) September 26th.

25,363. Electrical Conduit Systems. M. Railing and T. Taylor. November 6th.

25,790. Insulating Covering for Overhead Wires. G. H. Vaughan. November 11th.

26,704. Means for supporting Resistance-wires and the like. Credenda Conduits Co. and V. Summerhayes. November 20th.

1914.

4,211.—Means for Regulating the Reversal of Electric Motors, particularly applicable for use in connection with Elevators. Otis Elevator Co. (Otis Elevator Co.) February 18th.

8,178. Automatic Starters for Dynamo-electric Machines. F. Newton & Newton Brothers. March 31st.

10,523. Mercury Vapour Lamps. W. A. A. Steinmann. April 28th. (April 29th, 1913.)

11,612. Wall Plugs or Sockets. I. B. Malaby. May 11th.

16,234. Automatic Selector-switches for Telephone Exchange Systems. C. A. W. Hultman. July 7th. (July 11th, 1913.)

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VOL. LXXV. SEPTEMBER 25, 1914. No. 1,922.

ELECTRICAL REVIEW.

Vol. LXXV.] CONTENTS: September 25, 1914. [No. 1,922.

	Page
Export Trade and Long Credit	417
Co-operation in Trade Expansion	418
Repenting at Leisure	419
Prospects in the Egyptian Market	419
Rubber	419
The U.S.A. and the War	420
Notes from Canada	420
The Manufacture of Tantalum and Wotan Lamps (*illus.*)	421
Correspondence—	
Capturing German Trade	422
British Firms and the Home Trade	422
Temporary Substitutes	422
Is "Earthing" an Extra?	422
Arbitrary Action of a Public Authority	422
Strange Behaviour of a Motor	423
New Electrical Devices, Fittings and Plant (*illus.*)	423
Our Legal Query Column	424
War Items	424
New Radio Telephony Systems (*illus.*)	429
Reviews	430
Marble as Material for Lamp Globes	431
Business Notes	432
Notes	435
City Notes	440
Stocks and Shares	440
Exports and Imports of Electrical Goods during August, 1914	441
Electric Winding Plant at Burley Colliery (*illus.*)	442
Trade War, by "Ignotus"	444
Schrage Patent Three-phase Commutator Motor with Shunt Regulation by Brush Displacement (*illus.*)	445
Trade Statistics of Egypt, 1913	446
The Electric Vehicle Committee (*illus.*)	447
Foreign and Colonial Tariffs on Electrical Goods	448
New Patents Applied For, 1914	448
Abstracts of Published Specifications	448
Contractors' Column	Advertisement page xviii

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1914 EDITION

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EXPORT TRADE AND LONG CREDIT.

MANUFACTURERS who interest themselves in export trade know only too well that one of the principal difficulties with which they have been confronted in certain foreign markets has been the unconscionably long credit system employed by the German organisations. British manufactures might for a given case be all right as to suitability and quality, delivery and even price, but if very generous terms of settlement have been offered by Teutonic suitors, terms which no British or American would accept, this has frequently clinched the matter and the business has passed us by. There seems to be a peculiar readiness among the people of certain countries to deal with those who will give the longest time in which to pay, even though there be a substantial rate of interest charged on the amount of the debt—a sort of mutually agreed upon, and, from our point of view, painfully protracted moratorium. Twenty-five years ago, when British traders had a far freer scope in foreign markets, credit was not allowed over anything like the length of time that has now become too usual. In those days several months was, we believe, almost the limit for the average exporting manufacturer or merchant. The period that has elapsed since then has witnessed the development of the German spirit of world dominance no less in trade affairs than in national policy, and those who have been in commercial active service so long have observed the change that has gradually come over the methods of international trade. Authorities in the different quarters of the globe, where the competition for orders has become so terribly keen, have written home advising the readers of the ELECTRICAL REVIEW that it was largely the German long-credit system which had made the British position so much more difficult than it used to be. Of course Germany's electrical organisations have been under-cutting in price, but credit, credit, and again credit has seemed to be a leading part of German policy, and unless the purchaser was absolutely determined to have British-made goods, an easy way could be found to his heart when he saw the financial and commercial advantage of being allowed to pay just when he pleased. Consular and other Government advisers have given the same advice as our own contributors, urging British manufacturers and traders to strain in every possible way to meet this phase of competition. Indeed, it is advocated again this week in a Government report mentioned in our "War Items." In certain cases such advice has been acted upon and the system, evil in itself, has been extended and encouraged thereby. But the differences in organisation obtaining in this country and in Germany have often compelled small British manufacturers to admit the impossibility of their attempting to defeat long credit by means of still longer credit. German industrial consolidation and amalgamation, and the close relations of

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finance and industry which became possible in consequence thereof and because money was more freely available to assist industrial effort—these strengthened if they did not actually create the system.

The time is opportune for again considering this matter very seriously. There is room for gravely doubting whether extended credit is good for the purchaser, though with that aspect we need not concern ourselves at the moment. What is more interesting is whether it is satisfactory for the country which has encouraged the practice in the hope of gaining a permanent footing in markets from which it desired to oust us. Even more important is our own attitude toward the policy in view of present events in Europe. An illuminating article on the position considered from the point of view of the manufacturer appears in the current issue of the *Engineer*. The writer refers to occasions on which German firms have in some engineering lines been allowing two, three, four and five years' credit, and he gives particulars of what we should imagine is the limit—a case in which *ten* years was allowed! German tenderers meant, at all costs, to secure an order for two gas engines for a municipality in Italy. When they offered to accept instalments spread over 10 years the British firms withdrew, and the order went to Germany. According to British standards and beliefs, business on those conditions was best left alone.

By the war on the Continent, German manufacturers are for the time being, at all events, eliminated from the world markets. The writer of the *Engineer* article, after expressing the conviction that the death struggle will leave Germany absolutely exhausted financially and unable to hamper us with her trade competition for years to come, says that whereas in the past British exporters must have sustained heavy losses through being compelled to follow their rivals' methods, and give unwholesome terms of credit, the position has now been greatly altered by the sudden withdrawal of their only important rival, and that the rival responsible for the long-credit system. It is hoped, therefore, that in their efforts to take advantage of the unprecedented chance of expansion of exports, they will realise that "the main reason of the credit cancer that has done so much harm, is gone," and that "a pernicious system that was forced on us by our enemy, should be abolished for good now that the opportunity offers itself." British firms in pursuit of foreign business are urged not to try to outbid one another by again granting extended credit, and the larger firms in the engineering industry, whose financial ability would enable them better than smaller concerns to grant favourable terms, would be doing a great deal to relieve the situation and lead to the removal of the system for many years if they would fall in with the suggestion, and compete with other Home firms on industrial rather than on financial merit. It may be thought that this attitude ignores the activities of the American exporter, but, so far as we can recollect, the long-credit system has seldom been indulged in by American firms. Indeed, we believe that they have been criticised by their own advisers repeatedly for their unwillingness to give what we regard as ordinary export credit. Ready money appeals to the American business man, whose foreign trade efforts have never been so startling that they need be feared just now; at any rate, America need not be regarded as a factor to be seriously reckoned with in any efforts that Britishers may contemplate making to stamp out the system which allows the purchaser to pay for his purchases perhaps years after he has worn them out and put them on the scrap-heap.

Of course, most of our future action in this connection will be controlled by what emerges in Germany. If that empire, which at present seems to give to English eyes signs of very sure and certain crumbling, all that is hoped for in freeing the industrial market from German financial battering rams may be reasonably expected to follow. But even if we assume a different result from the conflict, the lesson of the danger of unduly extended outside credit in all parts of the world will have been learned by our enemies themselves. In concluding our present reference to the subject, we quote the *Engineer* writer's comment on this point:—

To Germany this war will bring home the peril involved by the very credit system which she advocated and used as a weapon against her rivals; she must have many millions of pounds outstanding on long terms of payment in countries with which she is at present engaged in war, or which have been so crippled in consequence of this conflict as to be unable to face their engagements, and it is difficult to see how she will contrive—whatever the outcome of the campaign itself may be—to recover any appreciable portion of this sum. Let us hope that this lesson will not be lost on British trade.

The German people may not be so great industrially in the future as they hoped to be. The revulsion of feeling against them throughout practically the entire world may compel them to beat their swords into ploughshares (their dislike for bayonets is well known), and engage more generally for a time in agricultural pursuits. But we shall do well to analyse, as the weeks pass by, just what the Teutonic commercial procedure in the past has been. Wherever possible we may be sure German officials will try hard, by fair means, and, perhaps, by foul, to work their way into positions in which they can influence the placing of business, and we may anticipate that in Germany nothing short of frantic measures will be adopted for saving the life of German export industries. But crippled by financial weakness, disgraced as nation never was before in the eyes of civilised and uncivilised alike, will those measures avail in our day? We trow not. The fate of Louvain, the ruin at Rheims—we regard these as presages of Germany's downfall, industrially as well as nationally.

CO-OPERATION IN TRADE EXPANSION.

In the absence of any definite information regarding associated efforts that may be on foot for beginning or extending electrical trading operations in the lands of our Allies, and those other markets where Germany before the war was doing a large business, we place ourselves at the service of British electrical manufacturers. Somebody must take the initiative in matters of this kind. As a preliminary step, therefore, we invite firms who have sympathy with, or are prepared to act co-operatively in, any new effort that may be made, to communicate with us. Though the nations are still at war and little in the direction of actual pursuit of new business can be done for the time being, we can proceed to deliberate seriously, perhaps prepare a plan of campaign and gather together the necessary forces ready for definite operations to begin at the psychological moment.

We can quite imagine that some of our electrical and allied manufacturers will regard the proposition of getting into so many new markets all at once as too big for them to tackle as individual units of the industry. Undoubtedly it is so—it is useless disguising the fact; but in co-operation many things are possible that individuals cannot do alone. Two kinds of co-operation occur to us. A dozen or so manufacturers of different classes of machinery or goods might collectively, by one or two efficient representatives sent to each market, study the whole of these

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markets simultaneously—say, first of all, Russia, Belgium, France, Spain; or they might send a stronger representation to study each in turn. They would be sure of a hearty welcome from the electrical engineering and trading fraternity in these countries as soon as things began to settle down, and as the result of inquiries and fraternisation, might be able to prepare excellent reports, or arrive at definite opinions and conclusions which it is not easy to form as a result of reading general Consular dispatches, or studying the position from afar.

We have no doubt that some will regard this as an almost insane suggestion at the present juncture, but any movements of this character necessarily take considerable time to organise, for there is much to be done by way of preliminaries. Shortly after daybreak on the morning after the expiration of the ultimatum to Germany, we saw the British Navy start out upon its wonderful mission of national protection from which it has not yet returned, and a few hours thereafter hundreds of ships, with decks cleared ready for action, awaited the approach of the invader. What our representatives at Westminster said was backed up immediately—why? Because we were ready! There were no preliminaries to delay us then. Among our other national attributes we still possess some ability as a "nation of shopkeepers," though the shops are just a trifle larger than they were when Napoleon first dubbed us so with uncomplimentary intent. We talk of "capturing" trade, let us not be less ready in our trade callings than our legislators in theirs, to follow up our talking with action. We urge our readers to prepare themselves for carrying the electrical trade war into the countries we have named, by beginning to organise their forces straight away. We have already received inquiries from some firms who are eager to get into these Continental markets if they can only find others who will act with them, and we should like to witness the making of a strong effort along these lines. The land has got to be surveyed, its people must be known and trade relations with them cultivated, and the extent to which existing British manufactures are, or are not, suited to the market, and what measures need to be taken to meet new requirements, are matters for the fullest investigation on the spot.

We shall be pleased to do whatever we can to bring together those who desire to consider the taking of joint action, and if our preliminary measures succeed, to leave the matter for those directly concerned to develop fully along their own lines.

Repenting at Leisure.

It is a matter for satisfaction that as the weeks pass by and we become gradually accustomed to the state of war, there is both the time and the disposition to devote to our domestic industrial concerns that maturer reflection to which we referred recently. Repentance at leisure, though it may not remove entirely the consequences of the action which occasioned it, is undoubtedly satisfactory, whether it be the outcome of "representations" respecting "the dominant feeling of members," or whether it be made possible by the publication of a new proclamation by the King. That proclamation did not materially alter the sentiment or principle of the earlier announcement referred to in our leading article of September 4th respecting trading with the enemy, but we are glad that it was issued, if only to allow the British Electrical and Allied Manufacturers' Association to avoid both an injustice to individual firms and a weakening of its own collective forces. Indeed, it may be open to question whether the incident has not to some extent undermined the prestige of the Association as a representative organisation; if it be so, probably any effect of that kind could be lastingly removed by the adoption of really thorough schemes for carrying electrical trade war into the countries of Europe, and for meeting the demands for *new* requirements hitherto dealt with in Germany or Austria—schemes conceived in the interests of the entire British electrical industry, and not conducted with too much secrecy.

Prospects in the Egyptian Market.

On another page statistics are given of the imports into Egypt of goods which are of interest to electrical manufacturers. An examination of these is encouraging to those at war with German trade, as it will disclose the fact that last year its influence in many lines was waning. In steam engines and boilers Germany makes but a poor showing. Her imports in 1913 were less than half her 1912 totals, whereas Great Britain's sales increased by more than 50 per cent. Even in electrical machinery and petrol and benzine motors Germany imported little more than half the value that Great Britain did, whilst under the classification "other machinery (except agricultural)" she lost considerable ground last year to our manufacturers. It is to the lamp trade that the efforts of British manufacturers require to be directed, as here, in spite of a decline in the total Egyptian demand, Germany last year managed to extend her sales. Again, in telegraphic and telephonic apparatus, Germany turned the tables on us.

Rubber.

It is hardly to be expected that the rubber market would show any great activity under the circumstances, and in view of this the course of affairs has been just about what was looked for. There has been a certain amount of buying done by the home trade, but the broad outlines of the market have been decidedly quiet. The position in the East has not been pleasant, and it is known that a certain amount of rubber has been compulsorily cleared off, the buyers being located in America, and the selling coming from Singapore and Colombo. The satisfaction of American demands from this direction has necessarily led to a suspension of buying in the London market, which is at the same time bereft of a good deal of the support met with formerly from Continental centres which are now practically closed. Under all the circumstances, the price has stood up very well indeed, and first latex on the spot is quoted in London about 2s. a lb., with forward at a fraction less. Para descriptions are still held for very high prices, comparatively speaking, and as much as 2s. 8d. is named for spot, with 1½d. a lb. or so less quoted for distant delivery. There is a good deal of the lower grades of rubber about, and this in the absence of any vigour about the buying has tended to cause a slacker feeling.

Private advices which have come to hand, speak of very high prices being current in Germany, where up to 4s. a lb. is spoken of for first latex plantation crêpe. There is not the least doubt that the demand in Germany has already far outstripped the supply, but this is only one of the consequences of the deliberate policy of the Kaiser, and there is every reason to hope that the German position will grow much worse before it is better. The situation of the rubber market in Germany must now be getting exceedingly difficult, owing to the enormous drain upon the stocks of material, and the impossibility of replenishing them.

By an order in Council which has been issued, exports of raw rubber from the United Kingdom are forbidden to all ports in Europe and on the Mediterranean and Black Seas, with the exception of those of France, Belgium, Spain and Portugal and Russia (Baltic parts excepted), and direct imports into Germany are impossible owing to the naval position. Holland will possibly be amenable to the blandishments of the Germans, but it is doubtful whether any considerable quantities will enter German territory through this

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channel. An indication of the position in Berlin is to be found in the instructions issued by the Berlin Board of Charity, impressing upon physicians for the poorer classes the necessity of economising surgical bandages. Parchment paper is ordered to be used instead of rubber, and the prescription of rubber bandages is forbidden. The importance of the German trade in rubber is to be gauged from the fact that last year the imports into that country were about 29,000 tons, and the re-exports about 10,000 tons, which means that the country consumed about 19,000 tons a year.

The exports of rubber from the F.M.S. for the eight months of the year are 11,415 tons, against 7,248 tons in 1913 and 3,279 tons in 1912.

The U.S.A. and the War.

Singular views have gained currency amongst our American cousins with regard to the European war, especially in respect of the position of the British nation. We have already quoted some passages from the *Electrical World*, which indicate that our contemporary regards us, industrially speaking, as *hors concours*, and philanthropically calls upon American manufacturers to come to the aid of the neutral nations which can no longer obtain electrical goods and apparatus from the European sources upon which they have hitherto relied. In the same issue Dr. Louis Bell, who is so well acquainted with Europe that he ought to know better, states that the United States is "the only nation upon which war has not laid the hand that strangles." He remarks that the war "removes from the ranks of labour every workman of active years who is not absolutely needed to provide material of war in every country having compulsory military service." But it is not true even in such countries. The *Vorwärts*, apparently the only German paper that publishes unpleasant facts, estimates that at least a third of the working men in all the large towns in Germany are unemployed, and the number is increasing. Germany's export trade has been arrested by our Navy—but ours has not; we are at liberty to supply goods to the whole of the world that is not at war. "So far as active commercial work goes," says Dr. Bell, "one may as well reckon every door as closed in all the warring Continental countries"; but, happily, we are not Continental, and he recognises that "such residuum of the British works as may be able to keep up activity . . . . will hold up with fair success" since England controls the seas and possesses freedom of transportation. Dr. Bell concludes that the electrical trade of South America will turn to the United States as the only large source of supplies remaining, and urges that the United States should not provide loans for the promotion of bloodshed, but save up its capital "for the promotion of the world's [*sic*] industry when peace comes at last." Other articles in the *Electrical World* are devoted to a study of trade conditions in South America, which certainly seems to be the prize that the United States has its eye on.

The *Engineering Magazine* for September similarly harps upon "America's opportunity in an Old-World Catastrophe," and publishes a "war map of the world," showing how small a proportion is left open to peaceful commerce. To arrive at this result, not only the European countries, but the *whole of the British Empire* and all Africa are shaded to show that they are affected by the war—as if Canada, Australia, South Africa, India and the rest were under martial law! The writer of a special article, Mr. H. Emerson, says, without any hypocrisy about rescuing the neutral world from ruin for want of European goods, "the national opportunity of a millennium is ours"! But he also deplores the unpreparedness of his nation, and points to South America as the golden opportunity. In an editorial note the same view is taken, that England is paralysed as well as the Continental States, and "the United States must become both granary and workshop for all the world."

We grieve to prick this brilliant bubble, but it is our painful duty to point out to the United States, and incidentally—more important in effect—to all the consuming countries of the world outside Europe, that we are *not* out of the running. We are giving of the best of our young manhood to the war, it is true, but our manufactories are not idle, our export trade is not strangled, our hands are not tied. We are ready and willing to fill orders for all kinds of electrical machinery and apparatus, cables, lamps, batteries—we want good prices for our wares, but we will supply good value. Our motors are not like the German motors, rated at 5 H.P. and fit to work at 3; our cables are of quality unexcelled. We are at war not only with the sword, but also with the order-book, and we look to all friendly and neutral nations to buy from us the things that they used to purchase from our present enemies. We can make them and we can transport them, and all this talk about our being paralysed is utterly mistaken. We do not say it is deliberately false, but it is untrue all the same.

NOTES FROM CANADA.

[From our special correspondent.]

After recovering from the first shock of the declaration of war this country is beginning to steady itself and, as in England, business men and manufacturers are being urged to keep their employees on as far as possible to work for stock, and generally to make every effort to keep things as normal as possible.

It is inevitable, of course, that there should not be some dislocation of business, and quite a number of factories are closing down altogether, while others are putting their employés on short time.

The Department of Trade and Commerce at Ottawa is issuing memoranda pointing out that there are likely to be openings for extended trade with the United Kingdom; these are said to have met with immediate response, enquiries having come in from all over the Dominion. The Government is now considering the question of cancelling German patents.

Municipalities are holding meetings to consider ways and means of keeping men employed, and of finding work for those who are already out. The Dominion Department of Agriculture is impressing upon all farmers the necessity of sowing as much seed as possible, in order that Canada may be in a position to supply much extra grain to Europe next year, and also that work may be found for many who might otherwise starve. Probably amongst the people who are suffering most from the effects of the war are Canadian agents for goods, etc., manufactured in Germany and Austria-Hungary; not a few of these deal in electrical materials and appliances, etc.

Of course, many efforts are being made to form rifle corps and other bodies for the training of men in military matters; the engineers are not backward in this respect. One noteworthy move has recently been made by the staff of the Hydro Electric Power Commission of Ontario, over 80 of whose members have, at the first mention of the subject, signified their readiness to start training in rifle shooting, drill and military engineering. The question is to be taken up with the authorities in Ottawa at once.

The "Canadian Engineer" reports that a representation of a syndicate of British steel merchants is over here trying to ascertain whether Canadian manufacturers can stop the gap caused in the building trades by the paralyzing of imports from Germany and other Continental countries; and it also states that the Minister of Trade and Commerce is trying to arrange for the capture by Canadian manufacturers of some of Germany's great trade in South America, Australia, and South Africa. The general opinion here seems to be that as soon as peace is declared Canada stands to gain enormously by the altered trade conditions of the world.

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THE MANUFACTURE OF TANTALUM AND WOTAN LAMPS.

We recently paid a visit to the Dalston works of Messrs. Siemens Bros. & Co., Ltd., to see how they make their well-known "Tantalum" and "Wotan" lamps. The works are situated in Tyssen Street, not far from Dalston Station, and are admirably adapted for their purpose, the rooms being lofty and well-lighted, and arranged on a plan providing for the maximum convenience and accessibility. In this building the manufacture of metallic-filament lamps has been carried on for the past six years, beginning with the tantalum lamp, of which the Siemens companies have maintained the monopoly, and which is still manufactured in large quantities, and adding to it the tungsten lamp when the latter was introduced. Labour is readily obtainable in the neighbourhood, and the nature of the work, together with the good wages offered, enables the company to attract workers of an exceptionally high class; the bulk of the employés, of course, are women and girls, who acquire remarkable skill and dexterity in handling the delicate parts of the modern metallic-filament lamp. Their labours are greatly facilitated by the free use of machines; it is not possible to adapt the operations involved in the shaping and joining of glass parts to entirely automatic machines, but a remarkably large proportion of the work can be effected by mechanical means, enabling the output per operator to be immensely increased. The management, however, makes a point of retaining always a certain amount of hand labour in connection with each process, in order to be safeguarded against all possible eventualities. Necessarily the company had to train almost all the employés, as there is no surplus of trained lamp makers in the labour market to draw upon.

Gas for the blow-pipes is obtained from the public mains, and electricity is provided by the company's own plant. The rooms are ventilated by means of electric fans, and a complete system of Grinnell sprinklers guards against the danger of fire.

The various processes of manufacture of the tantalum and tungsten lamps are generally similar; each lamp consists essentially of three parts: the foot, the filament, and the glass bulb. The foot is made up of the flanged sealing-in tube with leading-in wires, and the spider to support the filament. One of the most interesting details in the modern lamp is the seal, which is effected by a tiny piece of platinum wire fused to two copper wires. It is a singular fact that until recently platinum was the only substance with which a permanently tight seal into glass could be effected, and it is still almost universally employed for this purpose, in spite of its high cost, but the amount required has been ingeniously worked down to the minimum. In tantalum lamps the spider arms are of copper wire, but in tungsten lamps one set of arms is made of constantan alloy, and the other of very fine molybdenum wire. The connection between the filament and the copper electrodes is made by inserting the ends of the filament into the tubular ends of the electrodes, and pinching the latter with corrugating pliers, making a sound mechanical joint. The operations of pinching the seal, and joining the foot to the bulb, both of which require great care, are partly effected with machines, which enable women to do work which in the early days had to be done by skilled men. Exhaustion is carried to the highest degree practically attainable, whilst the bulbs are enclosed

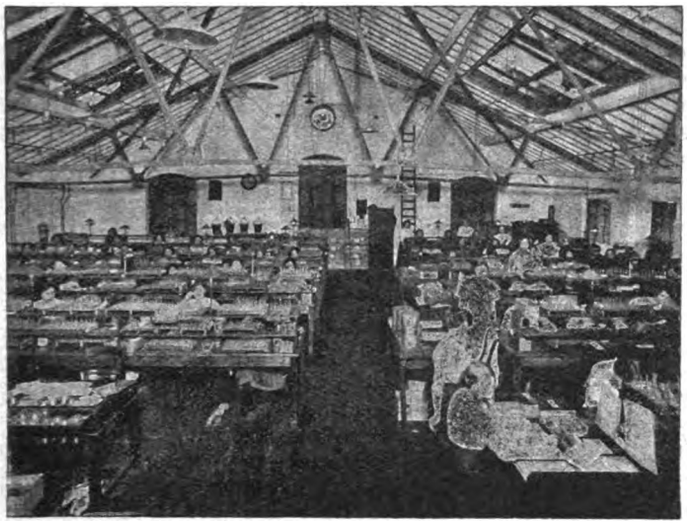

Fig. 1.—Making the Spiders.

Fig. 3.—Stemming the Bulbs.

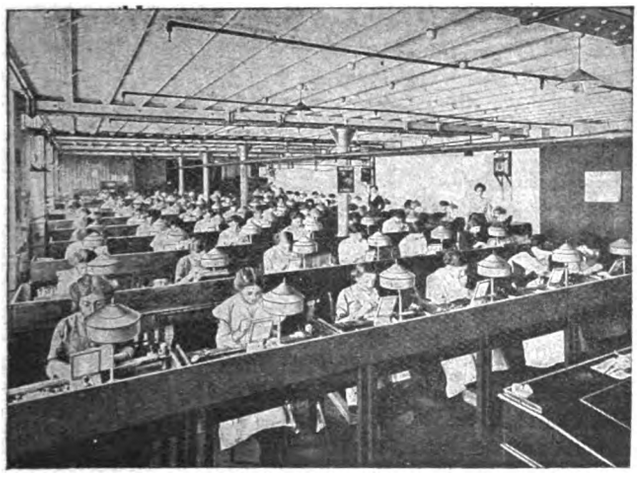

Fig. 2.—Winding Filaments.

Fig. 4.—Exhausting.

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in a heating cap, to drive off air and moisture from the interior surface of the glass. After sealing-off, it is usual to run the lamps at a pressure considerably above their normal voltage for a time, to "age" the filaments. Every lamp is tested for voltage and candle-power, at the current strength appropriate to the size of filament. The caps are fixed on not with plaster, as in the old days, but with a molten compound. Practically all lamp-makers, we believe, use brass caps made in Holland; with this exception, the Siemens lamps are made entirely of British materials, the firm having a large interest in a British glass-works, and using British tungsten wire. The completed lamp is finally tested again for vacuum, continuity and candle-power, before being wrapped in paper and put in store. The company has a large stock of lamps at Tyssen Street, and also has stores for a large quantity of lamps in Shacklewell Lane, close by. At present the works are very busy, having Admiralty contracts in hand as well as the ordinary demand. The tantalum lamp retains its popularity for many purposes, especially where severe vibration is present; a special traction lamp, for instance, is capable of withstanding violent shocks such as in practice could only be brought about, we should think, by a collision. We reproduce herewith some photographs of the works, which give a good idea of their internal appearance and arrangement.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Capturing German Trade.

As an engineer working about 14 hours a day in the endeavour to recover for this country the trade lost by us to Germany, I feel sure that my recent experiences are worth noting. I find, in short, that British capitalists and manufacturers have in no collective sense "woke up," and that it is just as difficult as ever to arouse any active enterprise or speculative effort to meet the crying need in this country.

I cannot find anyone willing to finance overcrowded works of existing profitable aluminium or brass die-casting businesses.

I cannot induce manufacturers to depart from their ordinary routine to supply large orders for:—

Nickel-coated (rolled) mild steel sheet. (The Continental works paid 40 per cent. dividend.)

Gutter section mild steel for pit props (made in Germany by the 500,000 and now required in this country).

Electrical insulating materials, *e.g.*, ebonite, galalith, syrolit, &c.

Steel deep stampings for mining specialities. Glassware of every description.

The reply received is either indifference, or "We have never made these things before."

Fredk. J. Turquand.

London, W.C., *September 19th*, 1914.

British Firms and the Home Trade.

As a topical and interesting sidelight on the past—and, I fear, the present—failure of British firms to secure the Home trade, the following is worth noting:—

Fifteen days ago you were kind enough to insert in your "Trade Announcements" a request on my behalf that firms would send catalogues to a new branch I had opened.

The result was: Two catalogues of electric blowers, one each of hair brushes, oil engines, heavy switchgear, accumulators, heaters and fittings, and some pictures from a lamp firm to whom I had already given an order for that branch. A useful selection for a seaside contractor! It will be noticed that not one list was received from makers of wires, novelties, bells, telephones, or any lighting accessories, and none of the large general firms sent anything. Doubtless their travellers will call on their weary journeys, and then wonder why they are passed over, and why the orders go abroad.

In the same circumstances, a few years ago, I had a similar experience with British firms, but was bombarded with lists, letters, and visits from the agents of all sorts of Continental firms.

E. Arthur Pinto, A.M.I.E.E.

Hythe, *September 19th*, 1914.

Temporary Substitutes.

Seeing the great need for the younger men of the electrical engineering profession and industry to place themselves at the disposal of their country, and the opportunities which they would have of doing so, it behoves the older ones such as myself, who cannot go to the front, to offer ourselves to take the places so vacated temporarily.

I have offered my services through the Institution of Electrical Engineers to serve in any rank where such would be of value in erecting or running plant, but understand that so far very few vacancies have resulted through enlistment. If this be so, it is not what I should have expected, and it may be that many have the fear that their prospects would be prejudiced in the future; such fear might be removed if it were widely known that men like myself would only hold posts until those who enlisted were able to return to them.

Robert Ritchie, M.I.E.E.

Battle, *September 15th*, 1914.

Is "Earthing" an Extra?

Should a contractor make a charge as an "extra" for earthing, under the following conditions?:—

A contractor contracts to lay three-core armoured cable on premises with a three-phase 440-volt supply power load (at a price per yard run, "the work to be finished in a workmanlike manner"). Earth plate and copper strip up to the main switchboard are supplied, together with the generating plant, under another contract. The armouring and lead sheathing serve as an earth throughout. The plant to be connected to the earth-plate at the power house through the copper strip mentioned above. Taking the term "extra" as meaning work unforeseen at the time of tendering, and since earthing must of necessity be carried out on work of this nature to comply properly with the phrase "to be finished in a workmanlike manner," it seems evident that earthing is not unforeseen. Should earthing, therefore, be an extra?

Extra.

Arbitrary Action of a Public Authority.

Your anonymous contributor of last week has adopted a high-sounding patriotic title, but is cowardly enough to sneak behind such a *nom-de-plume*.

Nevertheless, he raises two points and associates me with them in a manner calling for reply.

I always have and still contend that, failing mutual agreement, the purchaser has an equal right to specify his own conditions in the same manner as the sellers are insisting upon their's.

I have always been willing to support a standard set of general conditions when these are fair and equal to both sides, but I contend that the present conditions insisted upon by the sellers are grossly unfair to the purchaser.

I emphatically disagree with a statement as to conditions of contract which the I.E.E. consider fair.

The I.E.E. as a body have had no say in the matter; the conditions referred to were those which a select Committee of the I.E.E. passed, but although I made several attempts I was unable to find out the exact composition of the Committee, and I hold it was an act of injustice for this secret Committee to put forward such conditions as being the representative view of the Institution as a whole.

Like our expeditionary force, I have been fighting for liberty, but compelled to retreat for the time being on account of a stronger force, and not the justice of the battle.

Our First Lord of the Admiralty has, however, shown a way when he stated that the Government were not un-

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mindful of the necessity of starting an armour-plate works to combat the ring, and he speedily followed this up by inducing the Government to invest and obtain a controlling interest in the oil supplies as a set-off against the existing monopolies.

I trust the manufacturers and sellers will take this to heart, and not endeavour to force their present advantage to the hilt.

Incidentally, I should mention that the "certain public body" is not the one I have the honour to serve.

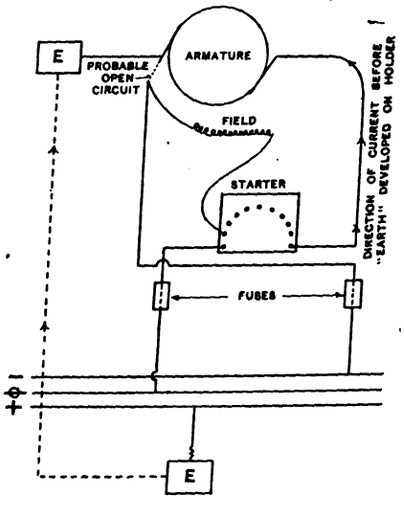
Fred. W. Purse,
City Electrical Engineer.

Carlisle, *September 21st*, 1914.

Strange Behaviour of a Motor.

Mr. Crauford's letter under the above heading in your current issue rather interested me, and presuming the motor in question is connected across the neutral and one of the outers of a three-wire distribution system, the seemingly strange behaviour of the motor may be explained in more than one way. I understand from Mr. Crauford that one side of the system was at "earth" potential temporarily. If this was so, and an open circuit existed between the main thereto and the "earthed" brush-holders, then the trouble may have been caused by a reversal of the armature current and an open field—probably this is what actually occurred, in any case it is one explanation.

Mr. Crauford does not state that there was an open circuit between the "earthed" holder and the field connection.



In fact, he does state that all the connections, &c., were O.K. I feel rather inclined, however, to doubt this. Assume, for instance, that the earthed brush-holder as shown in my sketch was negative and that the positive side of the section was also "earthed." It is clear then that the fuse on the negative pole must have been blown, or that an open circuit existed between the brush-holders and the negative main at the point of connection; it is probable that whoever afterwards carried out the isolating from "earth" of the brush-holders also made good the connection of the main thereto. The sketch of connections which I attach is a rough one, but will probably serve its purpose.

E. J. Walsh.

Kilmarnock Electricity Works,
September 19th, 1914.

Fire Alarm Successes.—Particulars of recent outbreaks of fire which were successfully announced direct to the fire stations by their apparatus, have been sent us by the Associated Fire Alarms, Ltd. The prompt notification enabled the fires to be extinguished before serious damage had been done. In view of the comparatively trifling cost of electric fire alarms, and the supreme importance of instant warning, it is difficult to understand why they are not universally installed in shops and warehouses, and other buildings containing valuable property

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Electric Fires.

A new type of electric fire has been placed on the market by Messrs. Ingram & Kemp, Ltd., of 27, Hatton Garden, E.C., which possesses several features of interest.

Electrically it is made up of several heater units each converting about 500 watts of electrical energy into radiant heat.

The heater is a flat strip of suitable metal spirals held securely along every portion of their length in specially-formed insulators. The insulator bed in which spiral wire is run is of such a shape that it permits the whole of the red-hot spiral to show and itself becomes red hot, but it does not allow of very free circulation of air round the heater wire. In this way an intense red heat is produced which is nearly all radiant, very little of the heat coming away by convection.

The specially-shaped insulator bed is built up of a number of small pieces of heat-resisting material suitably mounted in a sheet steel tray which also carries the contact pins. This construction provides a neat, effective and almost unbreakable replacement heater unit. Special porcelain is used where the heat is intense.

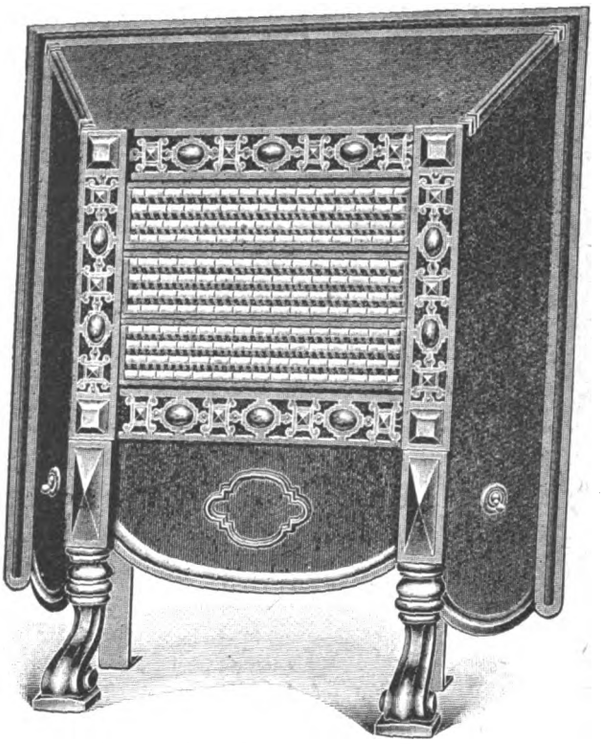


Fig. 1.—New Type Electric Fire.

The live wire spirals are securely held throughout the whole length without in any way putting mechanical strain on the wire; at the high temperature required for red heat, experience has shown that mechanical strain even of a slight nature cannot be sustained by a wire very long. The heater wire is sufficiently enclosed for it to have a uniform temperature throughout; this relieves the material of all internal strains due to uneven heating and materially lengthens the life of the wire. It is also confidently asserted that its life is enhanced by protection from a free air circulation.

Messrs. Ingram & Kemp also stock numerous high class electric lighting fittings in artistic designs, lamp radiators, &c., which, together with the fires, are on view at their Hatton Garden showrooms.

Arc Lamp Winch.

The London Electric Firm, of George Street, Croydon, have introduced a new arc lamp winch, made in two sizes for small and large lamps; it is of robust construction and is being placed on the market at a price which will remove the necessity of purchasing cheap foreign made winches. The firm carries large stocks of these winches, together with wire rope, pulleys, &c.

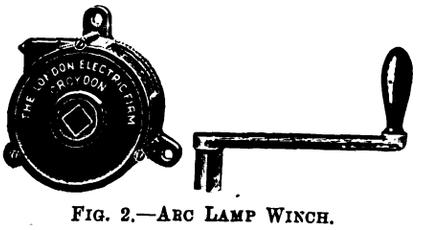


Fig. 2.—Arc Lamp Winch.

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"Eclipse" Cooking Apparatus.

We reproduce herewith an excellent view of an "Eclipse" cooking apparatus installed at Derby, where it is used in connection with the dining-room of the board of directors at the Midland Railway Station.

The installation consists of an "Eclipse" electric hot-cupboard and carving table combined, which measures 60 in. × 33 in. × 30 in. deep, with internal dimensions of 56½ in. × 27 in. × 26½ in. deep. The hot-cupboard, constructed of cast-iron, is fitted with two shelves and two sliding doors, and the top plate, ground bright, is arranged for electric heating. Six switches and terminals are provided for connection to the 350-volt three-phase supply, the voltage between each phase and the neutral being 200. The power consumption of the cupboard (interior) is 3,500 watts (three approximately equal circuits), and of the top plate, 1,200 watts (three approximately equal circuits).

The "Eclipse" Bain Marie is of the best quality copper, pure tinned inside, and measures 24 in. × 18 in. × 5 in. water depth, and 9½ in. overall depth. It is complete with inside perforated

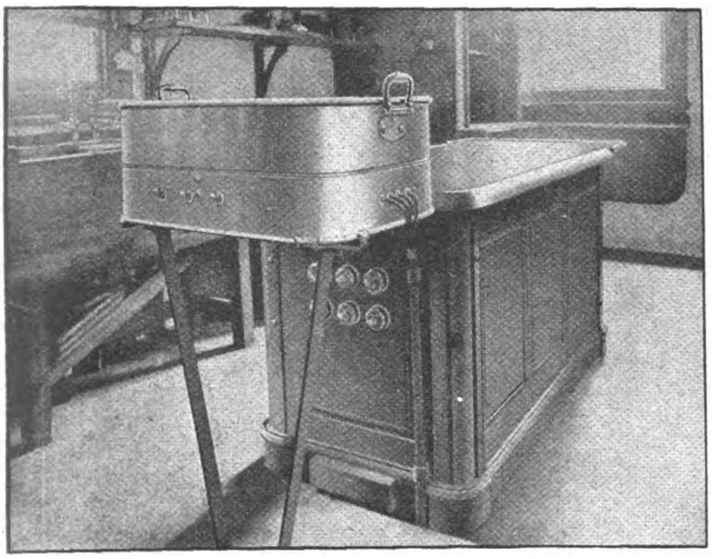

Fig. 3.—"Eclipse" Cooker used by the Midland Railway Co.

plate for supporting various utensils, and is fitted with a brass handle on either side of the body. Three switches are mounted along the side, and suitable terminals are arranged for connection to a 350-volt three-phase circuit, the pressure between each phase and neutral being the same as in the case of cupboard. The power consumption of the Bain Marie is approximately 4,500 watts. Three-pint "Eclipse" kettles are also used; these are of sheet copper, highly polished outside, and pure tinned inside.

The "Eclipse" grill and toaster included in the equipment, complete with drip pan, grid and toast grid, is made of sheet-steel, with stove black enamel finish. The external measurements of the grill are 9 in. × 10 in. × 10½ in. deep, the corresponding internal measurements being 6 in. × 8 in. × 8½ in. The weight of the grill is 8½ lb. and the power consumption is 1,000 watts.

"Eclipse" electric heating and cooking apparatus will withstand as much rough handling as ordinary domestic utensils of a similar character, the heating elements are guaranteed to last, and all the apparatus is manufactured by the Electric and Ordnance Accessories Co., Ltd., of Aston, Birmingham.

OUR LEGAL QUERY COLUMN.

"Z" writes:—"A small electric light company, having its plant and most of its consumers in the village of X, has extended its operations on a small scale in the neighbouring village of Y. Overhead wiring is used, and in every case a consideration is paid for wayleave of the poles, &c. Some of the poles are on the public highway, and in every case, of course, wayleaves are being paid for these to the Urban District Council.

"Now, in addition to these wayleaves, the valuer to the Urban District Council of Y is assessing the company's poles and overhead wiring for rating purposes, that is to say, such of them as are within the boundary of Y. He has been informed by the company that wayleaves are being paid already, and that, therefore, they are not liable for further rating. The matter has not been allowed to rest, however, and the valuer is now pressing for information as to the income derived from the company's consumers in the village of Y. Will you please inform me whether the company is liable for any rates to the Urban District Council of Y, and whether, if it is liable, the company is under any obligation to supply the authorities with information as to the income or profit derived from consumers in Y?"

*** The mere fact that wayleaves are paid for the wires which are placed within the boundary of Y does not appear to affect the question whether that part of the undertaking which is in Y is rateable. It seems that the rating authorities are quite in order in seeking information as to the income derived from the company's consumers in Y. In Halsbury's "Laws of England," Vol. XXIV, p. 38, it is stated that "Undertakings for the supply of electrical power or light are valued, and their rateable value is apportioned among various parishes upon similar principles to those which are applied to gas undertakings." This is said to be the practice at Quarter Sessions, and it has not been challenged in the Superior Courts. The principle applicable to the rating of property of gas or companies is as follows:—Where the system extends into several parishes, the rateable value of the whole system is first ascertained, and is then apportioned among the several parishes into which the system extends. The principle of apportionment is based on the distinction between the two kinds of property into which (by a rough division) every system of gasworks or waterworks may be divided, viz. (1) the pipes which deliver gas or water to the consumers, and are thus directly productive of profit; and (2) the stations where the gas is manufactured, or water pumped up, and where gas or water is stored, and the carrying mains which convey the gas or water from one station to another, or from the stations to the parishes in which the gas or water is sold; the stations and carrying mains being in themselves unproductive, but indirectly productive of the profits earned by the other parts of the system. Applying this principle to electricity, wires and mains would be regarded as productive, while the generating station would be unproductive. The rateable value of the whole system being ascertained, the rateable value of the indirectly productive part is subtracted therefrom, and the residue is divided among the several parishes into which the directly productive part extends, in proportion to the gross or net receipts earned in those parishes.

WAR ITEMS.

The B.E.A.M.A. and "The State of War."

We have received the following communication:—

I am directed by my Council to transmit to you the accompanying copy of a circular letter, dated to-day, which has been sent to the members of this Association.

This circular is marked "Confidential," but having regard to the publicity given by the technical Press to the contents of a previous circular to members, dated the 5th inst., my Council will feel obliged by your giving publicity to the present one.

D. N. Dunlop,
Secretary, The British Electrical and Allied Manufacturers' Association.

London, W.C., *September 18th*, 1914.

[copy.]

Confidential. "The State of War."

Dear Sirs,—Since the resolutions proposed by the Council on the 4th inst. were circulated to members for consideration, the Government has issued a further proclamation dated September 9th making somewhat clearer the legal position relative to "Trading with the Enemy," and an Act of Parliament has been passed in support of it.

The proclamation states that in the case of incorporated bodies, enemy character attaches only to those incorporated in an enemy country.

Without attempting to define the legal effect of the proclamation or the Act of Parliament, the Council, in view of the foregoing, and of representations made to them, desire to state that the practical difference between companies which largely manufacture here, and those which are merely branches (whether incorporated in Great Britain or not) of concerns domiciled in an enemy country, justify the Council in modifying, in favour of the former companies, the proposed resolutions, and thus give effect to the dominant feeling of members that this distinction should govern their patriotic business policy.

D. N. Dunlop,
Secretary, British Electrical and Allied Manufacturers' Association.

London, W.C., *September 18th*, 1914.

What Constitutes a British Firm?

We have no desire to intervene precipitately in the correspondence on this subject, but it seems to us that an opportunity having been given for the discussion of the matter from practically every conceivable standpoint, it may now with advantage be considered closed. Correspondents whose letters merely contain reiteration of views already stated by others, or indulge in personalities or display a spirit of vindictiveness, will excuse us if in future space does not permit us to publish their remarks. The following are the principal letters received this week:—

I am afraid some of your correspondents have allowed their natural feelings of indignation at our having this dreadful war forced upon us to run away with their judgment. The matter seems to me very simple. As regards the selling agent of a German manufacturing firm there is nothing to argue about. He cannot introduce his goods any more, and must therefore cease business. The case of a manufacturing works established here, which has been built wholly or in part by German capital, is different, but I cannot really see what good it will do the

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Germans if we go on using their capital if we don't pay them for it. It seems to me they suffer, not we. To put Englishmen out of work because they are working with capital owned by Germans, and for which the Germans are getting no return, seems to be a remarkably fantastic proposition. I am glad the Government have taken the commonsense view and arranged that, provided that no payments are made to Germany or Austria, such businesses may go on.

I should like to refer to another point, and that is that some of your correspondents seek to question the *bona fides* of naturalised Englishmen. I think this is unfair. These people have fulfilled the requirements of the law, and have taken the oath of allegiance to the King, and have been granted, under the signature of a British Minister, all the privileges of a British subject. An Englishman's word is his bond, and we must not assume, unless we have good evidence, that a naturalised fellow subject is both mad and a traitor at the same time. I say mad, because would any sane person, having once been an Englishman, wish to become a German again?

C. C. GARRARD.

Sutton Coldfield, *September 14th*, 1914.

In my letter, published in your issue of September 11th, I nailed to the counter a false coin put into circulation by Mr. Sydney Evershed. In your current issue the Langdon-Davies Motor Co. utter another; they state that I am "a director of the company." I am not and never have been.

In reply to their inquiry, the number of directors last elected corresponded exactly with the number of vacancies on the board.

I am attacked twice by trade rivals whose written word is falsehood; I am glad I am not buying from either.

Inquiry shows there is apparently only one mint for these false coins, for Mr. P. F. Brittain, in whose hand the last is found, claims elsewhere to be the "Representative of Evershed and Vignoles, Ltd.," and possesses the appropriate telegraphic address of "Purposeful."

JUSTUS ECK.

London, S.E., *September 21st*, 1914.

Your voluminous correspondence of last week, relative to associating Messrs. Siemens Bros. & Co., Ltd., with "The Enemy," has interested me considerably, and I rejoice to think, Sir, the answer is given in your own journal—always a recognised organ for fair and unbiased comments on matters of public interest—I read that this firm has sent no less than 723 of their employés to join the Colours, and is paying all married men full wages, and single men half wages, during their absence from business, fighting the enemy. Surely, Sir, the significance of this action proves unquestionably (if proof indeed be needed) that Messrs. Siemens Bros. & Co., Ltd., are doing what lies in their power as a loyal and patriotic firm to support *this* country in its hour of trial and anxiety. It is also well known to the writer that the company has done all in its power to stimulate recruiting for the National cause. I am confident that lovers of fair-play will concur with me in saying that this company (large employers of British labour) have, at least, done their part nobly and well.

If it were necessary for a company, as a guarantee of good faith, to prove they have always received the support of Government departments and municipal Corporations throughout the United Kingdom and Colonies, I question whether there are many other firms in this country who could bring forward such tangible and convincing evidence in support of such a claim as Messrs. Siemens Bros. Now, why is this true? Surely, for no other reason than that for very many years they have created a reputation for high-class workmanship and efficiency in all their productions, which result has been achieved by British labour. In dealing with this somewhat involved problem, let us try and be broad-minded. Our object will not be achieved by trying to stop foreign investors coming to this country, if, as in this particular case, they are providing the essential factor, viz., capital to create English labour. If the firm were depending on German labour it would be impossible for me to say a word in their favour, but I think I am correct in stating that practically all their employés are sound Britishers. I am, therefore, delighted—having no axe to grind—to say a word in favour of a company whose loyal treatment of their employés it would do well for many others to emulate. I am sure, Sir, a company who for years have had the respect of the most prominent engineers in this country, and whose name in the engineering and electrical world is so universally known, are entitled at least to the Englishman's version of justice and be considered "Innocents" until proved "Guilty," for the latter they can never be.

H. T. GEAR.

September 14th, 1914.

We, the undersigned, being representatives of organised workers employed by Messrs. Siemens Bros. Dynamo Works, Ltd., Stafford, desire to call public attention, through the columns of your esteemed paper, to a few facts concerning this company, which has lately been subject to malicious attacks from various sources; the same tending to damage the future trade of this old-established firm, founded about the year 1847 A.D. by Sir William Siemens, who was the pioneer of a new industry, which has since reached large dimensions.

At the outbreak of the present hostilities, many of our fellow British workers were called up for service, and the dependants of these men are being supported by the firm in such a manner that the fear of want has been dispelled; in many cases this help amounts to full wages allowance. This action on the part of the firm has lifted a deal of responsibility off the shoulders of the local distress committee

The works have been kept on full time up to the present in spite of many difficulties, and the management are doing their utmost to continue these acceptable conditions, while some British firms, in the face of the same inconveniences, have placed their men on short time.

Great encouragement has been given to the young men to enlist in the new army, and some hundreds have responded. All men who are serving King and country are having their situations kept open for them until the welcome time arrives when peace has once more been established throughout Europe, when every man will have the opportunity of returning to his work. The feelings of these men could be better imagined than described, if, on their return, after enduring the privations of warfare, they found the gate of their old firm closed, as the outcome of prejudice born of British patriotism.

The foregoing points show that Messrs. Siemens, although bearing a German name, have displayed more patriotism towards England than many firms who claim to be absolutely British. We also wish to state that in normal times about 2,000 workpeople are employed at these Stafford works, out of which approximately 4 per cent. are foreigners, comprising Germans who have grown grey in the service of the firm, others born in England, and a good number of other nationalities not alien enemies.

It has also been stated in reference to Siemens that Germany benefits to the extent of £35,000 annually in profits, without any corresponding advantage to this country; seeing that the company pay quite £100,000 per annum in wages at their Stafford works alone, is not this a decided counter-availing advantage?

Of course, Mr. Editor, we fully realise that during the period of this national crisis, when everything which is German in character is apt to rouse the wrath of Britishers, people are inclined to let their indignation gain the mastery over their powers of reason.

In conclusion, we would urge all Corporations and other public bodies to consider these facts before letting prejudice interfere with the welfare of the British workers.

F. Lees, Scientific Instrument Makers' Society.
L. Cooper, Brass Workers' Society.
H. H. Wickens, Iron Founders' Society.
E. Wainwright, Sheet Metal Workers' Society.
A. Spiers, United Patternmakers' Society.
R. Patterson, United Machine Workers' Society.
F. J. Gibson, Core Makers' Society.
A. Southall, Amalgamated Toolmakers' Society.
A. Frenzel, Amalgamated Engineers' Society.
T. Wood, Steam Engine Makers' Society.
H. Lovatt (President), United Patternmakers' Society.
F. Partridge (Hon. Sec.), Amalgamated Engineers' Society, 3, Sabine Street, Stafford.

I have no desire to add to the correspondence in your columns under "War Items," but I wish to correct a misstatement of fact made by "British Investors," in his letter concerning this company that appeared in your issue of the 18th inst.

It is a fact that this company has never, since its formation about 20 years ago, employed a single German or Austrian workman; further, neither the managing directors nor any members of the staff, with the exception of one correspondence clerk, are, or have been, German or Austrian.

I also take the opportunity of stating that all accumulators supplied by the company have always been made at its works at Dukinfield, near Manchester.

I trust you will be able to insert this correction in the next issue of your journal.

E. JACOB, *Managing Director*,
The Tudor Accumulator Co., Ltd.

London, S.W., *September 21st*, 1914.

I do not see why Mr. G. E. Kerss—not a very English surname by the way—should characterise as "a most unwarrantable and uncalled for insinuation" my friend Mr. Campbell Swinton's statement that he has sufficient respect for Mr. Alexander Siemens to believe that the latter "must retain considerable sympathy for the land of his birth."

Surely it is only right that Mr. Siemens should have such a feeling, for surely every man, however his legal status may have been altered by naturalisation, and however much he may condemn the acts of his former country, must continue to have some affection for the race from which he has sprung.

It would have been different had the allegation been that Mr. Siemens approved the present barbarous methods of his quondam compatriots, but neither Mr. Swinton nor anyone else has made such a suggestion, nor is anyone likely to do so.

In conclusion, may I confess that, like the eminent engineer that he has quoted, I, too, read Mr. Swinton's original letter with great pleasure.

As some of your readers may know, Mr. Swinton is a member of one of the very oldest historic Scottish families, so that it is quite appropriate in his case that the *Perfervidum ingenium Scotorum* should blaze out in time of stress.

JOHN E. GRAY.

London, *September 21st*, 1914.

Although I am of opinion that your columns should only be used for matters of public interest, since Mr. Höhne in his letter in your last issue touches upon a purely private matter, I feel it incumbent upon me to set him right upon one or two points.

England is not, as Mr. Höhne suggests, the country of my adoption.

I am a British-born subject.

D

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My father was a Russian-born subject and a naturalised British subject.

Having no desire to perpetuate a German name, more particularly for the sake of my children, in 1906 I adopted the name under which I have since been known.

Commenting upon Mr. Höhne's remarks concerning the microscopic profits made by my company since the starting of their works, whilst I am not disposed to accept his invitation to publish these particulars, I may inform him that my company has each year paid a dividend which has been quite satisfactory to the shareholders, who, after all, are the only people concerned, and not Mr. Höhne, who has the bad taste to intrude upon a matter which is my private concern, and who makes reference to affairs of my company of which he is totally ignorant.

GUY BURNEY.

London, W, *September 22nd*, 1914.

ENEMY FACTORIES.

It appears to be the opinion of many who write on this subject, that factories established in Britain and owned by the enemy, are being run solely for the benefit of the enemy, in that the profits go to him. But this is far from representing facts. A factory, if it makes profits at all, makes gross profits and net profits. Out of the gross profits, or rather should be said, incomings, are paid the outgoings and the net profits. The outgoings comprise rates and taxes, which go to the upkeep of municipal and Imperial services, and they comprise wages which maintain labour, and labour pays rates and taxes also out of wages. The outgoings comprise also charges for carriage, and, further, the building of the factory constitutes a hostage to fortune. After all these payments comes the profit, and since the present enemy has robbed us in various ways, our Government is entitled to waylay the profits and prevent them from being sent to the enemy for such period as may be thought fit. There can be no reason in withholding orders from firms like Siemens or other German-owned undertakings, if the profits are duly retained until the day of settlement. Close down these enemy works, and thousands of men will be thrown out of work at the time when we are all being urged to capture enemy trade abroad. We are all of us horrified at the atrocities in Belgium which are the direct outcome of the poisonings of every German mind since, if not earlier than 1870, by the false prophets in whom the German people have put their trust. But there are prominent industrial leaders among us who seem to have been here long enough to have forgotten them or to be old enough not to have had the misfortune of being taught the false doctrine of blood and iron. Why harry such men at this juncture? They have not earned the Nemesis which appears to be about to fall upon Kaiserdom. For all my thinking lifetime of 44 years, this menace has been an overshadowing dark cloud, for I remember '64 and '66, and could reason on these two years when '70 burst on us with its Bazeilles and other atrocious wickednesses. And with excellent reasons to beware of Germany and her methods, I would not harry any amongst us of whom we feel that they are free from blame.

W. H. B.

BRITISH-MADE TELEPHONES.

The lengthy communication of Mr. H. S. Höhne appearing in your current issue, seems to me to call for more than casual remark.

I should like to query the statements (1) that no firm cataloguing telephones in this country can truthfully declare that every part of the instruments displayed in their catalogues is made in this country; and (2) that within the last two years a British battleship was fitted with foreign-made telephones, supplied by one of the British firms of oldest standing.

As far as my knowledge goes, there is one British firm, perhaps not a very large concern compared with gigantic companies Mr. Höhne has in mind, but essentially British, manufacturing special types of telephone apparatus standing in a class by themselves as representing originality in design and efficiency in service, which are made throughout (except perhaps for the carbon transmitter material) in England, and all supplies listed or handled by this firm are of British origin.

To refer to the battleship alleged to be fitted with foreign-made telephones. To the best of my belief, no battleship built for the British Navy has been fitted with foreign instruments, and during the last 20 years, only one vessel constructed in this country for a foreign government has been provided with other equipment, and I think I am right in saying that this has since been replaced, at any rate as regards the principal circuits, by the British and undoubtedly superior article.

I may add that I have, for the past 15 years, been connected with the all-British firm to which I refer, and I think you will agree there is no necessity to mention this firm by name.

ARTHUR W. COX.

Wimbledon Park, S.W., *September 18th*, 1914.

Dear Sirs,—I enclose copy of a circular letter, dated August 28th, from the British L. M. Ericsson Manufacturing Co. In the interests of fair-play I would ask you to be kind enough to publish this in your columns.

Messrs. Ericsson infer that all the telephones which they supply are British made; in fact, their letter is in the form of an appeal to the public to support British-made goods. The potential buyer would naturally gather that the whole of their goods are British made, whereas I am in a position to say that out of the 150 telephone instruments in their beautifully-illustrated catalogue, only a very small proportion are made in England; the balance probably come from Sweden.

Commenting upon Messrs. Ericsson's statement that telephone manufacturers in Great Britain make a practice of merely assembling German-made parts, and selling them as "made in England," I can only say that so far as my company is concerned, ever since the establishment of the works in this country, all instruments sold by them as British made, are genuinely British-made goods. I am further in a position to definitely state that the value of the parts imported from Germany since 1909 has not amounted to £100 per annum.

In view of the foregoing facts, I hardly think Messrs. Ericsson are entitled to make sweeping statements of irregular trade practices which have no foundation.

A great deal has been written in the Press during the past few weeks with regard to war on German trade, and I agree that a very fine opportunity presents itself to the British manufacturer, but if by trying to throw dust in people's eyes, and mud at other telephone manufacturers in Great Britain, the Ericsson Co. imagine they will obtain the sympathy and the trade of the English buyer, I venture to suggest they will find they are vastly mistaken.

Having regard to the wording of Messrs. Ericsson's circular, I am curious to know whether they are prepared to point out to the trade which *are* the British-made telephones appearing in their current catalogue.

THE STERLING TELEPHONE AND ELECTRIC CO., LTD.
GUY BURNEY, *Managing Director*.

London, W., *September 22nd*, 1914.

[COPY.]

Dear Sir,—If you should be in the market for a telephone or for telephone material of any kind which you can absolutely guarantee to your clients as "British Made," we shall be glad to know of your requirements.

We definitely state that the whole of our British-made telephones and switchboards and parts are manufactured entirely at our factory at Beeston, Notts., and are not German-made parts merely assembled by us and then sold as "Made in England,"—a practice much too common.

Every 'phone made by us is of the same standard of workmanship and efficiency as those specially manufactured at our works for the Post Office, War Office, Admiralty, Crown Agents for the Colonies, leading railway and and shipping companies, &c., and are made by the same workmen in the same shops.

Send us your inquiries, no matter how small, and be assured that in manufacture of our British telephones British labour has been entirely used.

We shall be pleased to send you catalogues of leaflets upon application.

THE BRITISH L.M. ERICSSON MANUFACTURING CO., LTD.

London, W.C., *August 28th*, 1914.

L.B. & S.C. RAILWAY ELECTRIFICATION.

As a resident on the London, Brighton & South Coast Railway, one cannot help noticing that the operations connected with the further electrification of the line have been held up. It would be interesting to know whether this is due to shortage of labour in consequence of the war, or whether it is to enable the alien enemy manufacturers, who hold the contract for the plant, to complete their order when the war is finished. If such is the case, comment is needless. On the other hand, as an English undertaking, one would expect this railway company to cancel these contracts, and arrange for the work to be done in this country, in the way that other public bodies have done under these circumstances.

A BRITISH MANUFACTURER.

London, *September 16th*.

[We think our correspondent is mistaken, as we have seen cable hands actually at work within the past week on part of the line. —EDS. ELEC. REV.]

THE LAMP INDUSTRY.

The Corona Lamp Works are making distribution of a circular purporting to give information as to "Who's Who in the Lamp Industry." They are evidently doing this with the intention of suggesting that practically every lamp firm, except their own, is a foreign firm. To further this idea they give the names of directors of various firms, always being very careful to give only the foreign-sounding names, and, in certain instances, going to the length of altering the spelling to suggest German nationality. Their spirit of fairness, however, leads them totally to ignore the names of all directors, &c., who are obviously British.

Doubtless they hope to infer by this circular that they themselves manufacture their lamps in Great Britain.

Their action is strange in view of the fact that in May last a judgment was obtained against them regarding large quantities of lamps imported by them from the Continent! Peculiarly they do not, in their circular, make any reference to this fact, which I certainly think could not be ignored in any letter purporting to be giving advice and information to electric lamp purchasers.

ATLANTIC.

London, *September 22nd*, 1914.

REPORTS FROM MARKETS ABROAD.—SOUTH AFRICA.—The following information has been received from the office of His Majesty's Trade Commissioner in South Africa in a communication to the Board of Trade, dated August 17th:—

"The readiness on the part of the banks to meet the difficulties of existing conditions is equally shared by responsible merchants. The moral effect resulting from the steps taken by the Imperial Government to keep the African Ocean route free, and to remove financial difficulties, has been to restore confidence in South Africa to a wonderful degree. It would appear that in some respects, South Africa has had to rely on Germany and Austria for certain lines of commerce which are difficult to obtain elsewhere. Nevertheless, the country has awakened to the fact that something more than financial support to British industry is lost by dealing with foreign manufacturers, especially when its needs can, to a considerable extent, be satisfactorily supplied from one part or

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other of the Empire. The opportunity will shortly be given to British manufacturers of capturing an immense portion of the trade in this market hitherto held by Germany and Austria, but it is highly necessary that they should not mark the disappearance of these competitors by relaxing past efforts to reframe their trade organisation upon the most modern standards."

Algiers.—H.M. Consul-General at Algiers has forwarded (August 26th) a statement showing the value of goods largely imported into Algeria in 1912 from Germany and Austria-Hungary, to the exclusion of British products. One of the principal classes of goods included in the statement is scientific instruments and apparatus. The statement does not include goods such as coal and machinery, which are imported in larger quantities from the United Kingdom than from the German Empire and Austria-Hungary. The statement may be inspected by United Kingdom manufacturers at the Commercial Intelligence Branch of the Board of Trade in London.

Spain.—H.M. Consul at Seville has furnished (August 28th) a list of goods, which are usually imported into Spain from Germany:—Machinery, rails, iron pipes, steel cables, tools, brassware, enamel ware, brass sheets, gas pipes, tin plates, electrical fittings, lubricating oil, paint and varnish, india-rubber goods, chinaware, chemicals.

Portugal.—H.M. Consul at Oporto cables (September 11th) that amongst the most important classes of German goods imported into Portugal are chemical products, paints, hardware, iron, automobiles, locomotives and plant, and electrical machinery. H.M. Consul at Lisbon states in a telegraphic report dated September 12th that since the beginning of the war he has received inquiries from Portuguese firms for information as to British firms supplying electric fans. Amongst the goods which have hitherto been supplied entirely or partially by Germany are enamelled iron baths, name plates, railway carriages, locomotives and component parts, aluminium ware, telephones, shades and globes for gas lamps, and glassware. For lathes and drilling machines, agricultural machinery and implements, and electric lighting plant and fittings, it is considered that there will be a market in the future, but owing chiefly to the fact that there are large stocks of these articles on hand, no purchases are being made at present.

Italy.—His Majesty's Consul at Milan reports that since the outbreak of the war he has received inquiries from Italian firms who have hitherto obtained the following classes of goods from Germany, but are now anxious to buy or import British products, viz.:—

Rolled and hammered iron and steel bars.
Rolled wire rods: rolled tool and file steel.
Cold rolled iron and steel for saws, clock springs, corset springs, steel pens, &c.
Hot and cold rolled iron and steel strips.
Tubes of steel, iron, brass, lead, &c.
Metals.
Ironmongery.
Tinplate, sheet iron, brass, copper, &c.
Zinc, nickel, &c.
Electrical material, including telephones.
Steel wire.
Pressed steel parts for automobiles.
Soft steel sheets for laminated cores.
Electrical machinery.
Steatite insulators, for sparking plugs.
Automobile accessories.
Aluminium leaf.
Iron.
Carbons for electric arc lamps.
Ball bearings.
Workmen's tools.
Hardware articles.
Enamelled wares.
Surgical appliances.
Rubber.
Cinematograph materials.

Brest.—His Majesty's Consul at Brest reports (Sept. 7th) as the result of inquiries which he has instituted in his district with a view to obtaining information likely to be of use to British firms desirous of extending their trade at the expense of their German rivals, that in most cases the relatively high prices of British goods militate against their ready sale in Brest and district. British goods, though of high quality, are beyond the spending capacity of purchasers, who prefer, and, indeed, are often financially compelled, to buy twice and cheap, rather than once and dear. Surprise is expressed that British manufacturers, while maintaining their reputation for high quality goods, do not also make a bid for the custom of those to whom high quality combined with high price does not appeal. Complaint is also made that catalogues and price lists are usually in English, and deal in English coinage, weights and measurements, whereas German firms quote simplified and inclusive rates in French money, combined with metric figures of weight and size.

His Majesty's Consul further states there is a French firm at Brest, whose name and address can be obtained on application to the Commercial Intelligence Branch of the Board of Trade, which has a practical monopoly of the sale of all metal goods, and is a centre of distribution for all Finistere. The manager of this firm has expressed a desire to receive from England price lists and catalogues which he can readily understand. Stress is laid on the importance of quoting to Brest merchants strictly inclusive prices, so that customers may know the exact cost of goods delivered at their warehouses; strict attention to this point on the part of German firms has in a large measure contributed to their success in Brest and district. Porcelain and earthenware goods are obtained largely from Saxony through commission agents holding stocks in Paris. Lists of names and addresses of German and Austrian firms and of representatives of German firms in Paris with whom Brest merchants have done business may be seen at the Commercial Intelligence Branch.

Rio de Janeiro.—In a communication dated August 25th, His Majesty's Consul-General at Rio de Janeiro reports that it is obvious that the present condition of affairs affords British firms an excellent opportunity of securing much of the business hitherto handled by German houses in that city. The numerous German import firms there are absolutely debarred from receiving goods of any kind from Germany, and they can only rely upon such stocks as they happen to have on hand. They are quite unable to execute any orders for German goods.

Amongst the principal articles of German import in Rio de Janeiro have been iron and steel for constructional purposes, locomotives and machinery of various kinds, gas engines, electrical plant and fittings of every description.

Furthermore, it is to be noted that certain German firms in Rio de Janeiro have been doing big and lucrative business in connection with hydro-electrical installations. Indeed, there is hardly any branch of trade with which German firms are not largely connected. His Majesty's Consul-General emphasises the futility of attempting to build up a lucrative trade by means of correspondence only. It is the personal factor that counts in Brazil, and British firms desiring to capture trade hitherto handled by German firms, must make up their minds to send out alert and competent travellers possessed of a good knowledge of Portuguese, and of the requisite technical knowledge to enable them to deal promptly and authoritatively with their respective lines of business. These representatives should study the local conditions and requirements, and they should make it their business to satisfy such conditions and requirements. As regards the likelihood of British firms being able to secure regular payments from local firms with whom they might elect to do business, his Majesty's Consul-General states that this is a matter calling for the exercise of much judgment in the selection of the firms to be dealt with. Many firms are in a very precarious condition at the present time. Much of the success achieved by German firms has been due to the long term of credit allowed to local firms; and British firms desirous of securing German trade must be prepared to allow local firms a like measure of consideration. We refer to this matter somewhat fully in our leading columns to-day.

His Majesty's Consul at St. Paul de Loanda cables (September 18th) that amongst the goods of German manufacture which have hitherto been imported into Angola, but which might now be replaced by British products, are the following:—Locomotives; railway material; telegraph material.

Board of Trade Assistance.—The Board of Trade have received a very large number of inquiries for names of sellers or buyers of articles of which the sources of supply or markets have been interfered with by the war. Special arrangements have been made in the Commercial Intelligence Branch for dealing with the inquiries, and lists are being prepared and circulated of articles which inquirers desire (*a*) to purchase and (*b*) to sell. The first list was published on August 29th; the second list is now ready, and may be obtained on application to the Branch. Firms interested in any of the goods mentioned, either as buyers or sellers, should communicate with the Director of the Branch.

The last issue to hand of the Board of Trade series on different trades gives particulars of German and Austro-Hungarian exports of iron or steel bars, rods, angles, shapes, or sections, and information relating to the markets in which they are sold.

Other pamphlets of the series relate to motor-cycles and motor-cars and parts thereof.

Contracts in War Time.

In the House of Commons on 16th inst., Sir J. Simon, in the course of a reply to a question by Mr. Joynson Hicks respecting contracts with alien enemies, said (according to the *Daily Telegraph* report):—

It was quite true that there was a good deal of doubt and uncertainty in the minds of many persons in the commercial world as to how the outbreak of war had affected their rights and liabilities in contracts entered into before the war began. He did not mean the case of a man who wished he had not entered into a contract because prices and freights were rising. Everybody agreed that he must stand by his bargain, unless he could persuade the other party to come to his assistance. He meant the case where one party to the contract was a subject of our own, and the other was an enemy in the sense that he resided and carried on business in the enemy's country. Such a man said, "We have made our contracts in times of peace, and the performance is not yet completed; perhaps the time for performance has not yet come. How does the outbreak of war affect the performance of that contract?" The Government had been considering whether or not they could usefully and properly intervene to solve these difficulties. The real difficulty, which could not be got over by some formula or abstract statement, arose from the complexity of each individual case. He felt no hesitation in laying down, and he did not think any lawyer would deny, or any sensible man would question, this proposition, that if a party entered into a contract before the war began it was a lawful contract to enter into, and if the time to perform it had not come when war broke out, then, if performing the contract during the war was unlawful, no man was liable in the courts of this country because he did not perform it. That proposition was plain. The real difficulty was not in laying down such a proposition, but in applying it, owing to the large and infinite complexities of hundreds of thousands of cases. Although he had seen but a fraction of the difficulties, he had seen enough to know that it was not possible for him to lay down in advance a series of elaborate and particular rules that would govern these cases. Therefore, there was no alternative, except for those who felt any doubt in these matters to take the best advice they could.

German Trade and German Vandalism.

Much is appearing in the technical and lay press on the subject of Great Britain obtaining some of Germany's foreign trade. We shall not get it all, America will see to that! The world, too, has been scandalised at the wanton destruction by the Germans of property having no military value, and a good deal of such property is irreplaceable even regardless of cost, *e.g.*, cathedrals and other old buildings, many works of art, books, MSS., &c. It is out

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of the question for the Allies to lower themselves to the standard of German "culture" and to retaliate when they are in Germany, by destroying similar property, but why not retaliate, and at the same time assist the capturing of German trade, either by destroying German factories (especially Krupp's) or by confiscating all the plant in them? If this be not done, these factories will soon be at work again after the war, and the Germans will "cut" prices more than ever in order to recover their trade. Even 15 per cent. less in the price of an article will, a year or two after the war is over, unfortunately cover a lot of patriotism! Mr. Maurice Maeterlinck urges us to decide such matters *now*, while the horrors of the war are with us, and not to wait till it is over when sentimentalists, even in this country, will begin to plead for "the poor Germans" who are now committing, in addition to the above, diabolical deeds on human beings.

A. S. E. Ackermann.

London, S.W., *September 21st*, 1914.

P.S.—On account of my name perhaps I had better add that my family came to England in the 18th century!

The Future of Russia.—In an editorial on "Russia and the War," the *Financial Times* says:—"We may hope that one of the results of the present war will be a much closer association commercially and socially between ourselves and the Slavonic nations. Hitherto the economic development of Russia, and Roumania as well, has been largely directed from Germany, very much to the profit of the latter. The exports of Germany to Russia amount to about £60,000,000 annually, and the bulk of this consists of goods which can be easily supplied by English manufacturers provided the exact requirements of the trade are understood. It is certain that German merchants will be at a hopeless disadvantage in Russia for many years to come, and British and American manufacturers will be invited to supply their place. Moreover, should the war go favourably, it is probable that an immense impetus will be given to Russian trade in every department. . . . A message from the Petrograd correspondent of the *Times* points out, however, to take full advantage of the situation it will be necessary for our merchants to act promptly and not to wait until the termination of the war."

All-British.—The Klein Engineering Co. (1908), Ltd., wish it to be known that they are entirely British in every respect—capital, directors, shareholders, staff and workmen, and have no connection whatever with any foreign country. Everyone connected with the business is British born. The company does not work any foreign patents, and all its manufactures are made throughout in England. The directors are also the directors of Entwistle & Gass, Ltd., Atlas Foundry, Bolton.

Messrs. Scholey & Co., Ltd., write as follows:—"We had hardly thought it necessary to proclaim the fact that we were a British organisation in every sense of the word, but in some circles there is a misconception or a misrepresentation of our position. May we, therefore, say that 'Scholey' is an old English name, and is one of the oldest family names in Yorkshire; moreover, we might add that we have neither on our board nor on our staff anyone who is, or ever was, associated in the remotest degree with German or Austrian families."

As it might be thought that the firm of Messrs. Isenthal & Co., of Neasden, had some connection with Germany, we are pleased to be able to say that Mr. A. W. Isenthal, who is the sole partner in the firm, has been resident in this country for 25 years, and is a naturalised British subject. The business is carried on without any outside financial assistance, British or foreign, and the whole of the workmen and works staff are British-born subjects. The foreign patents which the firm is exploiting at present are of Swiss origin. The company has kept the works going so far with full time and the full complement of men, and hopes to continue to do so.

Contraband of War.—Additional articles to be treated as contraband of war in accordance with previous proclamations, are copper, unwrought; lead, pig, sheet, or pipe; and rubber.

Canada.—The Montreal correspondent of the *Times* says, under date September 14th: "Conditions in Europe are making it difficult for the larger industrial companies to secure new business. This is affecting iron and steel companies to the greatest extent."

Argentine Contracts Placed in England.—According to the *Times* a contract for a large number of passenger carriages for the new electrified services round Buenos Ayres of the Central Argentine Railway Co., originally placed with the Hannoversche Wagonfabrik, has now been awarded to the Metropolitan Amalgamated Railway Carriage and Finance Co., Ltd., of Birmingham.

Willans & Robinson, Ltd.—Within a few weeks of war being declared, over 20 per cent. of the total male office and works staff, irrespective of age, joined the Services, a record the firm has every reason to be proud of. Lord Kitchener has conveyed in a letter to the firm his special thanks. Places are being kept open, and half-pay rates paid for those who joined in that period. The company have always maintained a close connection with the Army, and contributed largely to the formation and support of a Howitzer Battery formed some years ago, whose headquarters adjoin the works. The company have in hand several orders for war material, and have acquired a special interest in aeroplane engine work, the company having secured, prior to the war period, the sole British manufacturing rights for the well-known "Salmson" engine (Canton-Unné system).

Chloride Recruits.—With reference to the paragraph given in our last issue, since this was written a good many more of the men of the Chloride Electrical Storage Co., Ltd., have enlisted. 20 men from the staff and works were called up on mobilisation, most of them being reservists, and several of these are now with the Army in France. Subsequently 53 have joined Lord Kitchener's Second Army, making a total of 73 men altogether. The company is making a weekly payment in the case of married men, or those having dependants on them. A weekly contribution from the works and staff to the Relief Fund is amounting to between £11 and £12.

Active Service Allowances.—The Mexborough and Swinton Tramways Committee have decided to pay a weekly sum of 7s. 6d. to the dependants of workmen in their employ who are on active service.

The Luton Electricity Committee have decided to pay each of their employés who have been called up for military service, his ordinary wage less the sum received from the War Office.

Messrs. A. M. Mulliner, W. Tomlinson, J. Eyre and J. Gegan, of the Eccles Electricity Department, having joined the Colours, the Corporation has decided to make up the difference between the army allowance and their salaries.

Relief Funds.—The Yorkshire Electric Power Co., of Dewsbury, have contributed the sum of £250 to the West Riding Distress Committee Fund, which is being raised by Sir John C. Horsfall, Bart., chairman of the West Riding County Council.

Trade with Belgium.—A correspondent at Ghent (M. Emile Pauwaert), who says that there is a broad field of action in Belgium for almost any British industry to replace German goods, wants to hear from British manufacturers.

Laurence, Scott & Co., Ltd.—About 140 employés of this firm have joined the forces. Wives and dependants are being assisted. The directors have promised £50 toward a fund that is being prepared by the staff and employés for the relief of distress, &c.

Salford Contracts.—The Salford T.C. has adopted the recommendation relating to contracts, to which reference was made in this column last week, to the effect that all contracts entered into with the Corporation be adhered to, with the exception of such contracts, or parts thereof as involve trading with alien enemies. An addition was made to the resolution which will allow any committee which desires to submit circumstances in support of any exception to the rule laid down to have its views placed before the Council.

Employés at the Front.—About 50 members of the staff of the Endolithic Manufacturing Co., Ltd., including several travellers, have enlisted. All places are being kept open. The company will not raise prices so long as the stock lasts, but if the war is of long duration, raw material from the Continent being unobtainable, they must eventually advance.

The Peel Green Engineering Works, near Eccles, are busy on an order from the War Office for searchlight plant. Sixty employés of the firm have joined the forces, and provision is being made for their dependants.

Messrs. W. Canning & Co., of Birmingham, ask that as 48 of their staff, foremen and workpeople are with H.M. forces, indulgence should be shown if there is a temporary falling off in their usual services. They have issued a general circular reviewing business conditions which they report to be steadier than when they issued their circular of August 13th.

Manchester Tramwaymen.—It was stated on Tuesday that the Manchester Tramways Committee was paying no less than £400 per week in wages to the wives of dependants of men who have joined the Colours. Men are joining Lord Kitchener's army daily, and already 720 men have left for service in connection therewith. The business of the tramways parcels department has fallen off by about 25 per cent. during the last few weeks.

Controlling Devices.—The Igranic Electric Co., Ltd., of Bedford, inform us that they are making every effort to carry on business as usual, though many of their employés are with the Colours. They obtain almost all their supplies from British sources, and carry a very large stock of finished articles. While they have had to withdraw outstanding quotations of special terms, they hope to be able to accept orders at the prices already quoted.

British-Made Labels.—The Endolithic Manufacturing Co., Ltd., of 61½, Fore Street, E.C., inform us that all their labels are British-made, and the whole of the capital of the company is held by British subjects.

Our Opportunity in Belgium.—Messrs. Bugg & Co., of 23, Rue du Brésil, Antwerp, electrical importers, write to inform our readers that owing to the cessation of sale of German goods in Belgium, there will be a great demand for British. The firm will be pleased to hear from British suppliers of armature stampings, brush-holders, carbon brushes, dynamo wires, cables, &c., with a view to representation.

The Bradford 5,000-kw. Plant Contract.—The British Westinghouse Electric and Manufacturing Co., Ltd., write as follows:—"As there seems to be a general impression that this company accepted the order for this set from the Bradford Corporation at an extremely low figure, we should like to state that, not only was our original tender price higher than that at which the contract was placed for the Bergmann set, but also that the price at which we have now accepted the order is higher than our original tender price, owing to the increase in the cost of raw material, which has taken place in the meantime."

Siemens and the Prince of Wales's Fund.—The sum of £460, contributed by the employés of Messrs. Siemens Brothers and Co. at their Woolwich works, has been handed over to the Mayor of Woolwich for forwarding to the Prince of Wales's Fund.

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NEW RADIO-TELEPHONY SYSTEMS.

The radio-telephone systems devised by the Italians Marzi, father and son—the former for some years Director of the Rome telephones—and the French officers Jeance and Colin have lately given very satisfactory results during trials on the Continent. Experiments with the Marzi system were made from the Goldschmidt station at Laeken* (Brussels), messages emitted being received at Antwerp, Sain, Trond, Luttich, Bostonge, Namur, Tournai, Ghent, Coutrai, Bruges and other places. Finally very successful trials were made between Brussels and the Eiffel Tower, an orchestral and vocal concert being satisfactorily reproduced, despite unfavourable atmospheric condition, when using 1½ amps. primary microphone current and 3 amps, secondary microphone and aerial current in the Brussels station. Successful radio-telephony requires the use of a generator of high frequency and very uniform oscillaations and a microphone capable of imposing on such a current oscillations corresponding to those of speech waves. A suitable generator is obtainable without much difficulty, but a microphone constitutes the most serious stumbling block in any system of wireless telephony yet devised. With all ordinary forms of carbon microphones the trouble is that the granules overheat and become covered with an insulating sheath, unless the working current is so weak that it does not suffice to control adequately the aerial current. Numerous attempts have been made to cool the carbon by metal or other heat conductors, air or water currents and so on, but in the Marzi microphone a new principle is employed. Instead of a stationary carbon contact, a moving contact is established by a stream of carbon granules, each of which remains in circuit too short a time to be injuriously heated. The Marzi microphone resembles the liquid microphones of Chichester Bell and Majorana in respect of continuous substitution or renewal of contact, but is distinguished from these types in that contact is restricted to the points of contact of the granules with a membrane instead of being distributed over a comparatively great length of the latter; the microphone effect is therefore greater and sharper than in hydraulic microphones.

Referring to A, fig. 1, a horizontal lever 2, 3 plays between the poles of electromagnets 1, 1 and carries a sphere 7 the upper half of which is platinised and lies within a platinised cup, mounted on the bottom of a cylinder 5. From the latter, fine carbon granules flow between the surfaces 9, 9 into a receptacle 10 when the magnets 1, 1 cause 2, 3 to oscillate in sympathy with speech or other sound vibrations. At other times the surfaces 9, 9 are held together and no granule flow takes place. When the apparatus is in use, the resistance between 9, 9 varies in proportion to the speech currents. Each granule is in circuit between 9, 9 too short a time to be heated appreciably, hence the carbon can be returned to 5 for indefinitely repeated use.

B and C represent alternative arrangements for the variable carbon-flow gap, and D shows the circuit connections employed. Speech or other sounds to be transmitted are directed into an ordinary microphone 16, connected in series with a switch 19, battery 17 and a primary coil 20 of a transformer, the secondary winding 21 of which is connected to the electromagnet 1 of the heavy current microphone already described and now represented by the pivoted lever 2, 3 and the variable-gap contacts 23, 24. The transmitting oscillating circuit is connected across 23, 24, a modification of the Moretti arc being used as the source of energy. Each arc is established by 600 volts p.d. between two metal electrodes, one of which is kept in continuous rotation. A frequency of 120,000 oscillations per second is obtained and a single arc suffices for distances up to 200 miles. With four arcs in series on a 2,400 volt supply, satisfactory communication has been established between the Italian arsenal at Spezia and Messina (520 miles). The apparatus is very compact and light (height 18 in., weight 9 lb.).

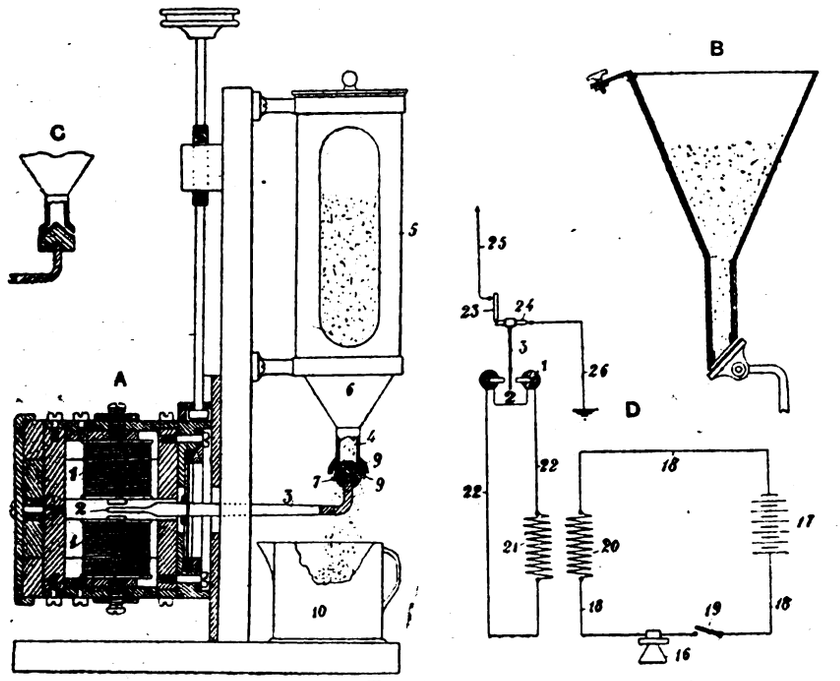

Fig. 1.

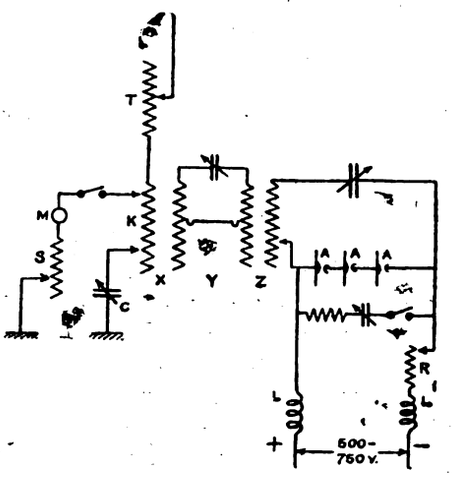

Fig. 2.

For reception, a very sensitive crystal detector with regulable condenser in the aerial and telephone circuits is said to be best. There follow in order of efficacy de Forest's audion valve, Fleming's valve (working at 4 volts from a battery of three accumulators with regulating resistance), and carborundum and electrolytic detectors.

The French officers Jeance and Colin also employ arcs to produce the high-frequency fundamental current on which speech variations are imposed. These investigators have devoted special attention to the problem of eliminating disturbances due to variations in the arc current. In the latest modifications of their system, the arc current is "filtered" free from all amplitudes and frequencies outside prescribed limits, leaving in the aerial a sinusoidal current of constant frequency and amplitude.

*This station was destroyed by the Belgians prior to the German occupation of Brussels.

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At the sending station three arcs, A, fig. 2, are used in series, each burning between a copper disc anode and a carbon rod cathode. The arc burns in an atmosphere of acetylene and hydrogen (produced simultaneously in a calcium carbide and hydride generator) which prevents combustion of the carbon electrode or even adds slightly to its length. The copper electrode forms the bottom of a paraffin-filled water-cooled cylinder, and such slight arc adjustments as are required from time to time are made by hand. By varying the d.c. supply pressure between 500 and 750 volts, the arc current is varied from 3½ to 4½ amps. Direct current is fed through choke coils LL and a variable resistance R to three parallel circuits, across the centre one of which (the arc circuit) there is available 250-350 volts. On changing over from sending to receiving the pressure is reduced to 150 volts and a resistance automatically switched in current. The main oscillating circuit X, comprising a variable condenser and inductance, is coupled by an intermediate tuning circuit Y to the antenna circuit Z. The intermediate circuit Y prevents transmission of foreign frequencies to the aerial circuit which comprises a coupling coil K, regulable condenser C and inductance T. Across K and C are connected a variable inductance and the microphones in series, all spoken into at once by aid of a megaphone. This method of connecting the microphones eliminates sparking and places no limit on the microphone current. One of the two duplicate microphone sets cools while the other is in use. Regulable air condensers make possible most accurate tuning, this being very sharp owing to the purity of the transmitting aerial oscillations. The wave length can be varied within wide limits. Experiments carried out with 985 metre waves between Paris and various amateur and portable installations in the vicinity (distances up to 150 miles) show the Jeance-Colin apparatus to be simple and satisfactory in use.

REVIEWS.

Motoring: An Introduction to the Car and the Art of Driving It. By Algernon E. Berriman. London: Methuen & Co., Ltd. Price 10/6 net.

The motor vehicle has now become so much a part and parcel of daily life that there is a tendency, in some quarters, to regard motoring as a pastime as a diminishing quantity. Although this is undoubtedly true to an extent, in so far that many of the themselves, yet there is an unceasing flow of new to be driven as passengers rather than take the wheel themselves, yet there is an unceasing flow of new recruits to the ranks of motorists who find considerable pleasure, and even health, in the outdoor life that the possession of a car affords. Indeed, the light car, to which increasing attention is now being devoted, would appear to have given quite a new impetus to the movement in this direction.

It is probably due to this fact that there is a steady demand for books relating to motoring and the motor car, and, the demand existing, there is, as usual, no lack in the supply. The latest book on the subject is that by Mr. Berriman, who, from his long association with the movement, is in an excellent position to undertake such a work. In the course of fourteen chapters, the author deals with all the varied matters associated with the construction and operation of a motor car, the text having been written in the interests of the non-technical motorist. On the whole, the reading matter is clear, so that a careful perusal of the chapters devoted to the mechanism, and a study of the numerous detailed illustrations, should result in a prospective or novice motorist gaining a good idea of the why and wherefore of the various components of a petrol car—for it is to this type of automobile that the book is exclusively devoted. In a few cases, the author is, perhaps, not so lucid as might be desired, as witness his statement that the frame of the car is attached by springs to its road wheels.

A comprehensive chapter is devoted to the magneto now universally used for ignition purposes, while another deals with the dynamo which is now being increasingly employed for car lighting. A good deal of space is devoted to sound advice on the choice and upkeep of a car, although we have one or two small criticisms to make of this section. First, the question of tires, which is generally admitted to be one of the biggest items in motoring costs, is very scantily dealt with, not more than thirty lines being allotted to their description and consideration. Secondly, in figuring out the annual cost of motoring, only the outlay for tires and petrol is taken into account, these figures being used to make a comparison with the cost of railway travel. Needless to say, there are many other charges, such as the annual motor tax, insurance, cost of garage, lubricants, repairs, and depreciation allowance, which have all to be taken into account, and which will greatly increase the author's estimate of 2¼d. per mile.

The important subject of driving receives adequate treatment, and if the author's suggestions were generally adopted, it is safe to state that drivers would not only reduce the danger to the public but would at times find motoring a less worry-causing occupation. The question of petrol and other motor fuels is also discussed, but we are somewhat afraid that the text is of too technical a character to either be followed by or be of interest to the average motorist, a remark which also applies to some of the tables, such as those of sines and tangents, logarithms, and hydrocarbon formulæ, that are included in the appendix.

While we do not wish to convey an unfavourable impression of the book, which undoubtedly contains a vast amount of useful and reliable information, somehow or other, we cannot help feeling that it does not altogether fulfil the requirements of a *popular* work on the subject. It may be that we have not quite fully realised the object the author had in view, but in our opinion, there is rather too technical a flavour in some of the chapters, while, on the other hand, various matters of vital interest to motorists, from the motoring point of view—and that, we take it, is the main object, especially in view of the title of the book—could have been more liberally dealt with. It is frequently stated that criticism is usually destructive and seldom constructive, and, to avoid our remarks being put under the first-named classification, we would suggest the omission, in a subsequent edition, of some of the technical matter mentioned and a more liberal treatment of the question of tyres, and the water circulation of the engine, the latter to include an explanation of the two systems in use on present-day cars, and the functions of the radiator, the radiator fan, and, where used, the circulating pump.

Elementary Graphic Statics. By John T. Wight, A.M.I.Mech.E. London: Whittaker & Co. Price 4/- net.

In none of the higher branches of engineering can mathematics be avoided. But they can be either simple or complex, according to the way the problem is tackled. Thus many a calculation which might be supposed to require the use of the differential calculus can be solved with an accuracy to within one per cent. by means of graphical representation of the forces at work. Just how problems in statics can be dealt with on these lines is well described, with the aid of 135 illustrations, in this useful little book by Mr. Wight, who is Lecturer in Machine Design and Prime Movers in Heriot-Watt College, Edinburgh. All kinds of structural engineering work are touched upon involving beams,

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girders, roofs, cranes, retaining walls; and many simple practical problems are worked out in detail all by means of the excellent science of graphics which, as the author says, "presents a ready means of circumventing the many intricate and cumbrous mathematical equations which can, all too easily, clothe comparatively simple problems with an air of mystery and difficulty." Undoubtedly there are mathematically-minded people who profess to scoff at graphical methods, but we know that every day of their lives there are numerous practical engineers who are satisfactorily carrying out big engineering works that have been admirably worked out by graphical means.

The Inventors' and Patentees' Year Book for 1914. By William H. Taylor. Manchester: The Dexter Press, Ltd. Price 7/6 net.

This is the first issue of what is really a very useful book. It is stated that future annual editions will keep the subject matter up-to-date, and enable new aspects of the subject to be dealt with. The subject matter is Patents and Trade Marks, and a perusal of its pages certainly leaves a clear impression on the mind as to what is a proper subject for a patent, how to proceed in getting the patent, and perhaps more important still, how to set about disposing of the patent. Mr. W. H. Taylor, the author, has had nearly thirty years' experience in patent office work, and acts as adviser to a number of important Northern industrial firms. He has placed his knowledge at the disposal of the readers of the book and given in succinct form the necessary information. In dealing with the question as to what may form the subject matter of a patent he quotes extracts from a number of legal decisions to illustrate his various points. The subject is such a wide one that it is not possible to deal seriatim with the various chapters. The author gives it as his opinion that in ordinary cases a total fee of £3 3s. should be sufficient to cover all charges for a provisional specification, and a further charge of £9 or £10 for the work and charges necessary on completing the patent. As is well known, there are no further fees till the end of the fourth year, when £5 is payable. A year later £6 is due, and so on to the end of the thirteenth year, when £14 is charged, the total renewal Government fees—exclusive of those paid on completing the patent—being £95.

There is much valuable advice on the way in which a specification should be drafted, and how it ought to be construed.

Sections of the book deal with the amendment of patents, their restoration, the reissue of duplicate letters patent in the event of the originals being lost, the procedure followed by the War Office and Admiralty for the issue of secret patents, the question of licences, patent registers, revocation of patent by Comptroller and infringement of patents. In each case much useful information is given in such clear language that the average reader can form a tolerably safe opinion as to when it is advisable for him to obtain expert advice.

The section dealing with "How to Market an Invention" contains a good deal of advice as to what to do, and much more on what not to do, this latter part being probably the most valuable.

An interesting account of the development of the Patent Office is given; there are full details as to the places in the country where Patent Office papers can be examined, and a list of patent publications.

This is followed by particulars as to foreign patents, how to set to work to get them, what they cost, and the conditions under which they are issued. In view of the war and the consequent chaotic condition of the European political and commercial relations, this part of the book is naturally more historical than applicable to present-day conditions.

The book contains 739 pages, and should be consulted by anyone in doubt as to how to proceed in procuring or dealing with patents. It is the pioneer year book relating to patents, and we have no doubt that as successive editions are issued, it will consolidate its position as the standard text-book on patent office work.

MARBLE AS MATERIAL FOR LAMP GLOBES.

It is well-known that thin sheets of marble are transparent, and, if suitably selected, of rare beauty. For window and other transparencies, Dr. A. Pfaff has mounted sheets of marble 0·1 to 0·5 mm. in thickness and up to 90 × 50 cm. in area between supporting sheets of glass, but the cost of production by this system is prohibitive. The practical application of marble, as a substitute for opal glass in the manufacture of diffusing globes for lamps, dates from the discovery, by H. W. Engel, of special grinding and impregnating processes whereby marble sheets from 3 to 20 mm. ($\frac{1}{8}$ to $\frac{1}{18}$ in.) in thickness may be made more translucent than the thicknesses of opal glass generally employed. After grinding on both sides, the marble is impregnated with various oils under high pressure and at high temperature; glass supporting sheets are no longer required, and the colour effects are much richer in the thicker sheets. The new material appears to be applicable to lighting fittings for all purposes, and particularly for decorative, advertising and electric sign work. The optical properties of white Engel-marble are described in detail by W. Voege in a recent issue of the *Electrotechnische Zeitschrift*, with special reference to its diffusing properties and its transparency to visible, ultra-violet and infra-red rays.

Comparisons were made between two 3·5-mm. marble plates (brightly polished in front but matt on the back surface); opal glass plates 1·8 mm. thick, matt on both sides and 3 mm. thick, polished on both sides; a 3-mm. frosted glass plate, and a 5-mm. clear sheet ribbed on one side. The marble and opal glasses did not, but the frosted glass did permit an incandescent filament to be distinguished through it. Taking the transparency of the marble as 100, figures for the other sheets were found to be: Thin opal, 81; thick opal, 56; frosted glass, 300. When similarly illuminated and viewed side by side, the marble had a reddish-violet and the opal glass a greenish tinge by transmitted light, owing to the comparatively small amount of yellow-green and large amount of red and (particularly) blue transmitted by the marble. A marble front to a funnel-shaped reflector absorbed only about 20 per cent. of the light emitted by a lamp therein, whereas an opal glass cover absorbed about 40 per cent. The high transparency of frosted glass is obtained at the cost of poor diffusing power, but photometric tests show that this is not the case where marble is employed. The polar curve of light distribution from a point is at least as close an approximation to a circle when marble as when opal glass is used. The importance of the grinding and impregnating processes to which the marble is subjected, is shown by Table I, the figures in which refer to the lux transmitted through

TABLE I.

	Opal glass.	Dry marble ground on		Impregnated marble ground on	
		One side.	Both sides.	One side.	Both sides.
	Lux.	Lux.	Lux.	Lux.	Lux.
At centre of plate ...	11·0	17·4	20·7	25·0	28·0
4 cm. from centre ...	8·7	14·0	19·4	24·0	27·0
8 cm. " ...	6·2	9·2	12·0	16·0	18·8
12 cm. " ...	3·5	5·5	7·5	11·8	13·0
16 cm. " ...	1·7	3·2	4·1	8·5	9·7

6 sq. cm. areas at various distances from the centre of a test plate illuminated by a 25-c.p. tantalum lamp placed 10 cm. behind the latter. In uniformity of transmitted illumination, the marble far excels the opal glass. Candle-power measurements made at a distance of 2·4 m. from the same 40 × 40 cm. sheets, gave the following percentage results: Bare lamp, 100 per cent.; opal glass interposed, 17 per cent.; marble, ground on one side, dry, 23·5 per cent., impregnated 35·5 per cent.; marble, ground both sides, dry 29 per cent., impregnated, 39·4 per cent.

Measurements of illumination at 1·2 m. above floor level in a 5·4 × 7 m. laboratory, showed the following average consumption per lux per sq. m.; (the bracketed data refer to the minimum, maximum and mean illuminations): (1) Using three central clear 25 c.p. tungsten lamps and six frosted wall-bracket tungsten lamps (25 c.p. each)—0·31 watt per lux per sq. m.; (6, 70, 25·6 lux). (2) Using 400 c.p. Osram fitting with opal glass plates—0·43 watt per lux per sq. m. (10, 36, 20 lux). (3) Same as (2) but with marble plates in fitting—0·34 watt per lux (11, 55, 27·7 lux). The uniformity and efficiency of illumination in case (4) is remarkable; ceiling reflection did much to disguise in the above data the real superiority of the marble fitting as regards diffusing power.

Measurements of ultra-violet radiation received from a quartz mercury lamp directly and through marble and opal glass sheets in turn showed no important difference between the transparency

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for visible and ultra-violet light, and hence afforded no explanation in this direction for the favourable characteristics of marble. On measuring the total radiation from a carbon-filament lamp, it was found that opal glass, though less transparent than marble to visible rays, was from 33⅓ to 6½ times as transparent as marble to total radiation. In other words, marble is relatively opaque to heat radiations (which are absent from diffused daylight, and if not injurious, are at least unnecessary to vision). Eye fatigue under artificial illumination is chiefly due to the reception of heat rays. Vogt has shown that the shorter infra-red rays do penetrate to the retina; indeed, radiations reaching the retina from a carbon-filament lamp are four-fifths dark and only one-fifth visible.

TABLE II. (Illumination by 32-C.P. Carbon Lamp throughout).

—	Photometer illumination. Lux.	Relative transparency to light.	Deflection of radiation meter.	Relative transparency to heat.	Relative energy transmitted for given light transmission.
Bare lamp	620	100	224°	100	100 (assumed)
Through—					
3 mm. dry marble ...	225	41	11·5°	5·1	12·4
3 mm. impregn'd marble	130	21	11·0°	4·9	23·3
0·5 mm. red-grey mica ...	200	33	151°	67·5	208
3 mm. ground glass ...	470	76	91°	40·6	53·4
2 mm. clear glass ...	570	92	179°	80	87
0·3 mm. ebonite	Nil	0	116°	51·7	—
White paper	170	27·5	10·8°	4·8	17·5
Ditto, oiled	340	55	37·5°	16·7	30·4
3 mm. dense opal glass...	155	25	38·2°	16·6	68

Semi-indirect lighting using marble fittings would appear to be perfectly safe and relatively efficient. Transparencies of various materials to luminous and thermal radiations are compared in Table II, which is well worth careful study. As regards minimum total energy transmitted for given light radiation, marble prepared according to the Engel process is the best material examined which can be used for lamp globes. It transmits maximum light and minimum heat, and can therefore be used with lamps of high candle-power without transmitting injurious heat rays. Thermal equilibrium is maintained by low-temperature radiations which cannot reach the retina.

BUSINESS NOTES.

Bankruptcy Proceedings.—Herbert James Godfrey, 23, Lucien Road, Tooting, London, late 188, Balham High Road, London, electrical engineer.—The first meeting of creditors herein was held at 132, York Road, Westminster Bridge Road, S.E., on September 15th, when the statement of affairs showed liabilities amounting to £582, to meet which there are net assets of £167, the estate disclosing a deficiency of £415. It appeared that the debtor started trading in 1899, at Defoe Road, Tooting, with a borrowed capital of £10. Debtor had since repaid that sum. About 1901 the debtor removed to 188, High Road, Balham, owing to the growth of his business, and he had since that time continued to trade there. He brought an action in October, 1913, to recover a book debt of £89. The action was defended by the book debtor, who paid £36 into Court, and set up a counterclaim of £90. Judgment was given in debtor's favour for £36 on the claim, and for the book debtor of £53 and costs on the counterclaim. The Sheriff levied execution on August 31st, 1914, on debtor's effects at the suit of the book debtor, and he thereupon filed his petition. Debtor sold the freehold premises, 23, Lucien Road, in December last, for £520. After payment of an existing mortgage and costs, a balance of about £80 remained, which was utilised in the payment of pressing creditors' claims. Debtor had kept a cash book, copy, invoice, and estimate book, work book, day-book and wages sheets. Debtor stated that he first became aware of his financial difficulties in July last. The case was a summary one, and was left with the Official Receiver. The following are creditors :—

Aland & Co.	£17	Godfrey, G. T.	£25
Crathorne & Green Mg. Co. ..	21	Rowe, A. F.	22
Crypto Electrical Co.	13	Siemens Bros. & Co.	18
Cox, R.	138	Sun Electrical Co.	51
Edison & Swan Co.	42	Sloan Electrical Co.	12
Elvared & Co.	29	Veritys, Ltd.	44
Falk, Stadelmann & Co. ..	23		

Permanent Magnets.—Noticing an inquiry for British-made permanent magnets in a recent issue, the High Tension Co., of 62, Belvedere Road, S.E., inform us that for some time they have been using for their "Mira" car-lighting dynamos permanent magnets made by Messrs. Swift, Levick & Sons, Clarence Works, Sheffield, and have found them quite as satisfactory as the German and French magnets that they had previously used.

Point Controllers.—Messrs. Quilliam Bros. write that their Collins patent automatic point controllers are manufactured in Salford. The Liverpool Corporation Tramways alone has ordered 50 machines since the beginning of the year.

Private Arrangements.—Bristow Bros., electrical engineers, 46, Hans Crescent, London, S.W.—The creditors interested herein were called together recently, at the offices of Mr. Chas. E. Carr, 17, Harp Lane, Tower Street, E.C., when it was reported that the liabilities amounted to £540, while the assets consisted of book debts valued at £165, and stock in trade estimated to produce £40, or a total of £205. It was reported that the business was carried on by two brothers, who started trading a few years ago, with a sum of £65, which was advanced by their mother. In consequence of the moratorium, the debtors had been unable to get in their book debts. Further, one of the debtors had joined the Army, and as the other was about to do the same it was thought desirable to call the creditors together. It was decided that the estate should be wound up under a deed of assignment. A Committee of the principal creditors was appointed. The principal creditors are :—

Coleman & Turner	£158
Foster Engineering Co.	76
Siemens Bros. Dynamo Works	83
Crypto Electrical Co.	48
Baxter & Caunter	84

Australian Tariff Matters.—The *Melbourne Age* in a report on the proceedings at Sydney early in August, before the Inter-State Commission, says that the managing director of the British General Electric Co., Ltd., Mr. Edward Hirst, applied for a 10 per cent. British preference on various telephone and electrical fittings.

Mr. A. D. Stevenson, chief engineer and director of the British General Electric Co., Ltd., gave evidence in support of the application. He said the company had extensive works in England, in which British capital had been invested. Items affected by the application were telephone appliances and switchboards.

The Chairman: Do you ask that the foreign duty should be raised or the British duty lowered?—Witness: I think the former would have to be done. Personally, I would be satisfied with 5 per cent. I ask for preference on British telephones and electric starting and controlling apparatus.

Mr. Lockyer: You already have the bulk of the trade?—No, I do not think so.

Mr. Lockyer pointed out that in 1912 the imports were:—United Kingdom, £58,300; Belgium, £18,000; Sweden, £44,000; and the United States, £30,000.

The chairman said that last year these figures had been altered. The importations from the United Kingdom were £46,000; from the United States, £47,000; while those from Sweden had also increased. It was for the witness to indicate why he would not compete with the United States, where higher wages were paid.—Witness said the claim was made for preference on those lines where the tariff at present did not give it.

The Chairman: Are you able to get a fair share of the trade? Have your imports fallen away? How have you fared during the four years of your establishment here?—We have naturally gone ahead, but we find ourselves in competition with foreign manufacturers.

Mr. F. W. Mattes, telephone engineer for the British General Electric Co., and representative of Peel-Conner Telephone Works, Ltd., said that under existing conditions Swedish and American competition was particularly strong in such goods as small switchboards and magneto telephones.

Bastian Heaters.—The Bastian Electric Heating Syndicate, Ltd., of 185, Wardour Street, London, W., state that they are prepared to accept orders for their "A" type heater (code word "Cabin") loaded up to 2 kw. As at present constructed the heater is fitted with six Vitrolite glowers of 333 watts capacity each, and a switch is provided to reduce the rate of consumption to 1·3 kw. In this construction the "Tabasco" resistance wire is wound as a perfectly close spiral around the exterior surface of a quartz tube, the convolutions being prevented from short-circuiting one another by the oxide on the wire itself. This construction has many advantages, in addition to that of cheapness, to which special attention is drawn as the most interesting feature. At the present time the syndicate are more busy than they have ever been before at this season of the year, owing to large orders on hand for heating apparatus for H.M. warships, and there is every indication that they are to have a busy winter.

Catalogues & Lists.—Messrs. Crompton & Co., Ltd., Salisbury House, London Wall, London, E.C.—32-page catalogue consisting of a collection of illustrated lists very fully describing and stating prices, dimensions, and other particulars of a wide range of electric heating and cooking apparatus. The range includes restaurant type grillers and toasters, counter apparatus, hot cupboards, fryers, grill-room suites, household and dining table apparatus, cooking ranges, hot-water circulators, convector heaters, electric fires, &c.

The Edison & Swan United Electric Light Co., Ltd., have issued some large poster cards emphasising the fact, for the education of the public, that their drawn-wire lamps are in every respect British.

Messrs. Adnil Electric Co., Ltd., Artillery Lane, London, E.C.—Small booklet, No. 61, describing the "Century" single-phase motors.

St. Helens Cable and Rubber Co., Ltd., Warrington.—An advertising leaflet dealing with cab-tire sheathed cable for portable lamp flexibles, &c. This is quite a new and unique departure, being printed in colours in close imitation of an old illuminated manuscript, and has a very striking appearance. It informs us, *inter alia*, that C.T.S. wire is used for wiring in the worst situations, such as breweries, acid factories, and the Houses of Parliament.

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Liquidations and Dissolutions.—Stolz Electrophone Co. (1913), Ltd., 85, Fleet Street, E.C.—Under the compulsory winding-up order made against this company last February, upon a creditor's petition, the report of Mr. H. E. Burgess, Official Receiver and Liquidator, has been issued to the creditors and shareholders. The accounts filed under the liquidation show liabilities £9,735, against assets valued at £1,387, and a deficiency of £68,348 as regards contributories. In the course of a detailed report on the company's affairs, it is stated that the business of the company appears to have suffered through neglect and want of organisation and too liberal terms being granted to agents. These considerations, and the fact that the company never had sufficient working capital, were the main causes of its failure.

The Ridings Arc Lamp Co., Ltd.—A meeting of creditors will be held at the North-Western Hotel, Lime Street, Liverpool, on October 19th, to hear an account of the winding up from the liquidator, Mr. F. Rawlinson.

The Consolidated Diesel Engine Manufacturers, Ltd., Aldwych, W.C.—First meeting of creditors and contributories, October 8th, at Bankruptcy Buildings, Carey Street, W.C.

Book Notices.—"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIII, No. 9. New York: The Institute. Price $1.

"Text-book on Wireless Telegraphy." By R. Stanley. London: Longmans, Green & Co. Price 7s. 6d. net.

Circular of the Bureau of Standards No. 49, entitled "Safety Rules to be observed in the operation and maintenance of electrical equipment and lines." Issued August 1st, 1914. Washington, U.S.A.: Government Printing Office.

Cab Tire Sheathing.—In view of the resistance to corrosion, moisture and hardware manifested by the rubber compound used for cab-tire sheathed cable by the St. Helens Cable and Rubber Co., Ltd., the company are now supplying to Admiralty contractors other materials, such as sheet, tubing, &c., which were formerly made of ordinary rubber.

LIGHTING and POWER NOTES.

Aberdeen.—Year's Working.—The annual report of Mr. Bell on the Corporation electricity undertaking shows a total revenue of £60,353, an increase of £4,254 on the year before. The total working expenses, £29,036, were a decrease of £111 on the year before, this being traceable to the economy resulting from the use of a new 3,000-kw. turbine plant. A total of 9,700,000 units were sold, or about 500,000 in excess of the previous year, but 1,689 less tons of coal were used—4·1 lb. as compared with 4·74 lb. per unit—and thus despite an increase in price of coal of 1s. 4d. per ton, a saving was made on working expenses. The consumers now number 3,190; the motors connected total over 8,400 h.p., and 961 heating and cooking and similar devices are now out on hire. The gross profit, placed to reserve amounted to £4,960, the reserve fund amounting to over £26,000.

Aldershot.—Mains Extension.—The U.D.C. has decided to supply current to the new premises of the Aldershot and District Traction Co., Ltd., Halincote Road.

Ascot.—Plant Extensions.—A 400-h.p. gas engine is being installed at the Ascot District Gas and Electricity Company's works in place of a 90-h.p. suction gas engine set.

Australia.—Melbourne.—For some years a conflict has existed between the town clerk and the city electrical engineer, the former claiming the right to supervise and exercise authority over matters brought forward by the engineer. The City Council has been divided in opinion on the question. The engineer recently suggested that the price of energy for power should be reduced, and the town clerk opposed the reduction on the ground that it would result in a loss to the electricity undertaking. The matter was referred by the Council to Mr. Forbes M'Kay, city electrical engineer of Sydney, and an accountant, who are reported to have decided in favour of Mr. Harper, the city electrical engineer.

The Council has allocated a sum of £128,000 to the Electric Supply Committee, which will be used to replace moneys expended out of the depreciation account.

The Brunswick, Vic., Municipal Council has decided to borrow £10,000 for extension of the lighting and power scheme throughout the municipality. It is contemplated to light the whole of the streets electrically.

Ayr.—Annual Report.—There is a credit balance of £1,450 in the T.C. electricity department, and which has been placed to the reserve fund, which now amounts to £5,134.

Belfast.—The Sub-committee appointed to report on the electricity undertaking stated that it had considered, and recommended, the reports of Sir John Snell and Mr. Pratten, the consulting experts, in respect of the erection of a new station on a site to be obtained in Hamilton Road from the Harbour Commissioners. The Committee endorsed the reports for recommendation to the Corporation.

Banchory.—Lighting Scheme.—The T.C. is to ascertain what support it is likely to get from residents before proceeding further with the lighting scheme.

Blackpool.—Sea Front Illuminations.—Last week an order was issued by Col. Aspinall Turner, the officer commanding the troops in Barrow and district, restricting lights in exposed places within a 50 miles radius. A deputation from Blackpool interviewed the Colonel with reference to the possible effect upon the autumn illuminations, and was informed that the order did not affect the Blackpool scheme which will be carried out as arranged.

Broadstairs.—E.L. Scheme.—The U.D.C. has decided to return to the Isle of Thanet E.L. Co., £1,000 deposit under the terms of the order, cables having been laid in practically all the roads set out in the schedule.

Bury.—Power Station Extensions.—The Electricity Committee has instructed the borough engineer to complete plans for a three-bay extension to the electricity works at Chamber Hall.

The Committee has also agreed to subscribe to the Electrical Vehicle Committee of the I.M.E.A. for the purpose of propaganda work.

Bushey.—The U.D.C. has sealed a supplemental agreement with the Watford U.D.C. for the supply of current to the district.

Cleethorpes.—L.G.B. Inquiry.—An inquiry was held last week into an application of the U.D.C. to borrow £10,000 for mains extensions.

Clonakilty.—E.L. Scheme.—A company has been formed in connection with a scheme for lighting the town with electricity, and the work of installation has been commenced by the Ampere Electric Lighting Co.

Clones.—E.L. Scheme Completed.—The inauguration of the electric supply took place recently at the power house of the Clones Electric Light and Power Co., Ltd. The entire installation was designed and carried out by Mr. J. Woods, late of Bantry, Co. Cork, engineer and manager to the company.

Edinburgh.—E.L. Surplus.—The Electricity Committee has recommended that the whole of the last year's surplus profit, a sum of over £3,000, be applied to the relief of the rates.

Flint.—E.L. Scheme.—A special meeting of the T.C. is to be held to further consider the electric lighting proposals which have been laid before it.

Gildersome.—Prov. Order.—The U.D.C. has decided to support the Yorkshire Electric Power Co.'s application for lighting powers in the district.

Harrogate.—E.L. Powers Refused.—The T.C. has been informed that the B. of T. has refused the Corporation's application for permission to supply electricity to premises in the rural district of Knaresborough, outside the authorised area of supply, on the ground that the Council is developing a general supply outside the area. The borough electrical engineer was authorised to have certain repairs carried out to the Parsons turbo-generator, at a cost of £310.

Helsby.—Loan Sanction.—The L.G.B. has sanctioned a loan of £515 for electric power at the sewage works.

Hornsey.—Loans.—The Council are making application for power to borrow £4,000 required for house services.

Keighley.—At a meeting of the T.C. last week when it was reported that the sale of gas for the year ended June 30th last showed a decrease of nearly 6 million cb. ft., as compared with the previous year, the chairman of the Gas Committee strongly protested against the practice of selling electricity for lighting purposes in mills, &c., at power rates, stating that the loss on the gas undertaking was chiefly attributable to that practice. The chairman of the Electricity Committee considered that the statements made constituted a splendid compliment to the electricity department, which did not charge customers more than the value given, and then give the profit back to those who did not take electricity, in rate relief.

Lees.—Proposed E.L.—The U.D.C. has decided to approach the Springhead Council in connection with a supply of electrical energy in the district.

Littleborough.—Bulk Supply.—A deputation from the D.C. waited on the Rochdale Gas and Electricity Committee, asking for a revision of the agreement for the supply of electricity in bulk to Littleborough. The Rochdale Committee, whilst unable to reduce the price, agreed to a 10, instead of a 15 years' agreement, and to revise the minimum guarantee as regards quantity.

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London.—Woolwich.—Last week a special meeting of the B.C. agreed to the L.C.C. being asked to sanction a loan of £10,000 for a 3,000-kw. turbo-alternator to meet the unexpected increase in demand for electricity by the military and Port authorities, &c.

Lewisham.—The Libraries Committee of the B.C. is considering the question of improving the lighting at the Brockley Library, which is at present carried out by gas. Local firms have been invited to tender for installing electric light, and the Committee is in communication with the Electric Light Co. as to the terms upon which it is willing to supply current.

Midhurst. — Overhead Wires. — The R.D.C. has decided to agree to the proposals of the Midhurst E.L. Co. for using overhead wires for E.L. purposes in the district, provided underground cables are laid in the town of Midhurst itself.

Mytholmroyd.—The U.D.C. has requested the Yorkshire E.P. Co. to send a representative to explain the scheme for supplying current for power and lighting at a cheap rate.

Nuneaton.—Several firms have applied to the T.C. for the release of retention money on contracts in connection with the electricity works, and as the sums are due for payment in a few weeks, the Council has decided not to entertain the applications.

Oban.—Street Lighting.—The engineer has been instructed to proceed with the conversion to electricity of a further section of street lighting; the Council intends to convert all the gas lamps in the burgh.

Rawtenstall.—At a meeting of the T.C., it was stated that the electric lighting of the Crawshawbooth district, which had been delayed by the recent bad weather, would be completed in a week's time.

Ross (Herefordshire). — Street Lighting. — The U.D.C. has decided to invite the gas and electric light companies to tender for the lighting and maintenance of the street lamps for a period of three years.

Sierra Leone.—Freetown.—An extraordinary meeting of the City Council was held on 19th ult., to consider the Colonial Secretary's letter of August 11th, informing the Council that Mr. Baron asks leave, under Clause 26 of the Electric Lighting Concession, to assign absolutely all interest in the contract to a new company. After the discussion the permission sought for was granted by a majority of votes.

Skipton. — Power Co.'s Bill. — The U.D.C. has elected a Committee to discuss with the company the proposed E.L. Bill.

TRAMWAY and RAILWAY NOTES.

Ayr.—Tramway Expenditure.—At a meeting of the T.C. it was stated that the cost of the tramway extension to Hawkhill had been £18,000. The income for the year was £860, and expenditure, exclusive of operating expenses, amounting to £1,572, had been incurred.

Australia.—The consulting engineer of the Brunswick-Coburg (Vic.) Tramways Trust has submitted his report on the construction of the line, the cost of which will be £134,610. It is anticipated that tenders for most of the work will be called for this year. A committee, consisting of members of the Melbourne City Council, the Trust, and the Brunswick and Coburg Councils, is considering the report. The Melbourne City Council is recommended by its representatives to join the Trust, and enable the line to connect Brunswick with the city to be constructed.

Belfast.—The revenue of the tramways for the five months ended August 31st shows a balance, after allowing for all fixed charges, of £13,651. The electrical engineer reported on tenders for the supply of an electric motor tower wagon, and that of the Edison Accumulators, Ltd., was recommended to the Council for acceptance.

Edinburgh.—A special meeting of the T.C. Tramway Committee is to consider the whole question of tramways with regard to the taking over and working of the existing lines by the Corporation, additional routes, extensions and methods of traction.

London.—A breakdown occurred on the City and South London tube line at London Bridge on Monday. Four stations between Old Street and Elephant and Castle were closed for an hour.

Norwich.—Track Renewal.—The Tramway Co. has decided to continue the work of renewing the tramway track from the foot of the Guildhall Hill to St. Giles Gate. The work was commenced on Monday last from the Guildhall end of the section, and is helping to relieve the labour situation to some extent.

U.S.A.—Electric Vehicle.—A proposal is at present under consideration to organise a National Electric Vehicle Day to be observed all over the country, by parades of electrically-propelled vehicles. It is considered that the public would thereby get an idea of the extent to which electric vehicles are now used for both pleasure and business purposes, and that the movement would consequently receive a further impetus.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The automatic telephone system is proving very popular in Australia, and orders for nine exchanges, aggregating 15,000 lines, are now being executed by the Automatic Telephones, Australasia, Ltd., in addition to those already equipped.

Bolton.—The Postmaster-General states that work is now in progress in connection with the provision of a new telephone cable between Bolton and Manchester, and that it will probably be completed about the end of the year. It is hoped to place the Bolton-Manchester trunk service on the "immediate connection" system next year.

Cable Tariffs.—The use of codes being prohibited at present, the P.M.G. has arranged with the Eastern telegraph companies as a temporary measure that the text of full-rate extra-European messages in plain language shall be counted and charged for as if written in groups of 10 letters to one word. It is hoped that this arrangement will be extended to other cable systems. Complaints are made that the concession is inadequate, and further relief is called for.

United States.—The wireless station at Tuckerton has completely broken down as the result of an accident, and as the broken parts can only be repaired in Germany, and the German-American trans-Atlantic cable has been cut, the representatives of Germany in the U.S.A. have now no means of communication in cipher with Berlin.

Wireless Amateurs Charged.—At Dublin Police Court, A. E. Archer was recently charged with having established and used a wireless installation at his father's house, in defiance of a warning from the Post Office. The apparatus was removed, but the defendant was discharged, the military authorities being satisfied that there was no guilty intention on his part.

A court-martial was held on Saturday last on W. Sharpe, of Thorne, who was in possession of wireless receiving apparatus, and stated that he had not seen the order prohibiting its use; the defendant was found not guilty and discharged.

Wireless Operators for the Navy.—On Friday last the Admiralty announced that no further wireless telegraph operators in the Royal Naval Reserve were required for the present.

Wireless Station Captured.—The German wireless station on the Island of Nauru (Pleasant Island) has been captured by an Australian force, and now, it is stated, the enemy have no wireless stations in the Pacific.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. — Melbourne. — October 12th. Three-phase motors for workshop machinery, for Melbourne Suburban Railways. See "Official Notices" September 4th.

November 25th. Victorian Railways. 25 battery signal machines for operating signals. Contract 27,479. Contractors' Room, Railway Offices, Spencer Street.

Adelaide. — October 28th. Telephones and flexiphones, telephone instruments and parts, for the Postmaster-General. See "Official Notices" September 18th.

November 4th. Telephone instruments and parts, for Postmaster-General. See "Official Notices" to-day.

Perth. — November 18th. P.M.G.'s Dept. 249 accumulators with assorted apparatus, for telegraph office, Norseman.—*Tenders.*

Brisbane. — December 15th. Switchboard, common battery, automatic or semi-automatic, for the Postmaster-General. See "Official Notices" to-day.

Birkenhead.—September 26th. E.L. plant, gas suction plant with dynamo and additional battery, &c., for the Clatterbridge Infectious Diseases Hospital, for the Wirral Joint Hospital Board. Mr. J. E. S. Ollive, Clerk, 54, Hamilton Street, Birkenhead.

Bolton.—September 28th. Telephone installation, Townley's Hospitals, Farnworth, for the B. of G. Mr. John Ward, Architect, 24, Mawdsley Street, Bolton.

Bury (Lancs.).—Three-bay extension at the electricity works, for the T.C. Borough Engineer.

Colwyn Bay.—October 20th. Turbo-alternators and jet condensing plant; water-tube boilers, chain-grate stokers, feed pumps, &c.; switchgear for power station and sub-station; cooling tower; travelling crane; power station cabling and wiring; underground cables; rotaries and transformers, for the U.D.C. See "Official Notices" to-day.

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Heywood.—October 17th. Corporation. Converting plant, A.C. and D.C. switchgear and cables, battery booster, E.H.T. overhead line, E.H.T. switchgear for sub-station. See "Official Notices" to-day.

Hornsey.—October 9th. Two rotary or motor converter sets, &c., for the T.C. See "Official Notices" September 18th.

Littleborough.—October 12th. U.D.C. (1) Removal of transformer kiosk and gear and connection of mains to new sub-station; provision of additional cables, road work, &c. (2) Transformers, equipment and switchgear, for new sub-station. See "Official Notices" to-day.

London.—L.C.C.—September 28th. Installation, 215 wiring points, 285 lighting points, at Gifford Street Elementary School, Caledonian Road, N. See "Official Notices" September 18th.

October 8th. Installation, 320 wiring points, 420 lights, at Vallance Road Schools, Mile End, E. See "Official Notices" to-day.

Manchester.—October 6th. Supply of a car-wheel tire boring mill. Specifications, Mr. J. M. McElroy, General Manager.

October 6th.—The Tramways Committee is inviting tenders for scrap materials, comprising miscellaneous copper, gun-metal and brass, &c.

Rochdale.—October 7th. Steam coal for Dane Street electric power station. Mr. C. C. Atchison, Engineer and Manager.

South Africa.—JOHANNESBURG.—October 9th. Ten single-truck double-decked electric tramcars, for Municipal Council. Specifications, &c., may be seen at Commercial Intelligence Branch of Board of Trade.

Spain.—Tenders have just been invited by the municipal authorities of Almaguer (Province of Toledo) for the concession for the electric lighting of the town during a period of six years.

October 28th. Municipal authorities of Salamanca invite tenders for the concession for the electric lighting of the town.

Swansea.—October 5th. Corporation. Lighting installation at Police Station. See "Official Notices" to-day.

Walsall.—September 29th. Corporation. Extra H.T. switchgear, static transformers, L.T. switchgear. See "Official Notices" September 11th.

Warrington.—September 29th. H.T. cable for the Electricity Department. See "Official Notices" September 18th.

Whitby.—September 30th. U.D.C. Construction of cliff tramway or lift. Particulars from the Clerk to the Council.

Whitefield.—September 28th. Electric motors, centrifugal pumps, sewage ejector, sewage disposal works. Specifications, &c., one guinea. Mr. G. M. Denton, Engineer and Surveyor, Council Offices, Whitefield.

Wigan.—September 29th. The E.L. Committee invites tenders for cast and steel scrap. Town Clerk.

CLOSED.

Attercliffe.—H.M. Government has placed the contract for the electrical installation at the new Labour Exchange at Attercliffe with the Sheffield branch of the Mechanical and Electrical Engineering Co., of Walsall.

Government Contracts.—The following tenders have been accepted during the past month by the Government departments named:—

H.M. OFFICE OF WORKS.

Electric wiring.—Marlborough House. Trollope & Colls, Ltd.

POST OFFICE.

Protective apparatus.—Western Electric Co., Ltd.
Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.; Western Electric Co., Ltd.
Silence cabinets.—Matthew, Hunter & Sons.
Submarine cable.—Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Telephone cable.—Connolly Bros., Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works, Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. and Co., Ltd.; Telegraph Construction & Maintenance Co., Ltd.; Western Electric Co., Ltd.
Stoneware ducts.—Albion Clay Co., Ltd.
Telegraph paper.—Waterlow & Sons, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; B.I. and Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., inc. in the London Electric Wire Co., and Smiths, Ltd.
Copper wire.—F. Smith & Co., inc. in the London Electric Wire Co.
Automatic telephone exchange equipment, Blackburn.—Automatic Telephone Manufacturing Co., Ltd.
Telephone exchange equipment, Admiralty.—Siemens Bros. & Co., Ltd.
Telephone exchange equipment, Wilmslow.—Peel-Conner Telephone Works, Ltd.
Telephone exchange equipment (extension), Walthamstow.—Western Electric Co., Ltd.
Laying lines of self-aligning ducts at York.—A. Schofield.

INDIA OFFICE, STORE DEPARTMENT.

Engines.—Lancashire Dynamo and Motor Co., Ltd.
Sounders.—Automatic Telephone Manufacturing Co., Ltd.
Switchboards.—Peel-Conner Telephone Works.

CROWN AGENTS FOR THE COLONIES.

Train lighting dynamos.—Mather & Platt, Ltd.
Electrical apparatus.—Electric Construction Co., Ltd.
"Lux" cells.—Chloride Electrical Storage Co., Ltd.
Tel graph material.—Bullers, Ltd.
Telegraph poles and line material.—Siemens Bros. & Co., Ltd.
Tramway spares.—R. Hudson & Co.
Bronze wire.—F. Smith & Co., Ltd.

Harrogate.—The T.C. has accepted the tender of Messrs. C. A. Parsons & Co. for alterations, &c., to the turbo-electric generator, at £310.

High Wycombe.—The T.C. has received the following tenders for the refuse destructor, with water softener:—

Goodrich & Hamblyn	(accepted) £1,997
Meldrums, Ltd.	£1,806, 2,561, and 2,436
Manlove, Alliott & Co., Ltd.	4,795
Hughes & Stirling	3,466
Heenan & Froude	3,840
New Destructor Co.	2,699

Belfast.—An important contract has been placed with the General Electric Co., Ltd., Belfast, by the York Road branch of the York Street Flax Spinning Co. for an electrical plant for the individual driving of spinning frames. This is one of the first installations of its kind in Ireland. The entire equipment will be manufactured at the G.E.C. Witton works.

London.—WANDSWORTH.—The Guardians are recommended to accept the tender of the Western Electric Co., Ltd., at £85 10s., for the provision of an additional internal telephone exchange at the St. James' Infirmary.

HAMMERSMITH.—The B.C.'s Electricity Committee has accepted the offer of the British Electric Transformer Co., Ltd., to supply one 150-KW. transformer, for £118.

H.M. Office of Works has just placed a contract with Messrs. J. H. Tucker & Co., for the supply during the next three years of the following tumbler switches: S.P., 5 amp.; S.P., 10 amp.; D.P., 5 amp.; D.P., 10 amp.; S.P., 5 amp., two-way, all of the firm's well-known No. 20 positive action pattern. The switches are to be mounted on either white or black china bases, with fluted or plain brass covers lined.

Norwich.—The T.C. has accepted the tender of Messrs. J. Anderson & Sons, at £423, for the erection of an electric light sub-station at Northcote Road.

Swinton.—The D.C. has accepted the tender of the Lancashire Electric Power Co., for providing and fixing the necessary equipment for the electric lighting of Bolton Road, Manchester Road, Chorley Road and Station Road, for £1,800.

Walthamstow.—The following tenders are recommended to the U.D.C. for acceptance:—

Walter Scott, Ltd.—Steel rails (Sandberg), fish-plates, &c.
Edgar Allen & Co., Ltd.—Castings.
Bayliss, Jones & Bayliss.—Fish-bolts, rivets and tie-bars.
Watlington & Co., Ltd.—Copper bonds.

Whitby.—The Guardians have accepted the tender of Messrs. Manlove, Alliott & Co., Ltd., for the refitting of the laundry with an electric power installation for £404.

FORTHCOMING EVENT.

Salford Technical and Engineering Association.—Saturday, October 3rd Visit to Textile Department, Royal Technical Institute, Salford.

NOTES.

The B.E.A.M.A. and the State of War.—Our contemporary, *Electrical Engineering*, states that the ELECTRICAL REVIEW was requested by the B.E.A.M.A. not to publish the "State of War" resolutions. This is a gross misstatement. No such request was made to us. We have communicated with the secretary who authorises us to state that he is in no way responsible for our contemporary's error, which is probably due to the editor's own imagination.

Ediswan Rifle Range.—The Edison & Swan United Electric Light Co, Ltd., have opened a rifle range at Ponder's End, with ranges of 25, 50 and 75 yards. The club already embraces a large and active membership. It is intended to cover in the range during the winter months.

Electrical Workers at Greenock Torpedo Factory.—In the House of Commons, on Wednesday, Mr. Barnes asked the First Lord of the Admiralty whether he was aware that at the Greenock Torpedo Factory electrical repair work was almost entirely done by naval pensioners at wages considerably below the standard rate for electrical workers, which was 10½d. an hour; and whether, in the event of any vacancies occurring, electrical workers would be employed at the proper rate. Dr. Macnamara promised to inquire into the matter.

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Institution Notes.—Greenock Electrical Society.—The office bearers for the new season include as hon. president, Mr. Archd. Robertson, manager of the Greenock and Port Glasgow Tramways Co.; president, Mr. D. McDougall, of the Corporation electricity department. The secretary, Mr. Jas. Frew, is on active service, so an interim secretary, Mr. W. B. Smith, A.M.I.E.E., of the Electricity Showrooms, Greenock, has been appointed.

The arrangements for October are as follows:—

October 1st. "'Cottonopolis' and its Electricity Supply." By F. H. Whysall, M.I.E.E.

October 8th. Visit to Hunter Place Sub-station, Greenock.

October 15th. "Alternating Currents." By J. H. Parker, A.M.I.E.E.

October 29th. "Manufacture of Electric Cables." By R. A. D. Macalister, A.M.I.E.E.

Press Visit to the Osram Lamp Works.—On Wednesday a number of representatives of the daily and technical Press accepted the invitation of the General Electric Co., Ltd., to inspect the manufacture of Osram lamps at the Brook Green Works, Hammersmith. Every department of the works, which are one of the largest in the world devoted to the manufacture of tungsten lamps, was thrown open to the visitors, who were also afforded the privilege, previously withheld in this country, of witnessing the manufacturing of the tungsten filaments from tungsten in the finely powdered form.

The various processes connected with the manufacture of ordinary tungsten and the new half-watt lamp were explained to the visitors; as was explained in a previous issue, the glassware is obtained from the company's works at Lemington-on-Tyne, and even lamp caps so long imported are being made at Hammersmith—the lamp produced being essentially "all-British." At the conclusion of the inspection the visitors were entertained to luncheon, Mr. Ernest Byng presiding, when the speakers included the Mayor of Hammersmith and Mr. Christopher Wilson, manager of the Osram and Robertson Works.

British Radium.—The *Times* states that the British Radium Corporation has for a considerable time past been manufacturing, under the supervision of Sir William Ramsay, F.R.S., and Mr. Norman Whitehouse, and selling the purest radium bromide obtainable by the medical profession, and has already manufactured and sold radium products exceeding £40,000 in value. All this radium was produced from pitchblende mined in Cornwall, and the corporation has recently completed new works at Elmers End.

Airships over London.—It is reported that the experiments mentioned in our last issue proved satisfactory, and that it was impossible to pick out the buildings in the darkened City. By an Order in Council the Home Secretary has been empowered to order that lights of any description shall be extinguished or obscured.

The Moratorium.—The Treasury has issued an official notice to the effect that the moratorium will not be extended beyond October 4th in relation to bills of exchange (other than cheques or bills on demand), nor in so far as it applies to debts due to and by retail traders in respect of their business as such, and to rent. As regards other debts to which the moratorium applies, there will be an extension to November 4th, on which date the general moratorium is to come to an end as regards all debts.

Inquiries.—British makers of heat-resisting globes, for use on single-enclosure arc lamps, and makers of "Wigan tape," are asked for.

"Nobrac" asks to be put in touch with any firms in this country manufacturing, or capable of manufacturing, grinding, mixing, and pressing machinery suitable for the manufacture of arc lamp carbons.

Electric Searchlights.—In the course of a paper read before the Victorian Institute of Electrical Engineers, by Mr. E. H. W. Westwood, the author described the Parsons, Stoney and Bennett's patent protected mirror, which has been specially designed in order that the light may not be put out of commission due to gun shot, or other accident. Wire netting performs the function of binding together the glass reflector. This mirror, although shot and fractured, passed the Admiralty test for aberration, and was quite serviceable even after receiving two or three shots more. It is claimed that this reflector has advantages over the metal reflector, and higher efficiency with reference to reflection, 97-99 per cent. being obtained, while for metal only 70-75 per cent. was obtained under actual tests. This reflector has also the advantage of suffering no damage due to handling or cleaning.

After explaining the use of prisms or lenses for producing a diverging beam, the author stated that with the object of obviating the necessity of having additional lenses, experiments had been made with a reflector which had vertical sections parabolas and horizontal sections hyperbolas, resulting in rays spread horizontally, the dispersing angle depending upon the shape of the hyperbola. Such a form is used for Suez Canal navigation. The Siemens and Parsons lamps appeared to be most popular through Suez.

Messrs. Parsons had developed this class of reflector specially, and undertook to throw a beam through a narrow loophole, with their flat projected beam, the object of which was to show a very small beam of light to avoid gunfire risk. In these reflectors, one axis is considered for parabolic results, and the other for an ellipse. So accurately are these made that the manufacturers are prepared to guarantee to project the whole rays of light of a 10-ampere arc, reflected from their standard 35½-in. reflector of 16½-in. focus, through a loophole only 3 in. wide. Amongst the practical applications of searchlights on land, the author mentioned their use by fire brigades and for advertising purposes, and stated that a giant searchlight was perched in the lofty fire tower on the tallest skyscraper in Indianapolis. The searchlight is of 18,000 c.p., and the lens 38 in. in diameter. When a burglar alarm is turned in, the huge searchlight is played on the place which has been robbed, and by a series of rapid signals all the patrolmen in the vicinity are put upon the trail at once. The district is entirely surrounded, and it is only with the greatest difficulty that the thief effects an escape. Before the light was installed, the desk sergeant at headquarters could not give the officers news of a robbery until they made their hourly call, which in some cases might mean a delay of 59 minutes.

The I.E.E. and the War.—As mentioned in our issue of September 11th, the three leading engineering institutions are co-operating in raising a force for service with the new armies, and the opportunity afforded by the First Lord of the Admiralty in forming a Royal Naval Division has come at a timely moment. We are informed by the President of the Institution of Electrical Engineers, Mr. W. Duddell, that the Admiralty has invited the three Institutions to assist in obtaining picked men for the Divisional Engineer Units and Signal Company of the Royal Naval Division, which will be raised on the lines of the undermentioned units of the military forces:—

One Divisional Headquarters R.E.
Two Field Companies R.E.
One Signal Company R.E.

The Division is being raised under the Admiralty with a view to its employment in the field, and the engineer units for which recruits are now being asked will be employed on duties similar to those on which Royal Engineer units are employed. Recruiting has been going on briskly, and a camp has been prepared near Martin Mill Station, Kent, to receive the recruits, many of whom are already there; the authorised strength will total some 500 men, with 18 officers, in addition to the commanding Royal Engineer and a medical officer. It is expected that a considerable number of the officers will be selected from among the recruits.

The terms of enlistment will be for the duration of the war, but not in any case exceeding three years. Pay is under consideration, but will not be less than the Army rates, and the conditions of service will be similar to those of the Army. (Information as to Army pay and service can be obtained at any recruiting office.) Applications are invited from members of all classes of the Institutions of Civil, Electrical and Mechanical Engineers, as well as from members of other professional societies, between the ages of 19 and 35, either in person at the Special Recruiting Office, 2, Savoy Hill, Victoria Embankment, London, W.C., or by letter to the secretary of the Institution.

We may add that the whole of the work of recruiting, attesting and dispatching recruits has been undertaken by the staff of the I.E.E., which has also provided the necessary accommodation in the shape of offices, waiting room, and rooms for the medical examination and swearing-in of recruits at its headquarters on the Embankment, which have lately presented a scene of animation very unusual at this time of the year. Although the Institutions have entered the field at a late hour, when, no doubt, many of their members have already enlisted in other branches of the Service, there has been a hearty response to the summons to the Colours. Early application is advisable, as the recruiting office will not long remain open.

The Patent Position of Half-Watt Lamps and Tungsten Lamps.—The following letter was received after our "Correspondence" columns were closed:—

Your issue dated the 11th inst. contained an inquiry from the Electrical Engineering and Equipment Co., Ltd., as to the patent position in regard to half-watt lamps. Following this letter appeared a note from yourselves to the effect that you believed that the principal patents covering the half-watt lamp in this country were owned by the British Thomson-Houston Co., Ltd.

You were correct in your belief. Not only does this company own the British master patents for half-watt lamps, but it also owns the fundamental patents covering the manufacture of drawn-wire tungsten lamps in this country. As you know, the Mazda drawn-wire process had a revolutionary effect on metal-filament lamp manufacture, and was, without question, the greatest advance since the introduction of metal-filament lamps. The drawn-wire process was destined to have a greater effect than anyone imagined. It made possible a strong and durable lamp filament capable of withstanding all service conditions—even the severe conditions of tramcar service and service on battleships. It made possible the shaping of the filament in any desired form to give concentration of the light, as witness, for instance, the perfection of motor-car lighting brought about by the Mazda automobile lamp with its helical point filament of drawn wire. But the greatest development of all is the half-watt lamp, and you yourselves, who have seen these lamps made in our lamp works at Rugby, will testify that without the previous introduction of the drawn-wire process, half-watt lamps would not be available to-day.

F. W. Willcox,
Manager, Lamp and Wiring Supplies Department,
The British Thomson-Houston Co., Ltd.
September 23rd, 1914.

B.E.A.M.A. Council.—At a meeting of the Council of the British Electrical and Allied Manufacturers' Association, held at the offices on the 17th inst., Mr. B. H. Antill, director and manager of Messrs. Siemens Bros. Dynamo Works, Ltd., was elected a member of the Council, vice Mr. C. Koettgen, resigned.

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Special Fire Service.—A Special Fire Service Force for war time has been organised by the British Fire Prevention Committee, with a nucleus of 300 fire surveyors, fire brigade officers, patrol inspectors and firemen. Parties can be dispatched for fire survey, pulling down and dangerous structure work, at short call; a number of fire patrols, comprising skilled patrol men, can be put on either night work or permanent watches, and several complete fire service sections, comprising fire-brigade officers and firemen with equipment complete, can be immediately mobilised to take up regular duty wherever requisitioned by public departments or other authorities requiring assistance in the national interest.

The direction and inspection of units is conducted by a small Headquarters Committee, of which the Earl of Londesborough is chairman. The British Fire Prevention Committee's office staff is conducting the secretarial work, and part of the Committee's testing station is at the disposal of the force as a depôt.

The fire surveyors and principal fire brigade officers are rendering gratuitous service, whilst the inspectors, foremen, firemen, patrolmen and clerks receive a moderate honorarium when on service.

All applications to render personal service, and all inquiries, should be addressed to the Registrar, the British Fire Prevention Committee, 8, Waterloo Place, London, S.W.

The Electro-Harmonic Society.—The twenty-ninth season of the Electro-Harmonic Society opens on Friday, October 9th, with a smoking concert. The following is a list of the events of the season, all of which will take place in the King's Hall, Holborn Restaurant:—

Friday, October 9th.—Smoking concert.
Monday, November 16th.—Ladies' night.
Friday, December 11th.—Smoking concert.
Friday, January 1st, 1915.—Smoking concert.
Monday, February 8th.—Ladies' night.
Friday, March 19th.—Smoking concert.

For the information of those who are not members of the Society, we may say that the entrance fee is 5s., and the annual subscription 10s. 6d. Mr. W. E. Lane, of Finsbury Pavement House, E.C., is hon. secretary.

Legal.—Eclipse Electric Sign Co., Ltd., *v.* Ashton.—The plaintiffs in this action, represented by Mr. Ashton Cross, moved before Mr. Justice Sankey, as Vacation Judge, on Wednesday, September 23rd, for an interim injunction to restrain the defendants from interfering with their possession of a certain office and preventing them from obtaining access to their books.

The offices, said counsel, were let to the plaintiffs, but on August 24th the defendants gave orders not to let them in, and declined to let their representatives have access to the books.

Counsel for the defendants contended that he had a right to turn them out neck and crop, as no rent had been paid, and that the company was not English, but alien, and therefore had no right to take advantage of the moratorium. Further, he submitted that no useful purpose would be served by granting the injunction, as the plaintiffs' tenancy expired in six days.

His Lordship granted the injunction asked for on the plaintiffs' undertaking to give up possession on September 29th next.

Educational Notes. — Northampton Polytechnic Institute.—We have received the "Announcements" for the Session 1914-15, which gives particulars of the educational and social amenities of the Institute. The programme was, of course, drawn up before the present abnormal state of public affairs arose, and it is uncertain what effect the change will have upon the work of the various departments, but, generally speaking, all the classes announced will be started, and most, if not all, of the work will be carried out as fully as possible. In the electrical engineering department there are to be two series of advanced lectures, by Mr. W. C. Kennett, B.Sc., A.M.I.E.E., on Transformer Design, and by Mr. A. C. Heap, M.I.E.E., on Electrical Instruments and Switchgear. There are also special classes in Submarine Cable Work and Radio-Telegraphy, the latter under the direction of Mr. E. S. Perrin, B.Sc., of the Engineer-in-Chief's staff of the Post Office.

Polytechnic School of Electricity.—Special courses in electricity, electrical engineering and physics commence on Monday, September 28th, under the direction of Mr. W. Hibbert.

Battersea Polytechnic, S.W.—Special course in electrical costs and quantities, by Mr. W. Brew, Thursday evenings, at 7.15, commencing October 1st. Particulars are given in our advertisement pages to-day.

Appointments Vacant.—Plumber jointer (£23 month), for Singapore Municipality; shift engineer (30s.), for Neath R.D.C.; fitter-driver, temporarily (30s.), for Severalls Asylum, Colchester; junior assistant engineer (15s.), for Newcastle-upon-Tyne Electric Supply Co.; electrician (Rs. 200 per month), for East Indian Railway; switchboard attendant (32s.), for Bermondsey B.C.; assistant engineer, for Sale U.D.C.; two switchboard attendants for Cleckheaton U.D.C. Particulars are given in our advertisement pages.

Fares and Traffic.—Figures presented at the last conference of the American Electric Railway and allied associations show that halfpenny and penny reductions in street railway fares have given disappointing results as regards increase of traffic obtained. Probably where such small amounts are concerned, a much larger percentage reduction is required than in ordinary trading before stimulation proportional to price reduction is obtained. On the other hand, the experience of the Hudson and Manhattan Railway (as reported in the *Engineering News*) shows that increase in fares seriously reduces the traffic carried and affects adversely the gross income. The Hudson and Manhattan Co. operates two pairs of rapid transit electric railway tunnels between New York and New Jersey. Its investment in tunnel construction is very heavy, and in view of continuous deficits, the company decided in December, 1911, to raise the fare on the up-town tube from 2½d. to 3½d. Though the increase appeared quite justifiable, it turned out to be a false move. Ticket sales showed a marked decrease for each month in 1912 (as compared with 1911) and a continued but less marked decrease in 1913. The fare increase was reasonable, but it resulted in a net decrease of 17·6 per cent. in ticket sales during 1912, as compared with 22·8 per cent. increase in 1911, and in 1913 the up-town traffic showed a further decrease of 5·8 per cent. Excluding joint line tickets (available over the Pennsylvania Railroad to Newark), traffic on the down-town tubes showed 2·9 per cent. decrease in 1912, but 47·4 per cent. increase in 1913. The temporary slump on this line is not easily explained, but the trouble on the up-town line was, doubtless, due to the reluctance of passengers to pay 40 per cent. increase in fare while there existed reasonable ferry and surface-line facilities. During the two years since the fare increase was effected, the gross income has been raised, by this increase, about £194,000, but, under the old fares, the increase would have been £260,000 had traffic continued to expand at only half the rate at which it was growing when the new fare was introduced.

The Public Service Commission holds that the operating expenses (8·25d. per mile) are too high for a system of this sort, but in 1913 they increased further to 8·55d. Corresponding figures for the subway were 5·05d. in both years. The operating costs per passenger were 1·08d. and 1·16d. in 1912 and 1913, as against 1·08d. on the subway. The passengers per mile of track (3½ millions) is high, but below the New York subway figure (4½ millions); due to the short run, the passengers per car-mile were 7·6 and 7·4 in 1912 and 1913, as compared with 4·7 and 5·1 for the subway; but the car-hours per mile of track (26,500 and 24,000) are little more than half the subway figures. The Commission states that the traffic density rather than the yield per passenger should have been increased. On this short route as many as 7 million passengers per track-mile per annum could be carried without overcrowding.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—On the recommendation of Mr. Whysall, the new engineer of the Greenock electricity department, Mr. J. H. Parker, who took charge of the undertaking during the vacancy caused by Mr. Robertson's resignation, has been appointed chief assistant of the department.

Messrs. J. T. Rodwell and W. Burgess, engineers-in-charge of the Hornsey Borough electricity works, and Mr. A. F. Bond (junior engineer-in-charge) have joined the Colours.

A recommendation by the Hastings Electricity and Public Lighting Committee forthwith to increase the salary of Mr. A. J. Ryan, chief assistant electrical engineer, to the maximum of £180 (reached by the terms of the appointment in May, 1916), was, on September 18th, lost, the voting for and against being equal.

The Radcliffe U.D.C. has appointed Mr. W. Jackson, of Burnley, as shift engineer at the electricity works.

Mr. L. C. F. Bellamy, engineer and manager of the Ilkeston tramways and electricity department, has joined the new Royal Naval Division, with leave of absence from his Council, and went into camp at Martin Mill on Thursday.

General.—The vacancy caused through the death of Mr. R. W. Edge, for many years the greatly esteemed manager of the Manchester branch of Messrs. Berry, Skinner & Co., has been filled by Mr. A. Shelton, from Birmingham. Mr. Shelton has an intimate knowledge of the fool-proof switchgear manufactured by the firm, having been employed for the last six years under the works manager, Mr. W. J. Markham; previously for seven years he was with the Electric Construction Co., of Wolverhampton. Mr. Shelton will be pleased to meet old and new friends at Messrs. Berry, Skinner & Co.'s office, 65, King Street, Manchester.

Councillor Pridmore, chairman of the Tramways Committee, and who has been chairman of the E.L. Committee, has been invited to become Mayor of Coventry on November 9th.

Obituary.—Mr. Edward Riley, whose work in connection with the Bessemer steel process made him famous, and who passed away recently at the age of 83 years, was a director of the Windsor Electrical Co. from its inception in 1895.

In the "Roll of Honour" list issued by the War Office on Monday last the following announcement appeared:—

"Killed. Captain Lord Guernsey, Irish Guards."

Lord Guernsey was chairman of Messrs. Duram, Ltd., a company registered in September, 1912, which commenced the manufacture of tungsten wire at Hanwell. We visited the works last year, and briefly commented on its interesting products in our issue of December 5th, 1913.

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NEW COMPANIES REGISTERED.

British Industries Support Federation, Ltd. (137,680).—This company was registered on September 15th, with a capital of £2,500 in 1s. shares, to carry on the business indicated by the title. The subscribers are:—E. D. Carey, 120, Clapham Road, S.W., surveyor and valuer, 2,000 shares; A. T. M. Jones, Holmstone, Harlesden, N.W., coal factor, 2,500 shares; J. H. Ogden, 56, Milton Street, Southend-on-Sea, civil engineer, 2,000 shares; A. Fraser, Lincoln's Inn, W.C., gentleman, 1,000 shares. Private company. The number of directors is not to be less than three or more than seven; the first are not named; qualification (except first directors, £100; remuneration, £100 each per annum (chairman £125). Solicitor, L. M. Parkin, 114a, Chancery Lane, W.C.; secretary, E. D. Carey. Registered office, Central House, 34 and 36, Oxford Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Brush Electrical Engineering Co., Ltd.—A memorandum of satisfaction in full on October 2nd, 1912, of prior lien second deb. stock, dated December 28th, 1911, securing £75,000, of which only £70,000 was issued. (Notified September 16th, 1914.)

North Wales Power and Traction Co., Ltd.—Particulars of "B" mortgage debs., to secure £21,000 and a premium of 50 per cent. thereon, created as to £7,000 on January 31st, 1912, and as to £14,000 on June 19th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £14,000. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to £40,000 and interest at 6 per cent. per annum secured to the Law Debenture Corporation, Ltd., secured by (a) charge dated August 15th, 1905, modified by indentures of April 18th, 1907, and (b) £80,000 first mortgage deb. stock issued by way of collateral security, but ranking in priority to £100,000 second mortgage debs. and trust deed dated July 31st, 1907. No trustees.

Efandem Co., Ltd.—Particulars of £12,000 debs., created September 1st, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Brotherton Tubes and Conduits, Ltd.—Particulars of £18,000 debentures, created September 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Southern Brazil Electric Co., Ltd.—Trust deed dated August 19th, 1914, to secure £750,000 debentures, charged on (1) 19,900 shares out of a total issued capital of 20,000 shares in Companhia Campaniera de Tracoao Luz e Forca; (2) 1,590 shares out of a total issued share capital of 1,600 shares in Emprez a de Melhoramentos Urbanos de Paranagua; (3) 70 per cent. of the issued capital of Banco Industrial Ampareuse; (4) all further shares in subsidiary companies to which the company shall subsequently become entitled; (5) certain concessions, lands, water rights and other immovable property in Brazil; and (6) the company's undertaking and assets, present and future. Trustees: Royal Exchange Assurance. 2 per cent. discount was made on the issue of 570,000 debentures and a brokerage 1 per cent. in cash and 2½ per cent. in fully paid shares was paid by the Parana Power Syndicate, Ltd., to brokers and other recognised agents in respect of debentures allotted on applications bearing their stamps.

British Arc Welding Co., Ltd. (108,759).—Return dated July 10th, 1914. Capital, £15,000 in £10 shares; 697 shares taken up; £4,870 paid; £1,000 considered as paid. Mortgages and charges: Nil.

British Continental Electricity Supply Co., Ltd. (57,088)—Return dated August 7th, 1914. Capital, £20,000 in 1,000 pref. and 1,000 ord shares of £10 each; all shares taken up; £16,400 paid; £3,600 considered as paid. Mortgages and charges: Nil.

MOVING PICTURES WITHOUT PHOTOGRAPHY.

By G. BASIL BARHAM, A.M.I.E.E.

Much has been said and written with regard to the extensive use that is made of electric signs by the American business man, and attention has often been drawn in the technical press to the fact that the sign industry has not developed in this country to anything like the extent it has in the United States.

Until a few years ago electric signs were comparatively rare in our big cities, and those in use were usually of the day and night type, consisting of gilded block letters, centred with carbon lamps from six inches to one foot apart. The lamps were usually under-run in order to economise current.

The first real fillip to the trade here was when the Underground Railways began to use signs in their corridors, and when they commenced to use them outside stations and for advertising purposes as well as for directions, the general public began to recognise their utility, and now quite a number of tradesmen have box signs of the continuous or intermittent light pattern. Many other forms of sign have been introduced such as the kaleidoscopic, and the sign with the rounded white opal glass letters and black metal-shaded portion that was advertised so extensively a few years ago, but none of them appear to have become popular in England, although they possess many good features, and certain of them have met with some favour on the Continent.

But it is in America that signs are principally used, and a study of some of the designs offered or an inspection of the signs fixed in any of their large towns would do more than half a dozen newspaper articles to show how backward we are in this form of advertising. And to be frank, one must admit that it is not the fault of the conservative English business man. The trouble is that the electrical trade seems to have nothing to offer him which is half-way between the humdrum advertising of the village sweetshop and the delirious delights of a Broadway get-rich-quick. The English trader will spend money freely for business purposes. He spends money on advertising schemes that are not nearly such good propositions as could be put up involving the use of electric signs. And he is not prejudiced against that form of advertising. He is in this position: he cannot tell the sign designer what kind of an advertisement he wants, for he does not know the possibilities of the electric sign. And the sign-maker is not prepared to go to him with a highly original scheme because he feels the business man dislikes spending money on electric signs. At present there is no doubt he does; few of the designs offered are worth spending money on. But the whole thing appears to be more or less of a misunderstanding, and with a little effort it is probable that the contractor, station engineer and sign-maker between them could easily remove what at present is nothing less than a reproach to the British electrical industry. A man will run his machines by electric motors, light his workshops with flame arcs, use metal filament lamps to light his retail stores and show off the goods he has to sell, and yet he does not use the finest advertising agent there is in the world to help him sell his goods, because—there is no one to tell him of its possibilities.

Perhaps the business man has led the maker to some extent in the United States. Here, only his own business is the concern of the trader; there, the trader is concerned with everyone's affairs. It is possible the business man saw that something could be done, and by insisting that his demands should be cared for, showed the American sign-maker that there was good business to be done and scared him into doing it. That this is so, is shown to some extent by the fact that in the earlier days of electric signs many American users kept them alight continuously throughout the twenty-four hours, the pioneer being, the writer believes, a seller of ready-made clothing, who fixed up a sign with 125 eight candlepower lamps in it and then objected to the expense of a main switch because he never intended to switch it off. His example was shortly afterwards followed by a big Brooklyn concern, which fitted up a giant sign with the name of the firm picked out in lamps and kept them burning day and night. In a short time the sign habit began to open up an almost untouched and highly profitable field for the electrician, and when the metal filament lamp became more reliable than it was when first introduced, specialist firms began to vie with each other in offering original and powerful advertising signs to the retailer and manufacturer, no less than to the music hall and picture theatre.

So far as the writer is aware, the nearest approach to the American moving picture signs in London is the "Drinking Scot" across the water, visible from

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the Embankment, and the small snake which, advertising a certain brand of cigarette, appears more or less convincing according to the hour of the night at which it is seen. These have a certain merit, and may, let us hope, prove forerunners to a more extended use of this form of advertising.

The modern American moving picture advertisement is an electric sign in which a large number of lamps are used, and these are controlled by numerous switches so worked that the lamps represent horses, people, trains, aeroplanes and other objects in motion. The signs are of mammoth size, and the majority of them are distinguishable over half a mile away. That method of advertising is as popular with the public as with the business man, and every evening thousands of promenaders walk up and down, with what the American calls "rubbernecks," looking for something new and fresh in the sky-sign world.

One of the most interesting and typical of these signs was put up some time ago on an hotel in New York, and some idea of its size may be gained when it is mentioned that it rises to a height of seventy-two feet above the roof of the hotel and is ninety feet wide. Further, the sign was not merely a skeleton with steel wire netting and waterproof lamp holders; it was made with a solid background ninety by sixty feet in area, and to enable the sign to withstand the wind pressure over sixty tons of steel were used for foundations, frames, struts and bracings. In this particular sign are over twenty thousand electric lamps and the average load is six hundred horse power. In the wiring, over half a million feet of conductor were used and there are no fewer than seventy thousand separate electrical connections. The controlling board contains some two thousand seven hundred switches, and the moving picture effect is obtained by the switches being worked at a very high speed. It appears that a train of eight cars was required to haul this sign from the factory to New York, and electricians and other workmen were engaged on it, after delivery, for some three months before it was finally erected and at work.

The sign represented a Roman chariot race, the lines being picked out in white and coloured lamps, and around the arena three chariots were driven at full speed by galloping horses. The point of the advertisement, it may be mentioned in passing, was that the goods advertised were "Leaders of the World," and consequently the leading chariot is never overtaken. A striking effect is gained by making it appear that the spectator is moving with the foremost horses whilst the roadway, the arena wall and the stadium appear to move away, travelling past the drivers. A somewhat similar optical illusion has frequently been made use of on English stages in dramatic plays wherein railway trains or race-horses have been shown travelling at speed. The sign was most realistic; the manes and tails of the horses fluttered about, the clouds of dust rolled from the wheels and spurted at every step from beneath the hooves of the horses, and the clothes of the chariot drivers waved in the wind.

The whole effect is exactly as stated. To all intents it is that of a motion picture, but gained by the switching on and off of thousands of lamps. Above the arena is a space on which a description of the advertised goods appears in letters, electrically lighted, four feet in height. The waving tassels hanging from the curtain are over six feet high, and the first chariot wheel is eight feet in diameter.

It must be mentioned that the entire sign was not produced on one flat surface. In the background were the arena walls, and the two pursuing chariots were in front of them. Slightly in front of these was the first or ever-victorious chariot, as it may be termed, with the curtain in the foreground.

It has been mentioned that the motion effect is gained by causing the walls of the stadium apparently to move past the stage. The bodies of the horses and the chariots are therefore stationary and appear to move only because the arena appears to move in the opposite direction. The legs of the horses are outlined with electric lamps in eight positions and the switch which controls the lighting causes the lamps in these to flash in and out so rapidly that the eye cannot detect the change but, just as when seeing a bioscope film, follows the apparent movement. Lamps were provided in the manes and tails of the horses, and a waving effect was obtained by means of careful and studied switching on and off. The effect of moving dust was obtained in the same way and detail was studied to such an extent that even small tassels and ornaments on the harness of the horses were made to move in a similar manner.

It must not be supposed that the effect was wooden in any way or that the moving picture show was an inartistic repetition of a series of stilted leg movements and mechanical or, rather, electrical reiteration of waving tassels. The whole display was staggered and irregular movements to break the sequence were freely introduced. There was no rhythmic movement of the legs; on the contrary, the effect was as though the horses in the two following chariots were every now and then on the point of overtaking the leader, only to fall back a moment later, evidently exhausted with the effort.

The apparent movement of the roadway is produced by concealing controllable lights beneath sheets of opalescent glass correctly painted. These lights are in rows, branching out from a common centre near the leading chariot, and as these are successively switched on and off, the waves of light seem to be moving in the reverse direction to that in which the chariots are travelling. The wall of the arena was made to appear moving in a similar way, being illuminated by small bulbs which outlined the upper edge and the wreaths suspended from the top. A very ingenious method was adopted of lighting this wall face: rows of high candle-power tungsten lamps were placed behind the charioteer and their light concentrated by means of powerful reflectors on to one side of the wall. This naturally gave a high light there and as that, by contrast, reduced the light on the rest of the wall, it made the wall appear to be convex.

Very many examples might be given of the American moving-picture form of sign. One which comes to mind represents a very tall and business-like lady hurrying along a street with a raised umbrella and holding her skirts with one hand. The wind effect is very fine and the impression of storm and rain is cleverly conveyed. Seaside resorts advertise in like manner, only in their advertisements the weather is always luridly sunny. One of these may be described, as being typical of all; in it is a sunny beach on which waves, produced in the same way as the clouds of dust in the chariot race, are breaking merrily; another is a morning scene with rising sun and a gradually awaking town. A more elaborate design shows gaily-clad bathers moving about the beach and entering and leaving the water, and another worthy of mention shows a watering place by moonlight, with pleasure-seekers returning from the promenade and entering the hotels and cottages, which are glittering with light.

There is no need to place more emphasis on the vast difference which exists between English and American electric sign practice. There it is a live business, growing so rapidly that one wonders to what stage of development it will ultimately reach. Here in England—well, apparently we only know how to light up boxes with block letters cut in them, behind which we have painstakingly learned to stick fragments of coloured and crinkled glass. The maker would probably say that is what the English business man wants. In my opinion it is what the English business-man has to put up with!

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CITY NOTES.

Automatic Telephones (Australia), Ltd.

According to a Sydney newspaper, this company held its meeting on August 5th. The matter was mentioned in our last issue.

The Chairman (Mr. J. B. Nicholson) stated that contracts were in hand which would keep the company busy for at least six months, and possibly 12. He did not know how the war would affect the business, but he had not much fear regarding it. The company had tenders extending over a number of exchanges. In Victoria and South Australia the position was that competitors of the company had been given a couple of small contracts. Geelong and Brighton exchanges in Victoria were under the company's system, and the question was whether the department in Melbourne would mix up the systems or stick to the one which had proved its worth. There would be a very small saving financially, and, in addition, the other systems were only in an experimental stage—they could not be introduced solely into any big city. The freedom from trouble on the company's system was largely due to the efficient staff of engineers. Mr. Nicholson recently made a contract in Chicago for a supply of instruments which had yet nine years to run.

Canadian General Electric Co., Ltd.—The directors have declared a quarterly dividend of 1¾ per cent. for the three months ending September 30th, being at the rate of 7 per cent. per annum on the common stock, and a half-yearly dividend of 3½ per cent. for six months ending September 30th, being at the rate of 7 per cent. per annum, has also been declared on the preference stock, payable October 1st.

Spain.—La Industria Electrogalvanica is the title of a share company formed at Barcelona with a capital of 75,000 pesetas, with the object of restoring and polishing metals by means of galvanisation and for other objects.

With the title of Instalaciones Generales de Electricidad, another company has been formed, also at Barcelona, with a capital of 25,000 pesetas, to carry out electric installations and similar work.

United Electric Car Co., Ltd.—The annual general meeting was held at Preston, on September 17th. Mr. Shorrock voiced a feeling of great satisfaction at the declaration of the dividend on the ordinary shares in view of the present state of affairs.

Japan.—During the seven months ending with July last, a total of £2,358,500 was invested in the electrical and electricity supply industries in Japan; of this sum only £225,000 was in respect of new concerns, the remainder (£2,133,500) being for the extension of old undertakings.

Madras Electric Tramways (1904), Ltd.—The directors have declared an interim dividend on the 6 per cent. cumulative preference shares, payable on 30th inst.

Shawinigan Water and Power Co.—For the quarter ending September 30th a dividend of 1½ per cent. has been declared.

STOCKS AND SHARES.

Tuesday Evening.

The prolonged battle has had a somewhat subduing effect upon Stock Exchange business. Until definite indications are forthcoming, Stock Exchange members, and the public generally, determine to wait before embarking upon new engagements. Naturally, in the suspense, confident and quiet though it has been, the tendency was for gilt-edged prices to give way a little here and there. Consols, for example, dwindled to 68½, below which price Stock Exchange members are not at present allowed to deal amongst themselves. To this extent the market marched to a deadlock; and since Consols are now the recognised leader for all prices in Stock Exchange securities, the rest of the quotations inclined to quietude.

Where the public score through the Stock Exchange being closed is in the fact that, should the news be negative, or not so satisfactory as could be wished, House men can shut up their books and go home without any of that feeling of compulsion which chains them to the markets when the House is open. In this way, any kind of slump is practically impossible, for the markets merely melt away, and prices cannot go down if there is nobody offering stock. The public, of course, are prejudiced by the lack of dealing facilities, but this is much more than compensated by the absence of depreciation in securities which the same set of conditions brings about. The man who grumbles because he cannot realise, say, £100 British Westinghouse Preference shares, may have a personal grievance against the Stock Exchange, but the cause which prevents his raising the money at the same time saves probable depreciation of thousands of other stocks and shares where interests infinitely wider are concerned.

The decision of the Government to recompense Home Railway companies for the carriage of troops, up to the extent of the traffics for the corresponding period last year, continues to exert a steadying influence over prices. Material recoveries have occurred. There are many buyers about for small sums of Underground Electric 6 per cent. Income bonds, now quoted *ex* £3 interest. Up to 80 *ex* dividend has been bid, this price comparing with 83, *cum* dividend, on July 30th. The shilling shares are quoted at 5s., at which they look a much more reasonable proposition than they did when the price was two-and-a-half times as much, and when, we venture to recall, the opinion was expressed here that the value was inflated, in spite of the noticeably unanimous conclusion in certain financial columns that the shares made a good purchase.

Metropolitan Consolidated at 31½, and Districts at 19, have recovered to the same prices at which they stood when the Stock Exchange closed. No changes have occurred from the figures quoted here last week for the prior-charge stocks.

It is a little surprising that attention should not be paid to the claims of electric lighting companies' shares at the present time. It is not that sellers abound, but rather that buyers are absent, which keeps prices dull. The companies are known to be doing well, on the whole; better, in fact, in some cases than at this period of the year in normal times. Public interest, however, is not yet awake to the possibilities offered by the electric share market, though special constables have been heard to discuss their possible merits as the men meet on their beats and watch the electric beams that play from the various quarters of the sky over the metropolis.

In the Telegraph market something like a comprehensive list of quotations has developed, and we append prices of the leading Telegraph and Telephone issues, with a column showing the figures at which the stocks and shares stood at the end of July. It is worth mentioning that buyers can probably be accommodated at prices very near the lower of the two given in the first set of prices, though this does not apply in every case. Western Telegraphs constitute one of the exceptions, there being several buyers about at 12⅞.

Stock or share.	Present price.	July 30th.	Fall.
Anglo-American Tel. 6 per cent. Preferred ..	105 — 7	108	2
,, ,, ,, Deferred ..	22 — ¼	22⅝	¼
Chile Telephones	6⅞ — 7¼	7⅜	⅛
Commercial Cable 4 per cent. Deb.	79 — 81	81	1
Constantinople Telephone Ord.	4 — ⅛	4¼	—
,, 6 per cent. Oblig. Bonds ..	98 —100	101	2
Cuba Sub. Tel. Ord.	8 — 9	8½	—
,, ,, 10 per cent. Preferred	15½— 16½	16½	⅛
Direct United States Cable	6 — ⅛	6⅛	⅛
Eastern Extension Tel. Ord.	12 — ⅛	12⅛	⅛
,, ,, ,, 4 per cent. Deb. ..	94 — 6	97	⅛
,, Tel. Ord.	127 — 30	130½	2
,, ,, 8½ per cent. Pref.	76 — 8	77⅛	⅛
,, ,, 4 per cent. Deb.	96 — 8	97	—
Globe Tel. and Trust Ord.	10¾— 11¼	11¼	¼
,, ,, 6 per cent. Pref.	12 — ⅛	12⅛	⅛
Great Northern Tels.	30 — 2	33	1
Indo-European Tels.	57 — 9	58½	½
New York Tel. 4½ per cent. Ist. Bonds ..	95 — 7	99	⅜
Oriental Telephone Ord.	2 — ⅛	2⅛	⅛
,, ,, 6 per cent. Pref.	1 — ⅛	1⅛	⅛
,, ,, 4 per cent. Deb.	85 — 7	87	1
Telephone Co. of Egypt 4½ per cent. Deb. ..	96 — 8	98	—
United River Plate Tel. Ord.	5⅞— 6¼	6⅜	⅛
,, ,, ,, ,, 5 per cent. Pref. ..	4¾— 5¼	5⅜	⅛
,, ,, ,, ,, 4½ per cent. Deb. ..	95 — 97	99	⅜
West India and Panama Ord.	¾ — 1¼	1⅛	⅛
Western Tels.	12¾— 13¼	13⅜	⅛
,, ,, 4 per cent. Deb.	95 — 7	96½	½

Amongst the shares for which there has lately been more inquiry are Marconis. The Government is partially working the company's lines, but it is understood that all the Marconi stations are extremely busy just now. At the same time, there is a heavy bull account in the market. This notwithstanding, the price has risen to 30s. Americans are 8s. 6d., and Canadas 4s. 6d. Cable companies, on the whole, are making up for their loss of traffic on the one hand by the fact that so many messages have to go now in plain words. A reduction in charges has been notified this week, but, allowing for this, there should be a useful margin of extra profit to compensate the decrease in ordinary cabling consequent upon the war.

The Electric Manufacturing section is somewhat dull, and in the case of the majority of shares the demand has not overtaken the supply. Prices are not called much lower than they were on July 30th, but those who want to pick up cheap shares would probably be able to do so by putting forward bids. Edison & Swan £3 shares have been changing hands between 2s. 6d. and 3s. In other sections, North Metropolitan Preference was dealt in at 108½, and London Debenture at 89. A good-sized line of Winnipeg Electric Railway 4½ per cent. Debenture stock was bought the other day at 93½. Anglo-Argentine Tramways 4 per cent. Debenture has risen to 86. Brazil Tractions keep very steady between 49 and 50. British Westinghouse Preference are said to be in the neighbourhood of 26s., but it is difficult to get a reliable price in them. Babcock & Wilcox have been offered in a small way at 2⅛, which looks low compared with 2¾ two months back. Vickers are up to 33s. 6d., which, allowing for the dividend of 1s. recently deducted, leaves the price unaltered since July 30th. Rubber shares strengthened in several cases. The raw material is about 2s. 0½d. per lb. in London and 4s. per lb. in Amsterdam, the apparent anomaly being due to the fact that sales of rubber are not allowed from England to Holland, because of the war with Germany.

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EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING AUGUST, 1914.

The returns of electrical export and import business for August naturally reflect the unsettled trade conditions brought about by the present European war, and while our overseas electrical business reached less than half of the value recorded for July, the imports fell to about a third of the corresponding value for July.

The export total for the month amounted to £238,621, as compared with £564,291 in the previous month, and the falling off is fairly generally spread over all sections, although, of course, most marked in such matters as machinery, cables, &c.

As regards the imports, the August total of £87,031 compares with £291,244 in July, while the re-export total was practically £10,000, or about half that of the previous month.

A great decline in electrical imports was the inevitable and not wholly unwelcome sequel to a war with Germany, and it is not surprising that her total of £168,000 in July should have fallen to £24,953 in August—still a very large share of the imports for the month. Another result of the war is the sudden increase of Dutch imports, this neutral (?) country's share of business being valued at £7,736 in August as against only £1,120 in July. The falling-off in business is apparent in all directions, and it is satisfactory that, as regards our own trade, this has not been more dislocated by the uncertainties of the past month.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	843	248	...	10	...	336	3,616	39	40	31	...	849	6,012
Germany	3,912	120	63	...	48	92	1,280	127	14	112	...	...	5,768
Netherlands, Java and Dutch Indies ...	...	12	112	10	30	32	978	15	185	112	889	31	2,406
Belgium	1,054	110	58	...	2,657	20	420	...	...	41	508	...	4,868
France	221	...	1,064	...	45	171	3,664	44	15	37	273	437	5,971
Portugal	...	85	...	11	...	...	136	20	...	...	989	...	1,241
Spain, Canary Isles and Spanish N. Africa...	1,165	...	53	67	52	403	1,035	520	108	7	...	11	3,421
Switzerland, Italy and Austria-Hungary ...	33	62	...	...	...	...	1,396	...	...	183	...	605	2,279
Greece, Roumania, Turkey and Bulgaria ...	41	73	26	...	...	...	1,283	51	...	...	750	2,648	4,872
Channel Isles, Gibraltar, Malta and Cyprus...	39	99	8	37	...	...	...	...	21	...	7	34	245
U.S.A., Philippines and Cuba	40	456	...	...	...	...	498	50	340	...	...	92	1,476
Canada and Newfoundland	270	1,564	1,434	991	35	116	8,180	...	1,706	...	547	117	14,960
British West Indies and British Guiana ...	40	...	5	31	...	30	...	...	59	...	9	3	177
Mexico and Central America	...	...	...	...	...	25	29	228	...	...	...	...	282
Peru and Uruguay	...	114	10	...	...	...	587	27	21	...	113	51	923
Chile	116	161	14	12	...	104	339	...	327	...	30	436	1,539
Brazil	135	...	275	...	...	...	113	...	22	...	302	10	857
Argentina	2,445	10,091	250	802	262	1,433	11,800	4,256	2,645	164	2,357	764	37,269
Colombia, Venezuela, Ecuador and Bolivia...	61	...	...	...	...	...	278	...	...	...	...	998	1,337
Egypt, Tunis and Morocco	36	392	15	33	300	65	413	113	118	4	113	52	1,654
British West Africa	186	74	18	18	...	68	125	...	...	...	190	14	693
Rhodesia, O.R.C. and Transvaal	1,734	2,942	211	179	51	15	2,028	30	263	...	...	...	7,453
Cape of Good Hope	1,921	639	154	103	125	185	2,205	849	118	21	260	371	6,951
Natal	543	1,365	109	...	15	...	658	...	33	18	4	155	2,900
Zanzibar, Brit. E. Africa, Mauritius & Aden	469	136	56	321	...	73	294	184	16	...	...	547	2,096
Azores, Madeira and Portuguese Africa ...	...	...	...	...	...	...	...	...	...	...	...	...	...
French African Colonies and Madagascar...	...	...	...	...	...	...	...	...	...	...	...	...	...
China and Siam	1,641	251	288	11	...	368	1,280	...	280	146	594	519	5,378
Japan and Korea	50	...	69	...	...	292	6,376	...	...	20	201	1,584	8,592
India	3,964	7,261	1,282	372	32	950	14,948	5,982	1,323	184	3,765	152	40,215
Ceylon	82	105	70	93	...	14	339	...	13	...	194	...	910
Straits Settlements, Fed. Malay States and Sarawak	297	464	218	19	137	209	3,358	311	109	10	264	322	5,718
Hong Kong	481	2,568	122	37	51	328	3,638	...	66	...	...	44	7,335
West Australia	618	3,733	58	35	...	5	165	...	321	...	111	...	5,046
South Australia	393	587	195	17	...	26	1,725	...	...	...	459	...	3,402
Victoria	1,729	4,649	356	253	105	345	4,735	...	229	14	1,105	258	13,778
New South Wales	1,163	4,717	202	1,089	89	200	3,968	925	742	41	631	388	14,155
Queensland	42	838	67	397	...	277	1,583	...	68	12	1,125	453	4,862
Tasmania	162	...	...	16	...	...	81	...	...	...	...	12	271
New Zealand and Fiji Islands	1,484	2,293	869	1,177	273	450	3,238	488	550	11	134	342	11,309
Total, £	27,410	46,209	7,731	6,141	4,307	6,632	86,789	14,259	9,752	1,168	15,924	12,299	238,621

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	15	...	...	...	45	621	1,554	...	354	250	1,498	4,337
Germany	913	3,011	512	2,454	2,390	312	11,729	...	1,058	721	1,853	24,953
Holland...	...	...	...	3,821	3,816	...	17	10	72	...	...	7,736
Belgium	68	847	...	50	10	12	987	320	...	...	1,461	3,755
France	284	...	846	116	305	8	711	...	...	659	279	3,208
Switzerland	280	...	...	...	...	57	693	...	...	...	...	1,030
Italy	...	1,040	...	...	10	...	394	...	...	...	180	1,624
Austria-Hungary	...	...	...	...	...	...	665	...	...	...	...	665
United States	3,099	...	717	290	69	65	12,402	20,124	1,323	1,036	301	39,426
Total, £	4,659	4,898	2,075	6,731	6,645	1,075	29,152	20,454	2,807	2,666	5,572	86,734

Additional imports: Spain: carbons, £52. Canada: Goods, £105; machinery, £60; telegraph apparatus, £80.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above... ...	2,479	89	...	1,867	271	...	2,475	...	227	503	2,090	10,001

TOTAL EXPORTS: £238,621 TOTAL RE-EXPORTS: £10,001 TOTAL IMPORTS: £87,031

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter; doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

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ELECTRIC WINDING PLANT AT BURLEY COLLIERY.

An interesting colliery electrical plant is to be found at Apedale, where the Midland Coal, Coke & Iron Co., Ltd., make extensive use of electrical power generated from waste gases. The power house for this purpose contains three 375-kw. Witton alternators driven by National gas engines, and generating three-phase power at 550 volts, 25 cycles. A view of the three gas-driven sets is given in fig. 1, whilst

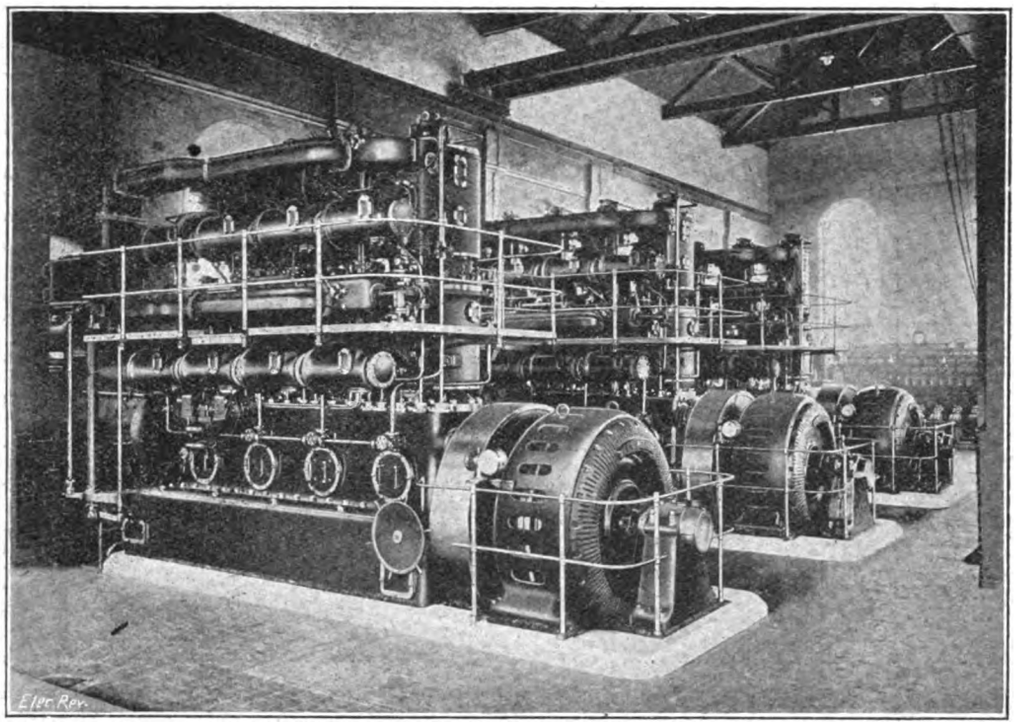

Fig. 1.—Power House at Apedale Iron Works of the Midland Coal, Coke and Iron Co., showing National Gas Engines driving G.E.C. Witton Alternators.

the Witton switchboard and a 150-kw. steam-driven Witton generator is shown in fig. 2.

The three gas engines are of the four-crank eight-cylinder vertical tandem enclosed type, provided with forced lubrication to all bearings, and running at a constant speed of 300 r.p.m. with a rated load of 600 b.h.p. The gas for the engines is obtained from the colliery coke ovens, and purified in outside scrubbers, being subsequently stored in a gas holder of 20,000 cb. ft. capacity. It may be noted that three further gas engines are on order with the National Gas Engine Co., for this plant, suitable for working on the blast furnace gas, one of these to be direct coupled to another Witton alternator, and the other two to reciprocating blowers, by Messrs. Alley & McLellan, for the blast furnaces.

Amongst motor-driven plant, perhaps the most interesting is the electrically-operated winder, which has been constructed by the General Electric Co., Ltd.

This winder is situated at the Burley Pit, the company being about to close down their Sladderhill Pit as far as coal winding is concerned, the coal from which will be brought up by way of the up-cast shaft of the Burley Pit. The winding drum is of the double-cone type, rising from 7 ft. in diameter to 13 ft., and being 11 ft. 8 in. wide over the flanges; it is mounted on a 9-in. diameter shaft carried in three bearings 8 in. diameter and 12 in. long. The drum is grooved to take a rope 1¼ in. in diameter.

A special feature of this winding plant is the brakes, which are of the double-post type, lined with wood blocks and arranged to be operated by a foot lever during normal working. For emergencies a vertical lever fitted with the usual over-winding attachment operates a trip gear, which releases a weighted lever controlled by a dashpot, and so applies the emergency brake. The failure of the electric supply will also bring into operation a solenoid, which will apply the brake and, in addition, a hand lever is provided by which the operator can apply the brake should the necessity arise. Naturally, the trip lever in operating cuts out the motor by means of an emergency switch. To replace the emergency brake after an application a small hand-wheel is provided on the driver's platform.

The winding drum is driven by a 145-b.h.p. Witton motor (continuous rating) specially designed for heavy overloads. This motor runs at 140 r.p.m., and is geared to the drum-shaft through reduction gear, supplied by the Power Plant Co., running in an oil bath and giving a drum-speed of 39 r.p.m. The depth of the shaft operated by the winder is 458 yards, and a gross load of 30 cwt., or alternatively 12 men, is raised in 80 seconds. As will be seen from the power-time diagram in fig. 5, the winding speed varies from 1,030 to 1,450 ft. per minute, the h.p. at the end of the accelerating period —12·25 seconds after starting — being 179, which falls during the running period to 86 h.p. The retarding period is equal to the accelerating period.

Special interest is attached to the construction of the controller, which involves an entirely new principle. One of the first points of importance is that it is completely mistake-proof, and that the operator cannot inadvertently accelerate

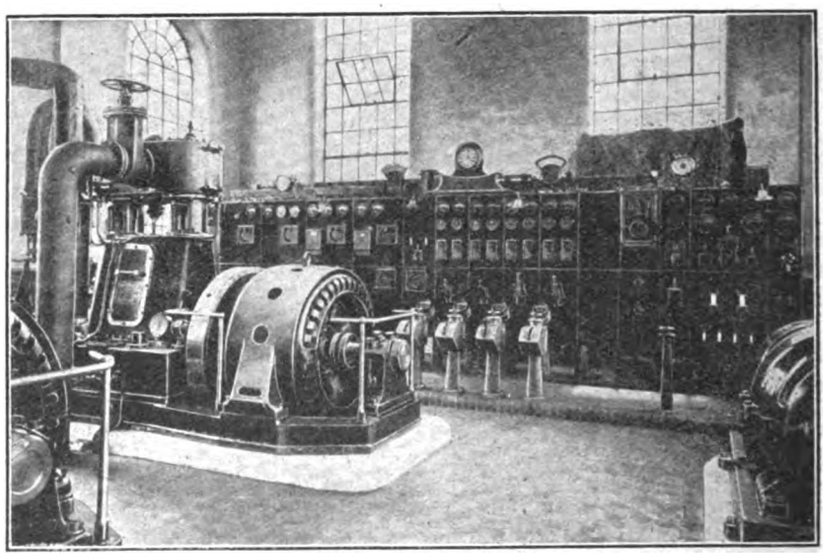

Fig. 2.—View showing the Switchboard and 150-kw. Steam-Driven Witton Alternator in the same Power Station.

or retard at any other than a predetermined rate. It will be remembered that one of the principles on which many winding controllers have been constructed is that of an electrolyte flowing over a weir, the electrodes being situated in the electrolyte, the level of which is varied by raising or lower-

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ing the position of the weir. In this way the speed of the motor is controlled. This method has a number of disadvantages; for instance, the pump has to circulate an electrolyte containing chemicals which cause trouble in the pump, the electrolyte, of course, being hot. In the controller used at the Burley Colliery the principle of a relay is introduced. The resistance is cut out of the rotor circuit by the downward motion of three movable electrodes connected together to form the star point of the circuit, and these dippers are attached by a chain running over pulleys to a float in an entirely separate tank. When the float rises the dippers are lowered and cut out the resistance,

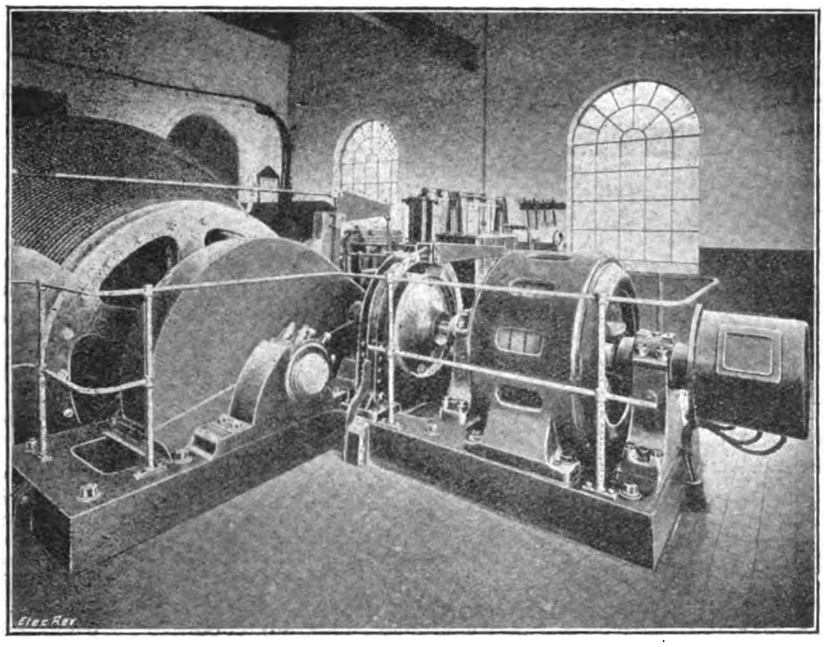

Fig. 3.—Electric Winder at Burley Colliery.

their movements in this way being delicately controlled. The float tank is constructed in two portions, an inner and an outer tank, water being kept constantly in circulation from the outer to the inner one by means of a small motor-driven centrifugal pump. This water constantly flows from the inner tank unless the valve is closed by the control lever, when the level of the water rises at the predetermined rate, carrying with it the float, which thus lowers the dipper blades in the control tank and runs the motor up to the predetermined speed.

The speed to which the motor accelerates is controlled by the position of a shutter forming one side of the inner tank, this shutter being itself controlled by a separate lever, which can, if desired, be placed permanently in any position, or, alternately, can be used during each wind. If this second lever be put to the slow position, the motor will accelerate to the slow speed when the main control lever which is normally used by the driver is put either in the forward or the reverse position. On the other hand, if the regulating lever is pushed into the "full on" position the motor runs up to full speed when the main lever is put over.

There are, of course, two motor switches, one for each direction of running, and these are so interlocked that they cannot both be put on at the same time. The rotor connections accommodate the fixed terminals in the starter tank.

The main operating lever is of the usual type, and actuates both the reversing switches and the valve in the control tank.

An additional feature is a special device preventing the stator switches being left partially in contact. This device also prevents the driver inching by rapidly switching on or off. There are three notches only for this lever, an "off" and a "full-on" position for either direction. The regulating lever is situated outside the main control lever, and has a number of notches representing different speeds; it can be set either for "full" or for any fraction of full speed.

It will be seen that the winding gear is fully equipped with safety devices to cope with every contingency. There is a depth indicator of the vertical type driven from the drum-shaft, and provided with an overwinding attachment which cuts off current and releases a weighted brake when the cages pass a predetermined point. That the brakes may not be too suddenly applied, the brake lever is fitted with a dash-pot. In addition to the overwinding device, an over-speed gear of the high-speed Hartnell governor type is also provided, and controls the speed of the cage at every point in the shaft. Should the driver fail to effect the necessary reduction in speed when nearing the end of the wind, the over-speed device, which is set to operate on a 5 per cent. speed increase, opens the motor-circuit and applies the weighted brake lever. The features of this system of control may be summarised as follows:—

1. For winding coal the regulating lever can be left permanently in the full position.
2. For winding men the regulating lever can be used for bringing the cage up to speed more slowly, and to moderate the speed down if required.
3. It can be similarly used for inching or examining the ropes.
4. The pump only deals with fresh clean water, and not with the electrolyte, as in some forms of controller.
5. The water with which the pump deals is cold, the energy dissipated in starting the motor not being absorbed in it.
6. It is impossible to make any partial contact on the stator switch, thus the driver cannot damage the contacts of the switch when inching.

Naturally, points 4 and 5 make for improved running and low maintenance of the pump.

A raised platform is provided for the engineman, upon which all the levers are conveniently placed. A visual and

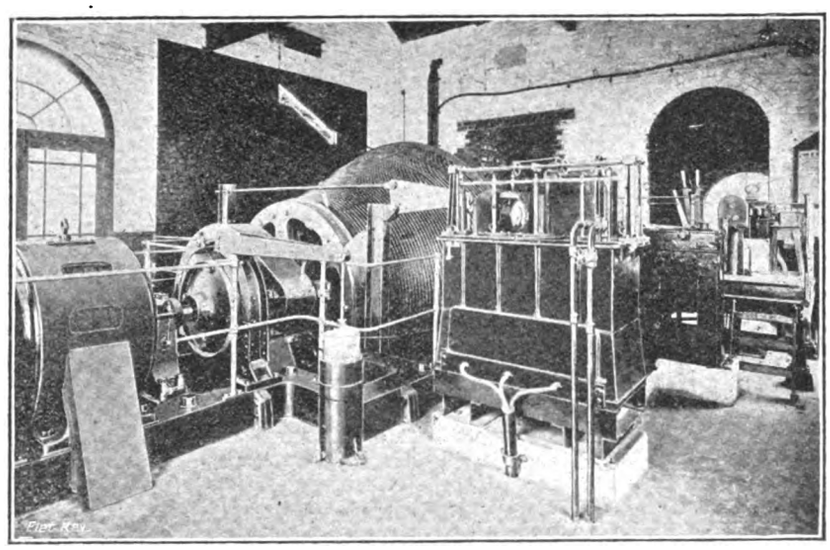

Fig. 4.—General view of the Winder, showing the Controller. The Driver's Platform is seen in the rear, and in the foreground the Dashpot for the Brake.

oral signal of the electrically-operated dial type is installed.

The power cost of raising coal from the full depth of the shaft by this gear is 0·5d. per ton.

The electrical equipment of the winder was supplied by the General Electric Co., Ltd., Messrs. M. B

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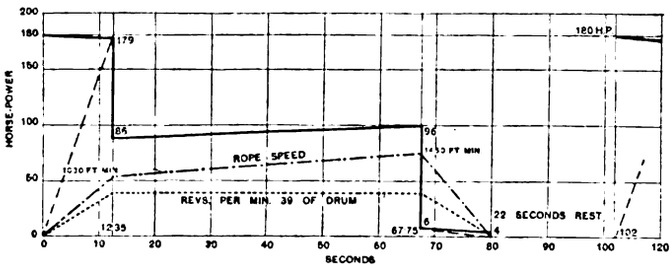

Fig. 5.—Power-time diagram of Electric Winder.

Wild & Co., Ltd., being responsible for the mechanical portion.

TRADE WAR.

By "IGNOTUS."

Now in those days there dwelt in The Island a great nation, waxed fat with the spoil of olden wars, and long years of prosperity. Withal, as ever has been, were there many wretched, who lacked bread, while their rulers rode in chariots.

But there arose certain soothsayers, bald heads, searching out hidden things, who discovered vast treasure, that lay deep here and there in the land, and could be won for the digging.

So they approached with humility divers rulers and rich lords, saying: "Behold, we wot of treasure in this place, and that; do you command the needy into armies of workers who shall dig at your guidance; so there shall be profit for you and bread for these starving ones and their children." But they were laughed to scorn; one saying "I have skill with rods of wood to strike a ball so that it drive one hundred and ninety and nine cubits; shall I waste my dexterity in digging?" And another answered saying: "Thou seest I am busy; come again therefore after many moons." Quoth another, haughtily: "Am I not known of all men as the Maker of Pills, daily with Kings eating delicacies from golden platters? Begone, lest my slaves chastise thee." And another said: "I am cunning in uttering terminological inexactitudes in the Forum and receive four hundred pieces of gold each year therefor; but digging is sore labour; am I then a fool in your eyes?" And one mocked them, saying: "I have such wealth of my father, the soap boiler, that truly I know not how to dispense it, even with the help of many maidens. As for these witless ones of whom ye prate, enquire of them wherefor they selected not their parents with a greater discretion." And another placed his forefinger beside his nasal protuberance, saying: "How many thrifty are in the land, who have hoarded shekels in pots! Well I wot how a prospectus artfully contrived will freely draw unto me their coins. And when at the meeting I shall say unto them, 'Through this and that, all is lost, despite my sleepless labours,' bear me witness that they will but say, 'Alas! Alas!' and return to their hoarding as before. Having already treasures unlimited at call, shall I also dig? Go to; thou weariest me."

In short, with one accord they drove away the soothsayers, treating them with contumely.

And it came to pass in those days that certain philosophers of renown came from afar off, and sojourned in The Island. They, hearing of the buried treasure, spoke with the soothsayers in the market place, saying: "Tell us of this treasure." So they told them.

Then they addressed the multitude, saying: "Hearken unto us, ye slaves and hungry, that ye may eat, and your children with you. In such and such a place shall ye dig, as we shall direct you, and much gold shall be brought to light. But heavily must ye labour to reach it, and in the meantime ye are faint, and your little ones cry out. Therefore, will we bargain with our friends in our own country; who, though they be but barbarians knowing not your speech, have flocks and herds and much strange money; yet desire more. These aliens, trusting us, shall lend us great sums, that we may eat and drink until our labour brings reward. And we will make certain bonds with them, so that when the treasure is won, such and such part thereof shall be paid to them in usury; and such and such part shall be ours; and the remainder ye shall divide between you for your labour; that all may be contented, and have abundance."

Then all who heard these words were astonied, saying: "It is good; let us do as these mad foreigners say; for our bellies are empty now, and our last state can scarce be worse than our first." And it was so.

Now after many days the treasure was plain to all men; and the philosophers and their friends gat much gain, for the bonds were light. And the slaves waxed fat unto truculence; having many children, and motor-bikes.

So all men blessed the philosophers, calling their leader "That Great One"; naming them Presidents of the Council, and erecting graven images in their honour.

Then were those rich men who had abused the soothsayers very wroth; for wags met them in the gate mocking them, and saying "We told you so"; though truly they lied in their throats.

And they communed with the Slide-rule Shifters, and their henchmen, in inner Chambers, saying: Can we endure all this?" And there was gnashing of teeth.

Now at that time there dwelt in the chief cities certain drummers from a land on the further side of the Pond; loquacious ones, speaking through the nose, and the hat, and worshipping, very faithfully, a powerful god named Bluff. And these subtle ones, scenting prey, brought the disgruntled rulers and merchants together privily in a certain place, saying unto them: "Behold these pretended philosophers, who were doubtless cast out from their barbarous country for their many crimes! What are they but alien thieves and foreign plunderers, knowing no shame? Have they not stolen the treasure that is yours of right?—seeing that it is in your own country, and was known even of your own soothsayers ere ever they adventured here to your undoing. Now therefore let us slay them and seize their riches, and constrain their servants to toil for us, so that we can eat the bread of luxury all our days."

But one crafty one said, "If one of us alone should slay them, all the people will clamour saying, 'Thou robber' and 'Thou murderer,' giving him no peace. Therefore let us all swear by the Five Sacred Letters that each shall stab in the back secretly, so that each may declare to the multitude, 'Not by my hand! Not mine!' And further, let us each with one accord loudly call the other 'Patriot' in the hearing of the ignorant; and the people's wrath shall shortly be appeased."

And this counsel seemed good to many that were eaters of fire. But others doubted exceedingly; men of judgment, who had striven in battles when those hot-heads had scarce cut their eye teeth, saying "This is folly; wot ye not these strangers' little game? Surely ye shall be guilty in vain, at best exchanging only one gang of robbers for another." But the Lords of the Lacquerers of Brass, and the Squirters of Tungsten, heeded them not.

For it was written of old: "The thoughts of the diligent tend only to plenteousness, and riches and honour are with them; but who is able to stand before envy?"

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SCHRAGE PATENT THREE-PHASE COMMUTATOR MOTOR WITH SHUNT REGULATION BY BRUSH DISPLACEMENT.

During recent years stationary three-phase commutator motors have been employed extensively in textile, hoisting and winding, machine tool and ventilating services, &c. Series motors offer the advantage of simple regulation by brush displacement, but shunt machines are frequently preferable in other respects, owing to the wide speed variation of series machines with load and voltage fluctuations. On the other hand, commutating motors with shunt regulation have hitherto involved complex and costly controllers, comparing unfavourably with the simple brush control possible in series motors.

The Arnold-La Cour single-phase motor with cross winding is a commutator motor with shunt regulation. The controller required is naturally simpler than that required for three-phase current, but the machine is regulable only within comparatively narrow limits. Three-phase shunt commutator motors (as made by the A.E.G., and the Allmänna Svenska E.A.) offer the advantage of wider speed regulation.

Fig. 1 shows the connections of the Allmänna Svenska-La Cour motors as built since 1907. P represents the stator primary winding, R the stator regulating winding, and S the rotor winding

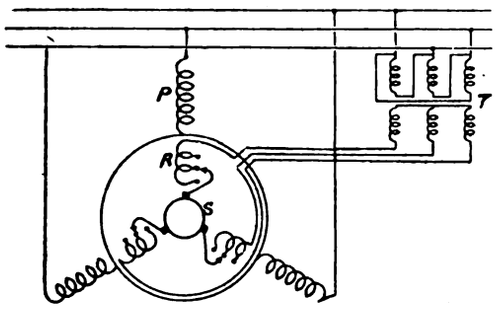

Fig. 1.—Allmanna Svenska-La Cour Winding for Variable-Speed Three-Phase Motor.

(a D.C. winding with commutator). Regulation is effected by varying the voltage applied to the rotor from R, and T represents a small transformer which supplies to S the E.M.F. required for brush rockers oppositely and by equal amounts (so that the axis of symmetry of the effective part of the regulating winding remains coincident with that of the stator phases), an E.M.F. is supplied to the secondary winding, which varies with the regulating turns between the *a* and *b* brushes. The motor speed then rises above or falls below synchronism. The light-load speed of the machine is given by $n = 60\ c/p \times (w_2 \pm w_s)/w_2$ (where c = frequency; p = pairs of poles; w_2, w_s = effective secondary and regulating turns respectively). The same formula is applicable to the La Cour motor (fig. 1), but whereas the frequency of the brush current is the line frequency in the latter case, it equals only the frequency of slip in the Schrage motor. Commutating conditions are, therefore, very different in the two cases.

Characteristics.—A Heyland circle diagram can be drawn corresponding to each brush setting. The conditions are more complex than in an ordinary induction motor, but, making certain permissible assumptions, it is possible to derive an equation for the circle diagram which agrees well with experimental results (see *Elektrotechnische Zeitschrift*, pp. 89-93, 1914).

TABLE I.—Symmetrical Brush Displacement.

11/3·7 kw., 200 v., 50 cycles, 1,500/500 r.p.m. Schrage motor.

Brush position.	Output, H.P.	Speed, R.P.M.	Power factor.
I	2½	1,580	0·6
	7½	1,540	0·87
	15	1,475	0·94
II	2½	980	0·55
	7½	940	0·81
	15	870	0·85
III	2½	550	0·52
	7½	350	0·7
	15	—	—

Table I shows the speed and power factor of an 11/3·7 kw., 1,500/500 r.p.m. (synchronous speed 1,000 r.p.m.), Schrage motor as a function of output for various brush settings. Very high power factor is obtained above synchronism, but at 500 r.p.m. the power factor falls to 0·65, assuming symmetrical brush displacement. If one brush rocker be displaced more than the other so that the axis of the regulating winding is displaced from that of the secondary winding (oppositely to the direction of rotation) at low speeds, much better power factor is obtained in the latter case, as shown by Table II, which refers to a 66/22 kw., 220 v., 50-cycle, 720/240 r.p.m. machine. By a suitable (complex) brush shifting device, it is possible to obtain unity power factor at full torque on each speed.

Asymmetric brush displacement improves the overload capacity as well as the power factor at low speeds, hence these motors

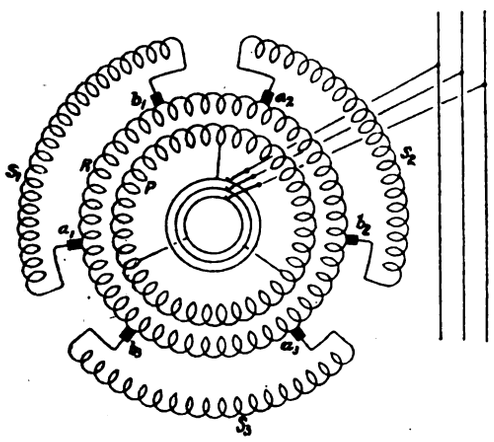

Fig. 2.—Winding of Schrage Patent Variable Speed Three-Phase Motor.

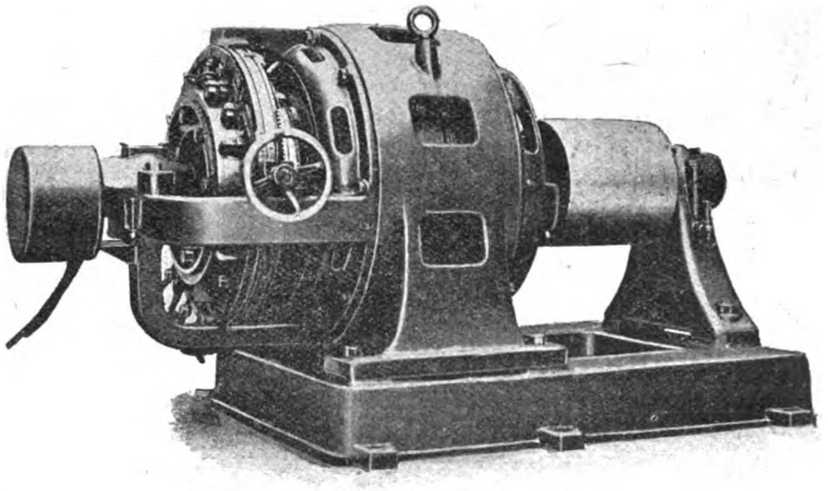

Fig. 3.—Schrage Motor of 37/9·2 kw. at 220 volts, 50 cycles, 800/200 r.p.m.

phase compensation. These motors are available with 1 : 4 speed range, but have hitherto found little application owing to their high prime cost; the controller is costly and complicated, particularly for wide speed range and fine regulation. The rotor pressure being low, the current is correspondingly heavy.

In a recent issue of the *Elektrotechnische Zeitschrift*, H. K. Schrage described a regulable three-phase shunt motor with simple brush-displacement speed control as built by the Allmänna Svenska E.A. under his Swedish patent 33,968. The new machine is cheap, simple and capable of continuous speed regulation over a wide range. Referring to fig. 2, P again represents the primary, R the regulating and S the secondary winding, but in this case P and R are carried by the rotor and S by the stator. The primary winding is fed through slip-rings from the mains; R is a ring winding with commutator, and S comprises three distinct phases, each connected across a pair of brushes on the regulator commutator. The *a* brushes are carried on one rocker, and the *b* brushes on a separate rocker.

If the brushes of each secondary phase are brought up to the same commutator segment, S_1, S_2 and S_3 are short-circuited, and the machine runs as an ordinary induction motor. On displacing the brush rockers oppositely and by equal amounts the motor develops a high starting torque without the connection of starting resistance in the secondary circuit.

TABLE II.—Asymmetric Brush Displacement.

66/22 kw., 220 volts, 50 cycles, 720/240 r.p.m. Schrage motor.

Brush position.	Output, H.P.	Speed, R.P.M.	Power factor.
I	15	730	0·80
	45	720	0·98
	90	690	0·99
II	15	500	0·43
	45	490	0·75
	90	475	0·81
III	15	300	0·92
	45	200	0·55
	90	—	—

Commutation.—Considering two motors of equal output, identical leading dimensions and arranged for 1 : 3 speed variation (50 per cent. above and below synchronous speed) by controller and brush displacement respectively, the commutator voltage is only half as

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great in the latter as in the former case. In the controller motor, the E.M.F. E_r induced, by the rotating field, between adjacent commutator bars varies directly with the slip, and is maximum at standstill and zero at synchronism. In the Schrage motor, however, E_r is constant at all speeds. Sparking is more serious at high than at low speeds in controller motors, owing to the influence of the commutating E.M.F. E_c; the latter is much smaller in Schrage motors, since the current to be commutated is only half as great, and since the regulating winding lies over the primary winding in the slots, which can, therefore, be widened at the top to reduce the inductance of the regulating winding. On starting,

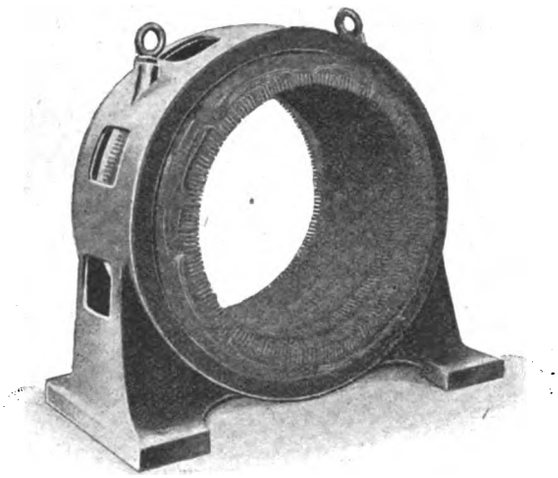

Fig. 4.—Stator of Schrage Motor.

the potential difference between bars is only half as great in the Schrage as in the controller motor; at maximum speed, E_r is the same in each case, but E_c is much smaller in the Schrage motor, which is, therefore, at least as good as the controller motor from the commutating standpoint under all circumstances.

Applications.—Schrage motors can be applied wherever regulable D.C. shunt motors would be applicable; the field of the latter is variable, but the field of a Schrage motor is constant, hence this machine yields the same torque at all speeds. One very advantageous application of the new motors is in works where only three-phase current is available, where constant-speed motors are chiefly required and where a few regulable machines are needed.

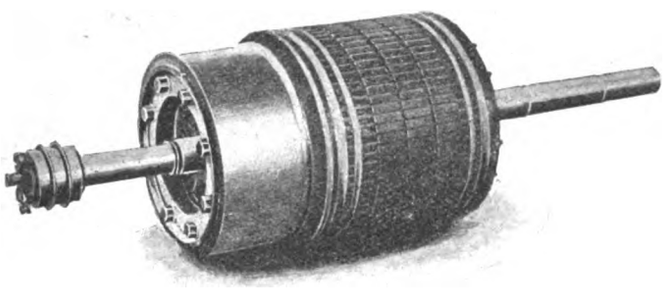

Fig. 5.—Rotor of Schrage Motor.

As compared with Ward-Leonard equipment, Schrage motors offer the advantages of lower prime cost, higher efficiency and less space occupied. If the torque required at the lower speed is small (as in fans), the motor may be arranged with symmetrical brush displacement. On the other hand, if the motor is to develop a high starting torque and to have a good overload capacity at low speeds, an unsymmetrical brush displacement can be arranged, at least in large motors. Small machines start well with symmetrical brush displacement. A large number of Schrage motors are said now to be in use in a variety of services. They are made by the Allmänna Svenska Elektriska Aktiebolaget, whose London office is at Norfolk House, Cannon Street, E.C.

TRADE STATISTICS OF EGYPT, 1913.

The following statement, showing the imports of electrical and similar goods into Egypt during the year 1913, is taken from the recently-issued trade statistics. The figures for 1912 are added for purposes of comparison, and notes of any increases or decreases are given:—

Rails.—	1912. £E.	1913. £E.	Inc. or dec.
From Great Britain ...	35,000	106,000	+ 71,000
,, Germany	60,000	20,000	— 40,000
,, Belgium	21,000	59,000	+ 38,000
,, Other countries ...	—	—	—
Total	116,000	185,000	+ 69,000

Steam engines, including boilers, etc.—	1912. £E.	1913. £E.	Inc. or dec.
From Great Britain ...	97,000	128,000	+ 31,000
,, Germany	15,000	7,000	— 8,000
,, Belgium	—	500	+ 500
,, France	4,000	8,000	+ 4,000
,, United States ...	1,000	500	— 500
,, Holland	2,000	6,000	+ 4,000
,, Italy	8,000	11,000	+ 3,000
,, Switzerland ...	5,000	2,000	— 3,000
,, Austria-Hungary ...	15,000	20,000	+ 5,000
,, Other countries ...	3,000	—	— 3,000
Total	150,000	183,000	+ 33,000
Electric machinery (including petrol and benzine motors).—			
Total	181,000	212,000	+ 31,000
Electrical machinery.—			
From Great Britain ...		15,000	—
,, Germany		8,000	—
,, Austria-Hungary ...	Not	3,000	—
,, Belgium	shown	6,000	—
,, United States ...	separately	3,000	—
,, France		27,000	—
,, Italy		3,000	—
,, Other countries ...		1,000	—
Total		66,000	—
Petrol and benzine motors.—			
From Great Britain ...		62,000	—
,, Germany	Not	31,000	—
,, Italy	shown	22,000	—
,, Switzerland ...	separately	29,000	—
,, Other countries ...		2,000	—
Total		146,000	—
Other machinery (except agricultural).—			
From Great Britain ...	88,000	103,000	+ 15,000
,, Germany	49,000	36,000	— 13,000
,, Austria	4,000	7,000	+ 3,000
,, Belgium	4,000	4,000	—
,, United States ...	42,000	30,000	— 12,000
,, France	39,000	36,000	— 3,000
,, Italy	3,000	5,000	+ 2,000
,, Switzerland ...	4,000	9,000	+ 5,000
,, Turkey	2,000	1,000	— 1,000
,, Holland	3,000	2,000	— 1,000
Total	238,000	233,000	— 5,000
Railway and tramway carriages.—			
From Great Britain ...	22,000	2,000	— 20,000
,, Germany	4,500	5,000	+ 500
,, Austria	42,000	21,000	— 21,000
,, Belgium	28,000	20,000	— 8,000
,, Other countries ...	2,500	—	— 2,500
Total	99,000	48,000	— 51,000
Lamps of all kinds.—			
From Great Britain ...	7,000	6,000	— 1,000
,, Germany	20,000	21,000	+ 1,000
,, Austria	32,000	29,000	— 3,000
,, Belgium	1,000	—	— 1,000
,, France	11,000	6,000	— 5,000
,, Italy	1,000	1,000	—
,, Sweden	6,000	7,000	+ 1,000
,, Holland	1,000	2,000	+ 1,000
,, Other countries ...	—	1,000	+ 1,000
Total	79,000	73,000	- 6,000
Copper manufactured.—			
From Great Britain ...	17,000	11,000	— 6,000
,, Germany	16,000	20,000	+ 4,000
,, Belgium	1,000	2,600	+ 1,600
,, France	18,000	17,000	— 1,000
,, Italy	7,000	6,000	— 1,000
,, Other countries ...	2,000	3,000	+ 1,000
Total	61,000	59,000	— 2,000
Copper, hammered, drawn or sheet.—			
From Great Britain ...	160,000	96,000	— 64,000
,, Germany	11,000	15,000	+ 4,000
,, Belgium	2,000	600	— 1,400
,, France	11,000	1,000	— 10,000
,, Other countries ...	—	400	+ 400
Total	84,000	113,000	— 71,000

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India-rubber and gutta-percha, raw or manufactured.—	1912. £E.	1913. £E.	Inc or dec.	
From Great Britain ...	8,000	12,000	+	4,000
,, Germany	16,000	15,000	—	1,000
,, Austria	4,000	4,000		—
,, France	12,000	8,000	—	4,000
,, Italy	3,000	10,000	+	7,000
,, Switzerland	1,000	—	—	1,000
,, Belgium	1,000	1,000		—
,, Other countries ...	1,000	2,000	+	1,000
Total	46,000	52,000	+	6,000
Electric, telegraphic and telephonic apparatus.—				
From Great Britain ...	57,000	46,000	—	11,000
,, Germany	20,000	25,000	+	5,000
,, Austria	26,000	15,000	—	11,000
,, Belgium	5,000	7,500	+	2,500
,, United States ...	1,000	1,000		—
,, France	13,000	19,000	+	6,000
,, Italy	3,000	3,000		—
,, Sweden	5,000	18,000	+	13,000
,, Switzerland	3,000	4,500	+	1,500
Total	133,000	139,000	+	6,000
Scientific instruments.—				
From Great Britain ...	17,000	20,000	+	3,000
,, Germany	16,000	21,000	+	5,000
,, Austria	1,000	1,000		—
,, United States ...	2,000	2,000		—
,, France	13,000	14,000	+	1,000
,, Italy	1,000	1,000		—
,, Switzerland	1,000	1,000		—
,, Other countries ...	2,000	2,000		—
Total	53,000	62,000	+	9,000

£E = £1 0s. 6½d.

THE ELECTRIC VEHICLE COMMITTEE.

In order to keep possible users of the electric commercial vehicle in touch with the advantages and developments in connection with it, it has been decided by the Committee to publish quarterly an official journal, the first number of which is expected to be available in October, when copies will be mailed free to town clerks, the heads of electric supply undertakings, city and borough engineers, medical officers of health, superintendents of cleansing departments, boards of guardians, railway companies, and others. announce contributions amounting to a little over £100 as having been already received or promised towards the fund for carrying on the Committee's work. For use outside charging stations and outside garages where charging facilities are provided, a final design of standard electric sign has been approved and will be published shortly.

The Committee is of opinion that in the case of lead batteries a voltmeter and an ammeter should be provided on electric vehicles for controlling the charge and discharge. Where, however, it is not proposed to remove the battery from the vehicle for the purpose of charging, and in cases where no constant attendance is provided during this operation, it is recommended that an ampere-hour meter should be provided in addition to the ammeter in order to show the condition of charge of the battery, and that provision should be made in connection with it for automatically opening the circuit when the battery is fully charged. An instrument is on the market which is provided with an auxiliary contact for this purpose. In the case of batteries of the Edison type, an ampere-hour meter is the only instrument which need be provided. The Committee considers also that a mileage recorder is a necessary accessory for judging the condition of the battery in conjunction with the electrical instruments, and for preserving accurate records of the working of the vehicle. The Committee has been informed that mounting these instruments direct on the dash-board has not proved satisfactory hitherto, and the latest practice in America is to have them fixed on a strong steel pillar well in view of the driver, and distinct from the dashboard.

Information as to charging equipments is being prepared for the Committee by two of its members who are representatives of the B.E.A.M.A.

Specification for Charging Plug, Receptacle and Cable.

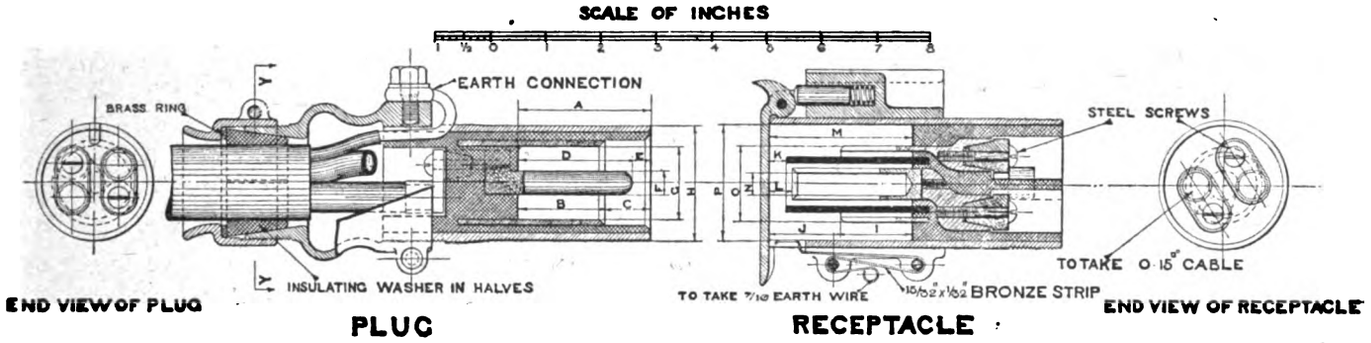
1. *Purpose.*—The plug and receptacle are recommended for standardisation, for use in connection with the charging of batteries of electric vehicles in charging stations, or in garages where charging current is available.

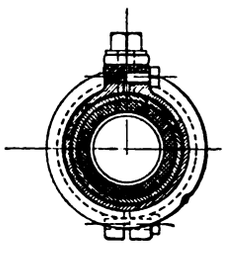
In order to ensure easy, quick and safe connection to the charging board, each battery vehicle should be fitted with the standard receptacle, and it is recommended that the latter should be placed in such a position under the front of the driver's seat that he will, of necessity, have to remove the plug, together with its cable connection, before he can take his seat and start the vehicle. It is recommended also that a standard receptacle and plug should be used to attach the charging connection (or cable) to the charging switchboard or charging circuit in the charging station or garage, so that, when not in use, the charging connection, with plug attached to each end, may be coiled away in a safe place.

The fixed receptacle, *i.e.*, that on the charging switchboard or circuit, should be in an accessible position and fixed horizontally.

2. *Capacity*—The plug and receptacle are designed to carry safely a current of 150 amperes continuously. They may also safely be used for boosting charges for an hour or two up to a maximum of 300 amperes.

Interruption of Circuit.—While the plug may, in cases of emergency, be used to break circuit with the comparatively low voltage for which it is intended, *i.e.*, in the neighbourhood of 120





CONTACTS MUST BE ACCURATELY CONCENTRIC TO INSURE INTERCHANGEABILITY

CAPACITY -150- AMPS	MEASURE	A	B	C	D	E	F	G	H	I	J	K	L	M	N	N	O	O	P
	ENGLISH Ins	2 3/8	1 9/16	13/16	2 1/16	5/16	+.438 -.437	1·406 1·403	2·10	1 13/16	1 3/16	5/16	7/16	2 23/32	·437 ·438	·422 ·427	1·404 1·406	1·418 1·421	2 1/8
	METRIC M/m	60·33	35·66	20·64	52·38	7·94	11·04 11·10	35·71 35·76	53·34	38·72	33·34	7·94	11·11	69·06	11·10 11·18	10·72 10·81	35·69 35·77	36·07 36·09	53·98

POLARITY- OUTSIDE CONTACT POSITIVE INSIDE CONTACT NEGATIVE

TERMINALS SHOULD BE LARGE ENOUGH TO RECEIVE 0·15" CABLE

TERMINALS ARE TO BE MARKED + AND - TO CORRESPOND TO POLARITY OF CONTACTS AS ABOVE

Charging Plug and Receptacle Recommended for Standardisation in Connection with Electric Battery Vehicles.

Electricity supply departments will be able to purchase, at cost, further copies for distribution amongst their consumers.

The Committee has in hand a series of mail cards dealing with the special features of merit of the electric vehicle.

The standard plug which the Committee recommends is specified and a drawing given herewith. This design is being submitted to the British Section of the International Electrotechnical Commission with a recommendation for standardisation.

At a meeting held on the 17th inst., the secretary was able to volts, it is recommended that the circuit should always be broken on a suitable quick-break switch provided for the purpose, and not broken on the plug.

Earthing.—It is recommended that the metal shell of the plug, as well as that of the receptacle and the framing of the vehicle chassis, should be efficiently earthed. To enable this to be done, the recommended standard design incorporates a special earthing contact finger on the receptacle. It is suggested that this contact finger should be made of hard-rolled phosphor-bronze strip. The

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fixed end of this finger is prolonged to form a socket terminal, into which a 7/16 S.W.G., or equivalent section, bare copper conductor can be sweated, the other end of the conductor being clamped to some part of the metal frame-work of the chassis, and, in the case of the charging board receptacle, being clamped to a common earth terminal which is efficiently connected to a water service pipe.

A three-conductor flexible cable should be employed, the third conductor being the earthing wire, the size of which should be equivalent to 7/16 S.W.G.

3. *Construction of Receptacle and Plug.*—The shell of both receptacle and plug should be made from solid-drawn mild-steel tubing, turned and bored to the dimensions specified on the accompanying drawing.

The bracket and cap for the receptacle are to be made in malleable cast-iron.

The spring plunger for keeping the cap closed over the opening of the receptacle, when the plug is not in place, is to be of hard-rolled brass rod, with a tempered steel helical spring in the socket at the back.

The malleable cast-iron bracket is to be bored out to receive the receptacle, the shell of which is to be turned smooth on the outside. The shell of the plug is also to be turned smooth on the outside, and finished bright, so that good contact may be made on it by the earthing contact finger of the receptacle.

The main contact pieces of both receptacle and plug are to be made of gun-metal, secured by being moulded into the insulating material, which latter should be capable of satisfactorily withstanding heat and moisture. The insulating material should also have ample mechanical strength.

The gun-metal cable lugs are to be provided with conical projections, which are to be made to fit accurately into the conical recesses in the backs of the contact pieces without bottoming in them. These cable lugs are to be fixed in place by steel screws, which should be of such length that not less than half of the length of the screw is in the tapped hole of the contact piece when the screw is fully home.

4. *Flexible Conductor, Cable Gripping Device, &c.*—Plugs for garages and charging stations should be provided with terminals and cable grips suitable for three-core flexible cable, having a sectional area of 0·15 sq. in. in each of the two main conductors, and not less than 0·0229 sq. in. (equal to 7/16 S.W.G.) in the third or earthing conductor. The approximate overall diameter of this cable is 1·75 in. For use in private garages in connection with cars fitted with lead plate batteries, it is not usually necessary to provide for the heavy boosting charges such as may be given to cars provided with Edison batteries, and, consequently, a smaller section of three-core flexible cable may be conveniently employed. It is, therefore, recommended that two alternative sizes of terminals and cable-grips should be standardised for three-core flexible cable having sectional areas in the main conductors of :—

(*a*) 0·10 sq. in.	Approximate overall dia.	1·5 in.
(*b*) 0·075 sq. in.	„ „ „	1·31 in.

(The third or earthing conductors always having the sectional area previously mentioned).

The design recommended for the cable-gripping device is indicated on the drawing. It consists of a sleeve made of either gun-metal or malleable cast-iron screwed on to the back portion of the plug. The sleeve is to have a terminal, as shown, to which the earthing conductor may be attached. The conical insulating split sleeve, forming the packing in the gland, must be made accurately to fit the cable.

It is recommended that the three-core flexible conductor should be provided with special hard rubber protection of the type known as cab-tire sheathing, which is a material now supplied by most British firms.

5. *Polarity.*—It is recommended that the centre contact of the plug and receptacle shall always be the negative pole.

Bennis Stokers.—Messrs. Edward Bennis & Co., Ltd., of Little Hulton, in their contract list for the past few weeks, report, in addition to a large amount of home business, orders for their machine-stokers from Switzerland, and for their chain grates with the new patent link for New Zealand and Constantinople. Messrs. Cammell Laird & Co., Ltd., of Birkenhead, who are particularly busy, have placed an order for four sprinkling stokers and self-cleaning compressed-air furnaces for 8 ft. dia. Lancashire boilers, together with an elevator and shoots to serve the machine-stokers. The municipal electric light and power stations of Rotherham, Worksop and Burton-on-Trent have placed orders for machine-stokers and self-cleaning compressed-air furnaces, and Manchester (Bloom Street and Stuart Street stations) for the re-linking of chain grates of another make. The list before us includes an imposing collection of contracts for stokers for woollen mills, steel works, dye works, oil works, chemical works and collieries.

Inert Cells.—We are informed that our reference to the new "Inert Cell" of Messrs. John C. Fuller & Son, Ltd., in our issue of the 11th inst., was slightly incorrect. The cell is not identical with the types which the company is supplying to the War Office and the Admiralty, but an improvement on these types. The company is willing to supply free samples of the new cell to large users

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

UNION OF SOUTH AFRICA.—The Customs Department of the Union of South Africa have notified a decision relative to the importation of wireless telegraphy apparatus. The general rate of duty leviable is declared to be 3 per cent. *ad valorem*, but there is a rebate of the whole of this duty on goods which are the manufacture of the United Kingdom or reciprocating British Colonies.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thomson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

19,506. "Electric condensers." W. H. Wilson. September 7th.

19,517. "Magnet-chargers." P. Lynch, H. Wochner, & F. W. Sauermann. September 7th. (Complete.)

19,538. "Electrophones." E. W. Schneider & E. H. Stolz. September 8th. (Complete.)

19,556. "Connections suitable for conduits containing electric conductors." J. W. Manley & W. J. L. Sandy. September 8th.

19,569. "Magnetos as applied to the ignition of internal-combustion engines." W. E. Dawson. September 9th.

19,587. "Electric-circuit interrupting means." British Thomson Houston Co., Ltd. (General Electric Co., United States). September 9th.

19,505. "Electric switches." F. B. Holt. September 9th.

19,598. "Electric switches." F. B. Holt. September 9th.

19,601 "Electrical switches or circuit breakers." F. B. Holt & E. O. Moller. September 9th. (Divided application on 23,247/13, April 14th, 1914.) (Complete.)

19,620. "Fittings for electric incandescent lamps and the like." W. E. Shuttleworth. September 10th.

19,630. "Apparatus and method for transient augmentation of voltage of electric currents." J. E. Taylor. September 10th.

19,637. "Terminals for electrical conductors." A. J. Hedgcock, E. C. Mann, & W. T. Henley's Telegraph Works Co., Ltd. September 10th.

19,674. "Dynamo-electric machinery." J. H. Potter & L. Perks. September 11th.

19,679. "Electric hand lamp." T. E. Dickinson. September 11th.

19,700. "Electric switches or circuit-breakers." F. B. Holt & H. Smith. September 11th. (Divided application on No. 24,593/13. October 29th.)

19,704. "Semi-automatic telephone systems." Betulander Automatic Telephone Co., Ltd., & T. Skerratt. September 11th.

19,705. "Telephone systems." Betulander Automatic Telephone Co., Ltd., & F. M. Ward. September 11th.

19,706. "Automatic and semi-automatic telephone systems." Betulander Automatic Telephone Co., Ltd., & D. C. Crowe. September 11th.

19,729. "Electric incandescent lamps." Deutsche Gasglühlicht Akt. Ges. (Augeres.) September 12th. (Convention date, September 13th, 1913, Germany.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

19,019. Train or like Signalling and Control Systems. F. W. Prentice & B. Starie. August 21st.

19,020. Train or like Signalling and Control Systems. F. W. Prentice & B Starie. August 21st.

19,249. Party-line Telephone, Telegraph or Signalling Systems. H. Hull. August 25th. (August 26th, 1913.)

19,388. Electric Switches. J. H. Tucker. August 27th.

19,669. Electrolytic Recovery of Metals from their Solutions and apparatus therefor. U. C. Tainton & M. F. L. A. Aymard. August 30th.

19,752. Electric impulse producing mechanism. Western Electric Co. (Woodward, acting for Western Electric Co.) September 1st.

20,618. Automatic Railway Signalling and the like. G. Mumford. September 12th.

23,137. Automatic Telegraph Transmitters. E. Thompson. October 13th.

25,795. Electrically-operated Diaphragm Horns and the like. W. A. Crosbee, F. S. C. Crosbee, and T. S. Rogers. November 11th.

26,367. Holders for Electrodes of Electric Arcs. H. Ayrton. November 17th.

29,070. Electrically-heated Utensils. W. F. Perry and Credenda Conduits Co. December 16th.

29,165. Telephone Transmission Systems wherein Reinforcing Repeaters are employed. A. S. J. Van Kesteren. December 16th. (December 19th, 1912.)

29,425. Globes for Electric Arc Lamps. T. Stave. December 20th. (December 23rd, 1913.)

1914.

767. Telephonic Systems. E. A. Graham & E. A. Sanftleben. January 10th.

1,062. Process for manufacturing a mass of Higher Oxygen Compounds of Nickel for use in the Positive Electrodes of Alkaline Accumulators. Svenska Ackumulator Aktiebolaget Jungner. January 14th. (January 16th, 1913.)

1,252. Electric Incandescent Lamps. G. M. J. Mackay. January 16th. (September 8th, 1913.)

2,118. Electric Griller or Toaster. G. Pate & A. R. Wood. January 27th.

2,624. Microphones for use with strong currents. Fratelli Marzi de G. B. (firm of). January 31st. (April 10th, 1913.)

2,924. System of Synchronising Electric Clocks. C. E. O'Kennan. February 4th. (February 5th, 1913. Patent of Addition not granted.)

4,010. Production of Electrolyte Matrices. J. H. Mullaly. February 16th.

10,061. Electric Furnaces. A. L. J. Quenau. April 23rd

12,641. Dynamo-electric Machines. N. W. Storer. May 22nd. (May 22nd, 1913.)

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THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

Vol. LXXV.] CONTENTS: October 2, 1914. [No. 1,923.

	Page
War, and the Neutrality of Science	449
Cables and Codes	450
Co-operation in Trade Expansion	451
German Agencies	451
Copper	451
Large Induction Motors: Some Features of Mechanical Design, by G. Moores (*illus.*) (*continued*)	452
Correspondence—	
German Culture	453
German Electrical Success: A Suggested Inquiry	454
Arbitrary Action of Public Authority	454
Capturing German Trade	454
Is "Earthing" an Extra?	454
New Electrical Devices, Fittings and Plant (*illus.*)	454
Reviews	455
Mechanical Charging of Blast Furnaces, by N. Kapp (*illus.*)	458
Coal-Cutting Machinery and the Output of Coal	460
War Items	464
The Osram Lamp Works (*illus.*)	463
The Crypto Electrical Co.'s Works (*illus.*)	465
Business Notes	467
Notes	472
City Notes	473
Stocks and Shares	474
Market Quotations	474
Problems of Industry, by "A Would-be Reformer"	475
Trade Statistics of Japan, 1913	477
Electrolytic Iron, by L. Guillet (*illus.*)	478
Utilisation of Heat Contained in Slag, by W. L. Johnson (*illus.*)	479
New Patents Applied For, 1914	480
Abstracts of Published Specifications	480
Contractors' Column ... Advertisement page	xviii

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WAR, AND THE NEUTRALITY OF SCIENCE.

SCIENCE is the common possession of humanity: it knows no distinctions of nationality or creed, it deals with fundamental verities, laws and relationships, its kingdom is not of this world only, it stretches to the confines of space and links us with the Universe.

The triumphs of Science are man's victories over Nature, her battles are for the advancement of mankind, her spirit is one of peaceful striving for the commonweal, and her ultimate aim is the conquest of Matter by Mind.

It is distressing at this time of international conflict to find that the neutrality of Science is in danger of being violated, and that a movement is on foot amongst men of science in Germany to divest themselves of distinctions bestowed upon them by British Universities and learned societies in recognition of the work they have done for mankind.

We expect from those who have climbed the steep paths and rugged ascents of the mountains of Truth, who have breathed the pure rare air of the heights, whose eyes have ranged the peaks of the Unknown, that they will bring with them some trace of the sublime calm of their surroundings, some gleam of the wide vision they have enjoyed, some sense of comradeship with those who have shared their labours and aided their efforts.

Let us see how far these expectations have been realised by some of our German colleagues: Dr. Lenard, Professor of Physics at Heidelberg, is credited in the *Hamburger Fremdenblatt* with the following expression of his views:—"Down, then, with all considerations for England's so-called culture. The central nest and supreme academy for all hypocrisy in the world, which is on the Thames, must be destroyed if the work is to be done thoroughly. No respect for the tombstones of Shakespeare, Newton and Faraday! We must realise that there can be no real peace with a highwayman until he has collapsed or has been destroyed."

This is by no means an isolated instance of the views held by men of science in Germany; indeed, it may be said to be representative of the opinions held by a considerable section of the German Intellectuals.

Comment is needless; the English attitude is well illustrated by the proceedings at the University of Melbourne on August 14th, on the occasion of the recent visit of the British Association, when on the conferment of honorary degrees the ovation of the afternoon was reserved for Prof. Johannes Walther, the distinguished German geologist. A perfect storm of applause greeted him as he came forward to take his degree, and it was renewed when Prof. Masson referred to him as a "worthy son of the great nation which has done so much to add to the sum of human knowledge."

In connection with the attitude of the German Intellectuals, it may not be without interest to ask ourselves how it comes about that such views can be held by men who may

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claim justly to be recognised as leaders in Science, Philosophy, Literature, or Art.

It is probable that no single explanation can be applied to all cases, but that many factors contribute to what is certainly a curious psychological phenomenon. War is due to an impulse of primitive character, and we must recognise that abhorrence of everything connected with the foe is a primitive impulse which even the kaleidoscopic changes in the combinations of the Powers of Europe during the past centuries have not dulled.

In some directions we feel this impulse ourselves, and are, therefore, in a position to understand it in others so far as it applies to material things, but when it invades the realm of the spirit, and is applied to science, literature and art, we can only regard it as being barbaric.

To this primitive childlike impulse of comprehensive antagonism some of the animosity displayed by the German Intellectuals must be attributed; there are, however, other factors which contribute to this result, which in the main are peculiar to German culture. Of these factors we propose to consider briefly the influence of the following:—(1) German educational methods; (2) the military system; (3) ignorance of the English character; (4) materialistic philosophy.

Throughout the curriculum of the German schools the importance of discipline and obedience to authority is strongly insisted upon, and these principles, together with Prussian military ideals and methods, are inculcated also in the compulsory military training to which the young manhood of the nation is subjected, and are further impressed upon the civil life of the community by numberless official rules and regulations.

The adult whose working life has been steadfastly devoted to some specialised branch of intellectual activity frequently turns in a time of sudden crisis to the ready-made political ideas which he received in his youth. With politics, as with religion, it is the early training that tells, and one often finds men who appear to reserve for these subjects a particular corner of their minds which is strictly partitioned off from the remainder of their mentality, and does not share in its development.

The Prussian military caste have succeeded in impressing their views upon the whole nation, and the people have accepted them with something of the docility and obedience with which they receive a word of command. Add to this a system of Government which is in no real sense a representative one, an autocratic ruler who believes as implicitly as did Charles Stewart in the divinity of his kingship, and a Press which is subservient to the governing classes, and we can hardly wonder at the ignorance of the aims and character of the English people which is to-day displayed in all quarters of the German Empire.

Lecky, in his "Rise and Influence of Rationalism in Europe," has pointed out that in a period in which all the virtues of an uncompromising partisan are cordially recognised, the higher virtue which binds men through a love of conscientious inquiry to endeavour to pursue an eclectic course when party and sectarian passions rage fiercely all round them, is not only entirely unappreciated but is almost impossible.

A period of this character has existed in Germany for the past decade, it has been nourished on the one hand by the "heaven-born" crusade of the Kaiser for the Teutonising of Europe, and on the other by the bestial gospel of brute force preached by Treitschke, Nietzsche and Bernhardi.

Whatever action our German colleagues may take in withdrawing from our ranks in the army of science, and whatever the material results of the war may be, let us not lose sight of the essentially spiritual character of the work of the man of science and of the engineer.

Materialism has lit the fires of Rheims and Louvain: let us recognise with Emerson that Nature is not fixed but fluid, that spirit alters, moulds, makes it. A corresponding alteration in things will attend this influx of the spirit; it shall draw beautiful faces, warm hearts, wise discourse and heroic acts about its way until evil shall be no more seen.

Cables and Codes.

A month ago we drew attention in these columns to the burden imposed upon British industry by the prohibition of cable telegrams in code. Various propositions were put forward at the time by firms with a view to securing the advantages of telegraphing in code whilst safeguarding the interests of the nation against the abuse of that privilege by our enemies, and alternatively we urged that a reduced rate should be charged for messages in plain language. The latter course has been adopted to a moderate extent by the Eastern cable companies in negotiation with the Government, as stated in our last issue, but the concession granted, which took the form of counting 10 letters as one word, cannot be regarded as of material value, especially as the use of telegraphic addresses is still prohibited. It is no wonder, therefore, that a great and growing agitation has sprung up in favour of further relaxation of the regulations.

The importance of free communication at cheap rates between this country and the Dominions, at least, was never greater than at present, when efforts are being made to secure the diversion of one-time German trade to our own factories, and the same applies with hardly less force to our communications with neutral nations in all parts of the world. Let it be granted that the risk of espionage is too great to admit of the use of codes in European countries, there still remains an enormous field in which trade can be cultivated by telegram, provided that the cost is not prohibitive.

We cannot help feeling that the abolition of codes is an ineffective precaution, out of all proportion to the enormous expense imposed by it upon British industry; the use of plain language is no bar to the ingenuity of an enemy who desires to convey valuable information to a confederate abroad, and indeed it is not improbable that the enemy's secret service provided for its use beforehand, as a "blind," for an open message naturally would excite less suspicion than one in cipher. We agree that if the employment of codes involves danger to this country, we must accept the situation no matter what the cost; but we doubt whether the desired object is attained by the authorities, and as a notorious example we may cite the telegram in "plain language" (!) by which a correspondent in South Africa announced the conclusion of peace terms to a London newspaper in 1902, under the nose of the censor. It is at present possible to transmit information by letter or by hand to neutral countries on the Continent, in the course of a day or two, whence it can be telegraphed to enemy countries; there appears to be little inducement, therefore, for a spy to telegraph by roundabout routes *viâ* Australia or India, at heavy cost.

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If, however, the use of codes is absolutely not permissible under any conditions, at least the rates for plain language should be reduced to the utmost possible extent, even if the Government has to subsidise the cable companies, and we see no valid objection to the use of telegraphic addresses. Unfortunately traders are wholly at the mercy of the companies, whose attitude can hardly be called patriotic. Provided that their cables are fully employed, and that their revenue is maintained at the normal value, in justice they can ask no more. They must not forget that the British nation pays for the protection of their cables from foreign attack. Under present circumstances it is probable that the traffic has greatly fallen off and the cables are comparatively idle—the patriotic course, then, is to lower the rates to such an extent that the cables are again fully occupied and the revenue no less than it was before the war.

Co-operation in Trade Expansion.

We have received communications from several electrical manufacturers who desire to take action co-operatively in some of the markets mentioned in last week's leader on this subject. We invite other firms to intimate their interest in the matter to us privately, so that they may be brought into touch with others similarly disposed. Nobody will be committed to anything by taking this step, our idea being purely to encourage likely parties to confer in a preliminary way. The willingness on the part of several firms to consider the matter in conference should induce others to take advantage of that frame of mind while it exists. In our view, it is not too early for businesslike deliberations to take place, so that suitable preparations may be made in good time. Indeed, information has reached our ears of magnificent engineering contracts that have been lately booked in a market which our firms have long desired to enter, the contracts referred to having been secured because of a policy of concerted action arranged some time ago by a number of firms. This success alone, coming during war-time, suggests that there need be no delay in taking definite measures. Furthermore, news is coming in from different directions showing that buyers in other countries are wondering why it is that when Germany cannot supply them British travellers are not already on the spot to take their orders. They taunt us with the remark that if placed in a similarly favourable position Germany would have flooded their countries with travellers. Of course they cannot be expected to appreciate the difficulties in which we are placed at home at the moment, but the criticism is worthy of notice and ought to stimulate our firms to conference even if they cannot immediately act.

German Agencies.

British manufacturers in various lines have been receiving numerous inquiries from the agents of German firms, who, being cut off from their regular sources of supply, are naturally anxious to obtain substitutes for their specialities which will enable them to fill the orders that they have in hand. With regard to these inquiries, a word of caution may not be out of place. We all hope to see the German imports permanently replaced by British goods as far as possible when the war is over and things have settled down again. In the meantime there is no reason why orders should be declined because they come from such quarters—subject to one proviso. The agents not unreasonably wish to fill their orders with goods resembling their standard lines as closely as possible, in order to maintain continuity in this respect and thus to facilitate the resumption of importation when circumstances permit, but we suggest that if this desire is acceded to, a great part of the benefit to British trade that may be derived from the war will be thrown away. To our mind it is important that British manufacturers should preserve the distinctive appearance of their products on all occasions, and should take care to incorporate their names and trade marks in the substance of the goods in such a way, by moulding them on castings, inscribing them on dials and charts, &c., that it will be exceedingly difficult to remove or to conceal the evidence of British origin. In this way the ultimate purchaser will be made familiar with the appearance of British goods, while he appreciates their quality and learns the makers' names, so that his future orders will be accompanied by the stipulation that they shall be filled from the same sources. If manufacturers do not seize the opportunity and insist on supplying typically British products in such cases, they will be playing into the hands of their enemies.

Copper.

The position of the copper market is far from being brilliant, and in the last week or two prices have gradually slipped to a lower level, with very little new business of a general character about. The production has been cut down to a phenomenal extent in all parts of the world, the average rate of reduction being fully 50 per cent., while a number of properties have ceased operations entirely, and there is good reason for believing that those at present at work will be put on shorter time yet, should it appear that there is an excess of metal being produced. At the moment it is too soon to be certain as to the position in this regard, but a close watch is being kept on events in this direction, and prompt action may be expected, should it turn out that the foundation of the market is still weakening. The extent to which output has been stopped, and the fact that so far it has not had any effect of a favourable character upon selling prices, is regarded with some apprehension for fear it betokens a still greater reduction in consumption than had been thought possible when the programme of restriction was arranged. The future is certainly obscure, but this much, at least, may be remarked, that at present, holders of commodities all over the world are much more concerned with turning their holdings into cash, than with any other consideration, and this must tell upon the course of prices. The leading American producers are not pressing material upon the market, for they appear to hold to the opinion that it is only a matter of time before the lessened quantity of material available will make itself felt; but this is a matter of faith, and there is not too much of this virtue about at this juncture. The main requirements which have come forward during recent days have been from the ammunition and war equipment makers, all of whom hold large State contracts on which they are working night and day, and these account, no doubt, for a heavy consumption of the metal, but the practical drying up of ordinary trade requirements is responsible for a very important contraction in the world's needs.

In all branches where the operations of peace are concerned, this indeed is an outstanding feature. The trade buying of all descriptions of manufactured copper is thus limited of course, and though a few orders have been booked from Colonial railways, &c., the total business doing is small. There are still material difficulties to be faced, too, in connection with the shipment of goods to markets overseas. Not only is there risk of capture by German cruisers, but there are many and manifold difficulties to be negotiated here in connection with the obtaining of permits for the goods to be cleared for overseas. This is a real trouble, and one which is much exercising the minds of makers and merchants, who find themselves rather awkwardly placed in connection with the execution of business for the East and elsewhere. The position, however, tends to improve in this respect. The outlook for the market is still indeterminate so far as the near future is concerned, though when financial conditions improve, and the reduced output can make itself felt, there will be a fresh complexion put on affairs no doubt. Meanwhile, as ever, war and its immediate consequences are decided bear points.

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LARGE INDUCTION MOTORS: SOME FEATURES OF MECHANICAL DESIGN.

By G. MOORES, B.Sc.Engineering.

I. *General Arrangement and Ventilation.*—One of the first points to be considered in deciding upon the general mechanical arrangement of a large induction motor is that of ventilation. The determination of the exact output of a new large motor for a given temperature rise is a matter of such uncertainty, that it is necessary to use every possible care in the mechanical design to see that efficient ventilation is provided for. Not only has the arrangement of the machine itself to be considered, but it is important to take into account also the external conditions under which the machine has to operate, as these may have a great influence on the performance of the motor.

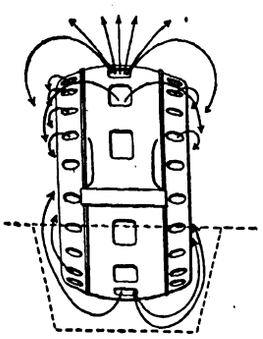

Fig. 1.

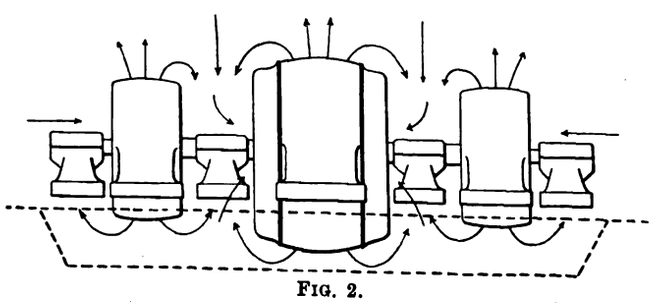

Fig. 2.

External Conditions.—The state of the atmosphere, the temperature and movement of the air around the machine, the proximity of other machines, the relative position of the machine with respect to surrounding objects, and the disposition of the air inlets and outlets of the motor, are all factors which affect the temperature rise and hence have a limiting influence on the output. It is advisable, if possible, always to locate a motor so that it can easily be supplied with plenty of fresh cool air, either by means of externally-fitted fans or by enclosing the air passages to the motor so that the fanning action of the rotating part, possibly with the assistance of internal fans, will cause cool air to be drawn in directly from outside or from some relatively cool part of the building in which it is situated.

It is also important to allow the hot air from the machine to escape easily, and to ensure that there is no possibility of its returning by a short path to the air inlet of the motor.

These considerations all affect the design of the motor

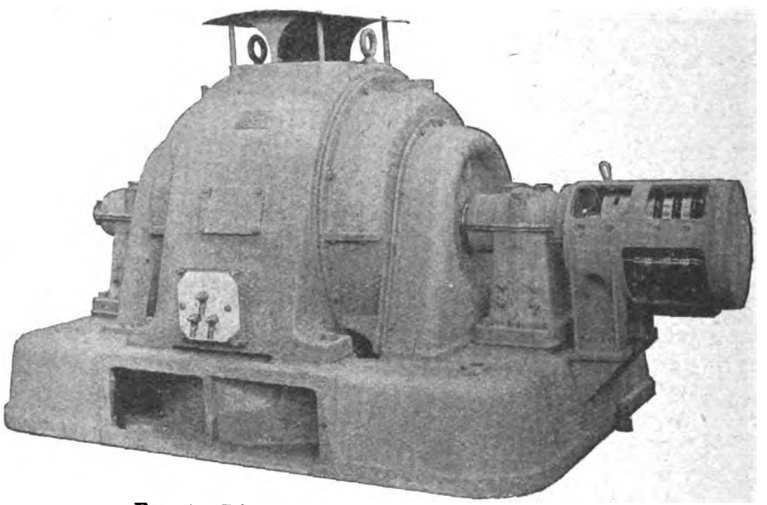

Fig. 4.—B.T.H. 700-h p. Enclosed Ventilated Motor.

itself. In the case of motors of small or moderate size, arrangements can, of course, be made to lead the air to and from the motor by means of pipes, for which arrangement the "pipe ventilated" type of motor is specially designed. For the largest motors, however, this is hardly feasible. These machines are usually of the "open" type, hence we find the arrangements made for their ventilation very varied and often very inefficient. An example of this is given by the case of an ordinary open-type motor placed in the usual way over a pit—fig. 1. The air enters at the sides through the end shields, and is thrown out at the periphery of the stator all round the machine. The result is that the pit becomes filled with hot air, which rises, and instead of escaping is drawn by the draught into the machine again, thus causing a current of more or less heated air to circulate continuously through the machine.

Or, consider again the not uncommon case of fig. 2—a motor driving a generator on each side of it. In this case the motor may draw in not only the heated air escaping from itself, but also that from the two generators.

To overcome such difficulties as these, the practice is becoming largely adopted of putting outlet ventilation holes only in the upper part of the stator frames, as shown in fig. 3. The heated air then, instead of accumulating in the

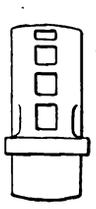

Fig. 3.

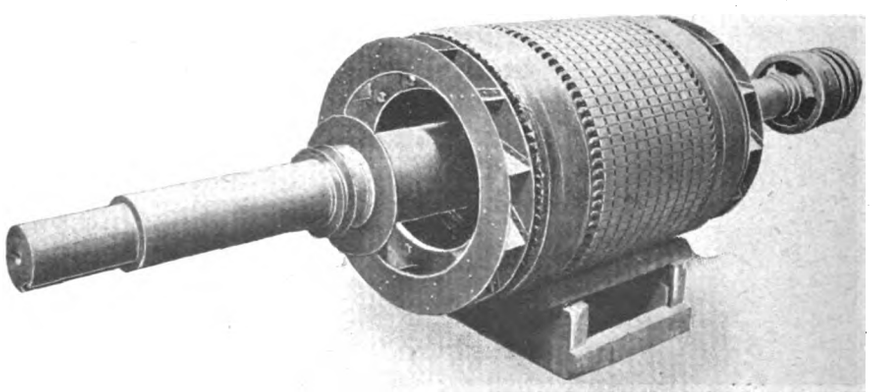

Fig. 5.—Rotor of 700-h.p. Motor.

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foundation or around the lower part of the machine, whence it would rise and re-enter the latter, can more easily escape upwards away from the motor.

Frequently the additional precaution is taken of constructing the foundations in such a manner as to ensure a plentiful supply of fresh air being obtained in them; for instance, by tunnelling to the pit from the outside of the building. When this is done, the motor, even if of the ordinary open type, is generally sufficiently well ventilated. A still further improvement may be effected, if necessary, by building the motor with enclosing end hoods, which fit over the end shields, and have an opening at or below the surface of the bed-plate, thus ensuring that all the air which enters the motor comes from the pit, or, at least, enters at the base of the machine, and by fitting enclosing covers over the bed-plate, or by specially constructing the latter, it can be further ensured that the heated air from the machine is separated absolutely from the cool air in the foundation from which the motor draws its supply for ventilation.

An example of the latter type of construction is shown in fig. 4, which illustrates a 700-H.P. induction motor by Messrs. The British Thomson-Houston Co. In this machine fans on the ends of the rotor—clearly shown in fig. 5—draw air through the ducts shown in the baseplate, drive it through the stator windings and discharge it through the opening in the top of the frame.

Internal Arrangement.—The arrangements which are made within the motor itself for obtaining good circulation of air are very varied, and such uncertainty exists as to the efficiency of various methods, that at the present time it may almost be said that the internal arrangement of the ventilation is a matter of individual taste. Experiment, however, seems to lead to a few conclusions which may serve as some guide in design. To take the most usual arrangement in which the air drawn through the rotor core cools both it and the stator core, and air drawn through the rotor windings cools both rotor and stator windings, the following conclusions seem to be indicated by experience. In the first place, it is generally of very little use to attempt to augment the amount of air flowing through the rotor core by fixing fans on to the motor shaft near the air inlet of the machine with the object of forcing air through the rotor. Fans of both the screw-propeller and centrifugal types have been tried in this connection, and whilst the latter were in particular cases of slight advantage, the former were generally a decided failure. Cases have been observed, however, where fans even of the latter type impeded rather than assisted the ventilation, and the performance of the motor was improved by removing the so-called fans.

The best results are usually obtained by making the fanning action of the rotor core as great as possible by supplying it with ample ventilating ducts and by fixing suitable air guides.

There are two faults in particular which easily occur in designing the ventilation of a motor unless care is taken to

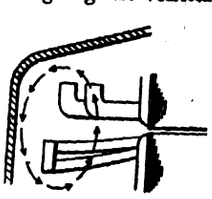

FIG. 6.

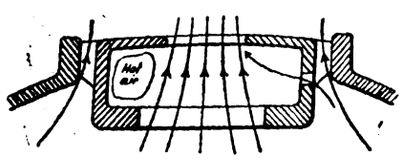

FIG. 7.

guard against them. The first is that of the formation of local air currents within the machine. An example of this is shown in fig. 6. Here the air thrown out by the centrifugal action of the rotor winding meets with a certain amount of resistance due to the stator winding and possibly narrow outlets through the stator frame, and instead of passing out it is deflected back again and re-enters below the rotor winding, thus forming a current of heated air which continuously plays on the two windings.

The second condition to be guarded against is that of the existence of pockets of heated air owing to the machine being so constructed that in certain parts of it the air does not get renewed at all. This fault is generally quite easy to overcome, once it is observed. Fig. 7 shows an example of it. It represents the air emerging from a stator frame. The left-hand side of the figure shows the manner in which a hot-air pocket may be formed, and the right-hand side shows how it may be prevented by drilling a few holes in the frame and allowing some of the air from the windings to pass through.

It is sometimes found when a machine is built that whilst sufficient air passes through it as a whole, the air is not well distributed, with the result that the core, say, may become overheated whilst the windings are well below the limit in temperature. Fig. 8 shows a method of construction designed to overcome this difficulty as well as that of

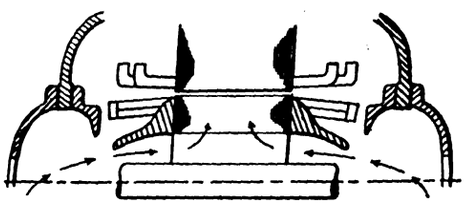

FIG. 8.

local air currents. It will be seen that the "tunnel" through the rotor core is extended almost to the ends of the winding, and this by reducing the cylindrical open area beneath the winding prevents an excessive volume of air being drawn through the winding instead of through the core. The possibility of the formation of local air currents is at the same time prevented by the fitting of baffles as shown. It will be seen that a current of air similar to that in fig. 6 cannot be formed with this method of construction.

Although fans fixed on the shaft designed to force air through the rotor are usually of very little assistance, on the other hand, fan blades attached to the rotor as shown in fig. 5, or even quite small blades attached to the rotor winding, with the object of cooling the stator winding, are usually of considerable value.

It is intended here to deal only with features of interest in the mechanical arrangement of machines; for valuable information dealing with the subject of ventilation from a more theoretical point of view the reader is referred to a paper on "Heat Paths in Electrical Machinery," by Messrs. Symons & Walker, contained in Vol. XLVIII of the *Journal* of the Institution of Electrical Engineers.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

German Culture.

I have been attacked for suggesting that a very scientific family of German origin, and mostly still German subjects, may not be altogether too friendly to this country.

These particular people have not, so far, given any indication of their sentiments; but let us hear what is written by the renowned Dr. Lenard, Nobel Prizeman, Fellow of the Berlin Academy of Sciences, Professor of Physics at Heidelberg University, and well known throughout the world as the discoverer of the Lenard Rays, the precursors of those of Röntgen.

Here is an extract from what he writes in the *Hamburger Fremdenblatt*:—

"Down, then, with all consideration for England's so-called culture! The central nest and supreme academy for all hypocrisy in the world, which is on the Thames, must be destroyed if the work is to be done thoroughly.

"No respect for the tombstones of Shakespeare, Newton and Faraday! The spirit of these great men has long ago passed into the souls of the living—and more so in those countries which England is trying to put down than in England itself. Down with all this! We must realise that there can be no real peace with a highwayman until he has collapsed or has been destroyed."

Here is another fine chance for thorough-going pro-German apologists.

A. A. Campbell Swinton.

London, S.W., *September 22nd*, 1914.

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German Electrical Success: A Suggested Inquiry.

[Although we felt compelled last week to suggest a closing down of the correspondence on "What Constitutes a British Firm?" we are quite prepared to devote space to helpful and constructive suggestions concerning the present situation and methods for dealing with it. The following is an extract from one such letter received before the writer was aware that the "Correspondence" was closed.—Eds. Elec Rev.]

The general trend of this correspondence makes it appear obvious that much of it has been animated by trade jealousies rather than by either patriotism or sound commercial instinct.

Supposing the outbreak of war between the same countries had taken place in the earlier stages of the electrical industry, in which so much valuable pioneering work was done by Germany, it seems to me the progression of this industry in the United Kingdom would have been put back a number of years if the advice of your correspondents to-day had then been acted upon.

If German competitors have succeeded in capturing a big slice of the electrical business of the United Kingdom and her Colonies, it would be much better for us to probe the commercial and economical causes, and immediately to set about putting British electrical industries on the soundest possible basis to enable them to compete successfully for future trade with all comers, rather than to try and set up a National bias, which is bound to die out after the war is over. British electrical manufacturers undoubtedly now have a fine opportunity, as, between sentiment at home and ruinous financial conditions in Germany, they will have a considerable breathing space in which to set their house in order.

In conclusion, I would appeal for calmer and more reasonable consideration of this question than has hitherto characterised some of the correspondence on this subject.

Dublin, *September* 23*rd*, 1914. T. G. A.

Arbitrary Action of Public Authority.

I think Mr. Purse's letter in reply to mine must be an example of those written in haste to catch the midnight post, to which you referred a week or so ago. The words "cowardly" and "sneak" are not such as a gentleman should use in a calm moment in objecting to a communication to the Press being anonymous. When I say that I am one of the wicked manufacturers in question, it will be evident that it would be absurd for me to reveal my identity. The authority in question will, no doubt, be in the market again sooner or later, and what chance should I have of obtaining an order if the inquirer knew I had written the letter which has aroused Mr. Purse's ire? The inquirer is almost certain to have seen the letter and could not fail to recognise the matter.

Mr. Purse omits to say whether he considers the authority acted correctly or not. I do not wish to be drawn into a discussion as to whether the I.E.E. conditions of contract are fair or unfair, but it is indisputable that they are much more equitable than some of the conditions (including those referred to in my letter) drawn up by purchasers. They do not, for instance, appoint the contractor sole arbitrator.

Being, as I mentioned above, a manufacturer, it is not within my province to reply to Mr. Purse's allegations as to the manner in which the I.E.E. conditions were adopted.

Mr. Purse apparently suggests that if we manufacturers are not careful, steps will be taken—presumably by the Government—to put us into what he considers our places. If we never do anything worse than insist on I.E.E. conditions, I think we can contemplate this possibility with equanimity. Meantime, I expect few people will agree that insistence upon these conditions justifies the placing of an order abroad.

Advocate of Patriotism in Time of Peace.

Capturing German Trade.

Are we not allowing ourselves to run away with this fascinating thought regardless of prudence?

No one doubts but that this country has the opportunity of benefiting for the present by business being diverted to her which would previously have been placed on the Continent, and that new markets will to some extent be available of which she has previously been deprived due to the unfair competition emanating from Germany. But the numerous suggestions of capturing German trade by taking up new lines of manufacture would seem to be largely ill-considered.

I venture to predict that six months after the conclusion of peace, the business community of this country, lacking all sense of patriotism where commerce is concerned, except in so far as patriotism lies in buying in the cheapest market regardless of all considerations excepting price, will resume buying German goods, if available. And only in the event of the Teuton ceasing to exist as a trading nation would there seem to be any justification for capital being invested in new industries as long as our policy offers capital no protection against unfair competition from outside.

For instance, whatever arguments may fairly be advanced in favour of encouraging foreign capital being invested in this country for manufacturing purposes, and to the extent of such operations treating these concerns as British, no arguments can surely be advanced for allowing, as we have done, German-controlled companies, by trading under the British flag to act primarily as stalking horses for their German factory, and under cover of the British company accepting British and Colonial orders which keep employed in Germany often many times the number of men employed in Great Britain. And yet our policy is to accept such acts as advantageous to the country.

Apart from the larger question of Free Trade *v.* Protection, manufacturers in this country will require to feel that the commercial policy of the country offers some protection before being able to induce capital once again to flow freely into her industries.

That the terms of peace, when they come to be drafted, may result automatically in removing some forms of unfair competition would not be surprising; but until this comes about it is difficult to see what security can be offered to capital in attempting, under our present policy, the creation of new industries.

E. J. Fox.

London, S.W., *September* 28*th*, 1914.

Is "Earthing" an Extra?

This question of "Extras" is as old as the hills with a certain class of wiring contractors.

They contract to lay cables and wire buildings with the best material, and finish in a workmanlike manner. When the work is finished, in what he pretends to think a proper manner, the contractor is quite surprised when told he must have continuity with his conduit, and cable armouring properly earthed, before he can have the power switched on. After a lot of hot words, heard and unheard, he earths the job to pass the requirements of the Home Office and the local authority.

Now we get to Stage 2 of the farce.

The consumers have been protected so far by the Home Office and the Local Supply Co. Why do not they make examples of the men who are in the habit of dissecting essential parts of the contract, and serving them up again in the form of extras? An authorised plumber might just as well start to charge an extra on a contract job for the red lead used on his pipe joints.

My advice to engineers up against this injustice of "Extra for Earthing," is to let the contractor sue for his extra and give himself the publicity he deserves, which I have no doubt will have the desired effect on his future orders, if he is fortunate enough to get any.

Inspecting Engineer.

September 26*th*, 1914.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Ediswan Heaters.

With the near approach of cold weather, the Edison & Swan United Electric Light Co. draw attention to the subject of electric heating, business in which they feel will be but little, if at all, affected by the war.

In particular they draw attention to their "Royal" heater, illustrated in fig. 1, which is constructed at their works at Ponder's End, Middlesex.

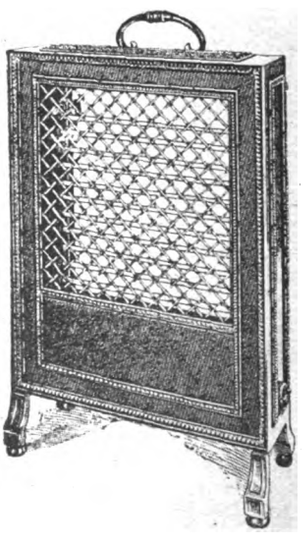

Fig. 1.—Ediswan "Royal" Heater.

The apparatus shown is constructed in brass, fitted with quartzalite heaters and is specially suitable for use in drawing rooms, boudoirs, convalescent homes, hospitals, &c.

A Converted Bar Mill.

In a recent example of a conversion from steam to electric drive, the mill was previously driven direct by a horizontal steam engine. This mill has three high roughing rolls and two high finishing

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rolls and guide train, and is engaged in rolling iron and steel billets varying between 100 lb. and 200 lb. in weight down to flat rounds, &c.

To convert to electric drive the steam engine was removed and replaced by a 30-ton fly-wheel, coupled to the mill shaft and rope-driven from a 500-volt direct-current compound-wound "Witton" motor of 300 H.P., running at an average speed of about 220 R.P.M. To enable the fly-wheel to do its share of the work, the motor was compounded so as to have approximately a 20 per cent. drop between no load and full load.

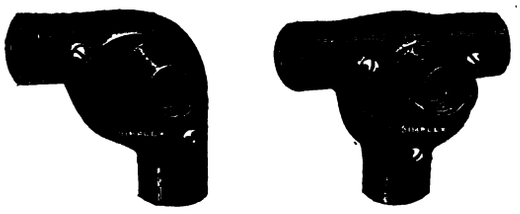
The motor is controlled by a switch panel provided with main switch, circuit-breaker, ammeter, speed regulator and multiple switch starter; with the exception of the circuit-breaker, which is at the top of the board and out of reach, the switchgear is fitted with protecting covers, and it is also interlocked so that the circuit-breaker, switches and starter must be operated in the correct sequence whereby accidents are prevented. In addition to this switchgear a push-switch is provided near the rolls by which the motor can be stopped in an emergency.

One of the owners recently said it was found (with the motor) that an increase of 20 per cent. in output was obtained, partly due to the greater regularity with which the train was driven, and, further than that, the quality of the work was better, due to the more regular speed which gave a more regular size of bar rolled. There was also a considerable economy in the matter of labour and in lubricating materials.

The energy for driving this motor is generated from exhaust steam, so that the power is obtained very cheaply. The electrical plant driving this mill was supplied by the General Electric Co., Ltd., of Witton, Birmingham.

Simplex Conduit Fittings.

Messrs. Simplex Conduits, Ltd., of 116, Charing Cross Road, W.C., have forwarded us one of their mailing cards referring to the Simplex outlet cover inspection bends and tees, which provide



Figs. 2 and 3.—Special Simplex Conduit Fittings.

an easy means of branching off from the main run of conduit to a light point and switch, and result in an exceedingly neat junction. These are made in ⅜, ½ and ⅝ sizes, and are illustrated in figs. 2 and 3.

Aster Generating Set.

The accompanying illustration shows a new type of direct-coupled generating set just put on the market by the Aster Engineering Co. (1913), Ltd., of Wembley, Middlesex. It consists of a four-cylinder high-speed single-acting petrol engine of 8 H.P., driving a 4½-KW. dynamo, with a water-cooled radiator mounted on the yoke of the latter. A large number of these have recently been supplied to the Government.

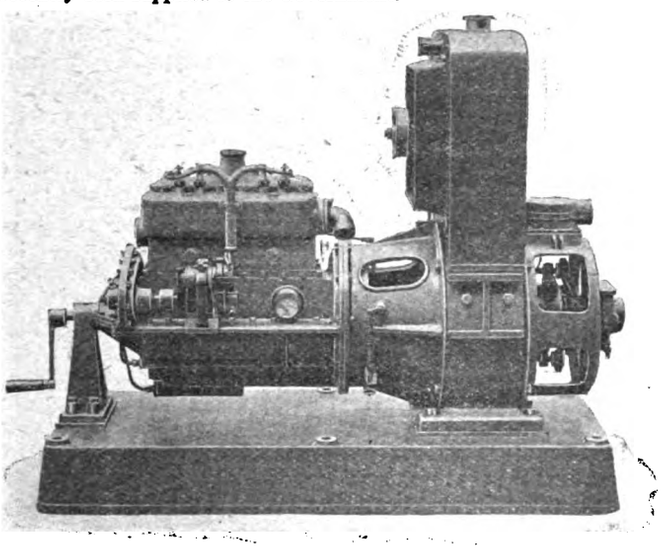


Fig 4.—Aster 4½-kw. Generating Set

As will be seen, the design is exceptionally neat and workmanlike; we understand that extremely silent running is a special feature of the set, which also runs without vibration. The speed is 1,225 R.P.M., and the gross weight of the set about 1,300 lb.; it is suitable for country house and yacht lighting, kinematograph theatres, &c., and can be provided with a paraffin carburettor or run on town gas if desired. A sensitive governor is fitted, and an oil circulating pump; the crank-case is of aluminium

REVIEWS.

Photo-Electricity. By A. L. Hughes, D.Sc., B.A. London: Cambridge University Press. Price 6/- net.

This work gives an account of electrical effects due to the action of light, so far as these have been ascertained. It is true that the whole subject is still very much in the experimental stage; nevertheless, a sufficient quantity of data has now been obtained to render a concordance of the results desirable and valuable. Practical men should remember that future great discoveries are likely to lie along the borderland of the sciences of physics, chemistry and electro-technics, and that for this reason they should keep a very observant eye upon the results of researches into this region. A great amount of experimental work is now being carried on all over the world, and we are indebted to the author of "Photo-Electricity," amongst others, for simplifying such results as have been obtained up to the present and putting them into readable and consecutive form.

Hertz, in 1887, was the first to note that a spark passed between metallic terminals in air more easily when light from another spark fell on the negative terminal. This effect led to a number of investigations by Hallwachs, Elster and Geitel, and others who found that electrified metallic conductors lost electrification when illuminated by a suitable source of light. It was afterwards discovered that the illuminated metal could lose negative but not positive charges. If the metal were initially insulated and uncharged, then it acquired a small positive charge, but the potential to which it rose did not exceed a volt. The effect on these metals was found to be due to ultra-violet light alone. With the alkali metals, on the other hand, experiment showed that the light of wave-lengths within the range of the visible spectrum as well as ultra-violet light was effective. The emission of negative electricity from an illuminated plate is now generally known as the photo-electric effect, and the theory which at present holds the field states that when light of suitable wave-length falls upon the surface of a metal sudden and violent changes occur to some of the atomic systems in the line of fire—changes so disturbing that one of the electrons leaves the system altogether. This electron—which is a negative unit of electricity and the smallest quantity of matter known to exist, having a mass but one-eighteen-hundredth part the mass of the hydrogen atom—alone can escape, and the positive charge necessarily associated with the parent atom remains in the surface. In the presence of a gas these electrons become ions. Experimental research also makes it pretty clear that each substance has a definite wave-length at which its photo-electric effect starts. Longer wave-lengths are useless, while all wave-lengths shorter are effective.

The author considers the ionisation of gases and vapours by ultra-violet light. Up to the present, experiments have been chiefly concerned with establishing the fact of this ionisation. Many questions still remain unanswered, such as the effect of temperature, pressure and mixture of gases. He then discusses the velocities of emission of photo-electrons and the total photo-electric effect, the latter including applications to radiometry, the results of temperature variation, the effect of an electric discharge on sensitiveness, and fatigue in presence of a gas and in vacuo. Much work follows on the photo-electron effect considered as a function of the frequency and state of polarisation of the light, and then there are chapters on the photo-electric properties of thin metallic films and of non-metallic elements and inorganic compounds. A few short chapters on dyes, on fluorescent and phosphorescent substances, on positive rays produced by light, and

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German Electrical Success: A Suggested Inquiry.

[Although we felt compelled last week to suggest a closing down of the correspondence on "What Constitutes a British Firm?" we are quite prepared to devote space to helpful and constructive suggestions concerning the present situation and methods for dealing with it. The following is an extract from one such letter received before the writer was aware that the "Correspondence" was closed.—Eds. Elec Rev.]

The general trend of this correspondence makes it appear obvious that much of it has been animated by trade jealousies rather than by either patriotism or sound commercial instinct.

Supposing the outbreak of war between the same countries had taken place in the earlier stages of the electrical industry, in which so much valuable pioneering work was done by Germany, it seems to me the progression of this industry in the United Kingdom would have been put back a number of years if the advice of your correspondents to-day had then been acted upon.

If German competitors have succeeded in capturing a big slice of the electrical business of the United Kingdom and her Colonies, it would be much better for us to probe the commercial and economical causes, and immediately to set about putting British electrical industries on the soundest possible basis to enable them to compete successfully for future trade with all comers, rather than to try and set up a National bias, which is bound to die out after the war is over. British electrical manufacturers undoubtedly now have a fine opportunity, as, between sentiment at home and ruinous financial conditions in Germany, they will have a considerable breathing space in which to set their house in order.

In conclusion, I would appeal for calmer and more reasonable consideration of this question than has hitherto characterised some of the correspondence on this subject.

Dublin, *September 23rd*, 1914. T. G. A.

Arbitrary Action of Public Authority.

I think Mr. Purse's letter in reply to mine must be an example of those written in haste to catch the midnight post, to which you referred a week or so ago. The words "cowardly" and "sneak" are not such as a gentleman should use in a calm moment in objecting to a communication to the Press being anonymous. When I say that I am one of the wicked manufacturers in question, it will be evident that it would be absurd for me to reveal my identity. The authority in question will, no doubt, be in the market again sooner or later, and what chance should I have of obtaining an order if the inquirer knew I had written the letter which has aroused Mr. Purse's ire? The inquirer is almost certain to have seen the letter and could not fail to recognise the matter.

Mr. Purse omits to say whether he considers the authority acted correctly or not. I do not wish to be drawn into a discussion as to whether the I.E.E. conditions of contract are fair or unfair, but it is indisputable that they are much more equitable than some of the conditions (including those referred to in my letter) drawn up by purchasers. They do not, for instance, appoint the contractor sole arbitrator.

Being, as I mentioned above, a manufacturer, it is not within my province to reply to Mr. Purse's allegations as to the manner in which the I.E.E. conditions were adopted.

Mr. Purse apparently suggests that if we manufacturers are not careful, steps will be taken—presumably by the Government—to put us into what he considers our places. If we never do anything worse than insist on I.E.E. conditions, I think we can contemplate this possibility with equanimity. Meantime, I expect few people will agree that insistence upon these conditions justifies the placing of an order abroad.

Advocate of Patriotism in Time of Peace.

Capturing German Trade.

Are we not allowing ourselves to run away with this fascinating thought regardless of prudence?

No one doubts but that this country has the opportunity of benefiting for the present by business being diverted to her which would previously have been placed on the Continent, and that new markets will to some extent be available of which she has previously been deprived due to the unfair competition emanating from Germany. But the numerous suggestions of capturing German trade by taking up new lines of manufacture would seem to be largely ill-considered.

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E. J. Fox.

London, S.W., *September 28th*, 1914.

Is "Earthing" an Extra?

This question of "Extras" is as old as the hills with a certain class of wiring contractors.

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Inspecting Engineer.

September 26th, 1914.

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In particular they draw attention to their "Royal" heater, illustrated in fig. 1, which is constructed at their works at Ponder's End, Middlesex.

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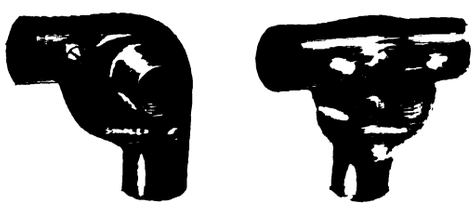
Simplex Conduit Fittings.

MESSRS. SIMPLEX CONDUITS LTD. of [illegible] W.C., have forwarded us one of their [illegible] the Simplex outlet cover inspection [illegible]



FIGS. 2 AND 3.—SPECIAL SIMPLEX [illegible]

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Aster Generating [illegible]

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William Thomson, afterwards
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n's methods, and brought the calculus
the strictly guarded pedestal on which
posed as an object of veneration to make
more a useful tool for the study of nature,
ended by its makers.

books of the type of which the present volume is
very excellent example are among the fruits of
this work. It is written for the average type of
engineering student who has no aspirations towards
becoming a mathematician, and who studies the
calculus solely with the view of acquiring such a
working knowledge of it as will enable him to carry
out such calculations as he may expect to have to
deal with habitually in his professional work, and
to follow intelligently such professional treatises -

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on sources of light used in photo-electric experiments conclude the work.

The book goes very thoroughly into all modern experimental research related to its subject, much of this research being due to the author himself. The whole question of the action of light on the electrons of the atom is important and may have valuable and far-reaching results, and we consider the author is to be heartily congratulated on the lucid manner in which he has dealt with it.—W.J.C.

Water Turbines. By Ing. Johann Hallinger. Munich: Verlagsanstalt Joh. C. Huber.

With characteristic Teutonic thoroughness, Herr Hallinger sets out opposite to the German text of his treatise excellent translations in both French and English. His object, apparently, is to show that most hydro-electric power stations are not laid out to the best effect. Nowadays, certainly, it does happen that with larger machines proportionately higher building costs have to be confronted. To enable the proportion to be adjusted the author describes new hydro-electric buildings that are 40 per cent. cheaper than those with the ordinary lay-out. Not only this, it is claimed that the installation of the machinery is simplified and its working capacity increased.

Briefly, the idea is to do away with right-angled gearing between the turbine and the dynamo and to have both units direct-coupled and all in one plane. Not only one, but two turbines running in tandem, or even three all on one shaft, can be used, an arrangement that Herr Hallinger claims "enables turbine and dynamo constructors to produce the most practicable and cheapest sets of machines." The row of turbines is placed at right angles to the flow of water, thus giving a simpler building than if they were parallel with the stream. The new arrangement is claimed to be suitable for small or large power stations with falls of from 10 to 100 feet.

The author's monograph is replete with diagrams, plans and photographs of actual stations built on these lines, and calculations showing the savings effected in construction and operation, and is worthy of study by electrical engineers interested in water power schemes.

Electro-Thermal Methods of Iron and Steel Production. By John B. C. Kershaw, F.I.C., with an introduction by Dr. J. A. Fleming, F.R.S. London: Constable & Co., Ltd. Price 8/6 net.

Electric furnaces for use in the metal industry seem at last to be coming to occupy the position that common sense dictates they must ultimately reach now that this type of furnace has proved its importance in conjunction with the open-hearth furnace, Bessemer converter and blast furnace.

In his very useful volume on this subject, Mr. Kershaw wisely directs the attention of his readers towards the practical application of electric heating in the iron and steel industry rather than to the theory of the subject which, after all, would interest only a small class—the designers and constructors of large furnaces. By keeping to accounts of actual installations—often very difficult to learn of, by the way—and of methods of operation of the various types of furnaces described, and by giving summaries of working costs and tests of raw materials and finished steel, the author has rendered a useful service, particularly to the average steelmaker.

Mr. Kershaw has no axe to grind, so he is able to describe and discuss the many types of furnaces and processes quite impartially. By virtue of his position in this respect he has been quite successful in securing the active assistance of the makers or inventors of practically all the well-known electric furnaces, such as the Héroult (the recent death of the inventor of which is so much to be regretted by the electrical and metallurgical world), Girod and Stassano. These are the most widely used furnaces, there being over 50 of the former and 20 of the Girod type now in successful operation. As might be expected, the lack of suitable water-power causes this country to occupy a low position in the lists prepared by Mr. Kershaw to show where the various types are being employed. Germany would seem to be in the forefront, with the United States taking second place. Both of these countries are large users of electric steel rails, five thousand tons of which have been laid on railway tracks out in the Western States of America, and it is reported that not a single electric rail has failed. Similarly good reports have been received by the author regarding German rails made from electric steel, and he surmises that "the savings resulting from their longer life and greater freedom from breakage may more than counterbalance the extra cost of the electrical treatment." Such steel must obviously be more costly than ordinary steel, since it is simply Bessemer or open-hearth steel subjected to special heat treatment in a neutral atmosphere. Rail steel and construction steel is usually produced in the Héroult type of furnace. As regards cost, Mr. Kershaw, speaking of the latter type, makes the interesting statement that "at Sheffield, where the cost of electric power (as generated from coal by the Corporation Electricity Works) is .48d. per KW.-hour, the cost of refining molten metal will probably run between 4s. 6d. and 8s. 6d. per ton, and when cold scrap is used as raw material for the electric furnaces, the costs will rise to between 19s. and 21s. 6d. per ton." Other types of electric furnace described are also being used in Sheffield, particularly in the manufacture of the alloy steels required for tools and projectiles, for which Sheffield is justly famed, and which it is hoped will at least be equally as satisfactory, both technically and financially, as the steel made by the older methods.

Steam Pipes: Their Construction and Maintenance. Manchester: The Vulcan Boiler and General Insurance Co. Price 1/-.

This book contains the digested experience of a boiler insurance company in the important detail of steam pipes. Accidents to steam pipes have been far too frequent for anyone to entertain longer the opinion that pipes are a negligible item in steam engineering. Until quite recently steam pipes were of cast iron. As pressures rose they remained of cast iron, but were merely made thicker. For modern pressures the material is unsuited, and pipes have for some years been made of wrought iron or steel, but the valves and junction-pieces were still of cast iron, but very thick. Especially with the high temperatures that go with high pressures and with superheat on the top of these, the stresses in steam pipes have been increased in a double ratio, and expansion has now to be specially provided for. Steam pipes must, says this book, be regarded from six special points:—A sufficiency of area to carry the steam without undue loss of pressure-head—a matter which entails cost and loss of heat if overdone. Full discharge of water must be provided for; expansion and contraction must be allowed for without producing creeping; and, without sacrificing these, the pipe must be supported and provision made to prevent vibration and strain from any cause; the pipes must be strong enough to carry the pressure within them, and they must be protected from heat losses.

The first consideration is a matter of proper choice of velocity. Loss of heat is a matter of velocity very largely, but larger diameters than necessary cause loss of heat; the two losses must be worked out to give a minimum net loss, and

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some extra pressure loss may be allowed for short periods for a big demand, rather than incur the constant loss of heat from larger pipes half employed.

The calculated velocity for steam at 200lb. should, it is said, be limited to 60ft. per second, and exhaust pipes may carry steam at even 350ft. per second.

Experiment is called for to determine the losses due to the friction of excess velocities, rough surfaces, changes of direction and excessive condensation. As to drainage, it is recognised as foolish to attempt the obsolete practice of draining back to the boiler, for what can gravity effect in a nearly horizontal pipe as compared with the drag of the rushing steam? An illustration is given to show a case which would cause water hammer. There are some good illustrations of water separators and comment on their faults and virtues, a specially commended one being inclined and apparently capable of fulfilling all that is claimed for it.

As to material for pipe, cast iron is rightly condemned. It is neither elastic nor fully sound and rarely of even thickness all round. It is permeable to liquids and is liable to ultimate disintegration, especially with superheated steam. It is also liable to increase in bulk when heated to 530° F. and even to 430°. Nor is copper a safe metal, especially when brazed; and copper loses half its strength at 700° F. Steel only remains, and even this is not always safe for lap-welds are apt to be cold shut. Many pipes are riveted. Even if this reduces the nominal strength of a pipe one can at least know that it can be relied upon up to what percentage of strength rivets will give.

Between 32° and 212° cast iron expands 1-900th. Between 32° and 366° it expands 1-500. Hence the rule for expansion in inches E = difference of temperature Fahr. degrees × length in feet ÷ 13,500. For steel the divisor is 11,000 to 14,000, and for copper 9,000. Thus the expansion for steam at 150lb. works out at 2.67 inches per 100 feet, and the same steam superheated to 500° would cause an expansion of 4 inches.

It is advised to make each section of pipe short by one-half the calculated expansion.

Illustrations are given of expansion bends and other details. Some steel alloy is hoped for which will have a very low co-efficient of expansion. Nickel steel—invar metal—is already known to have an expansion of nearly 0. But sad to say, invar will not stand high-temperature steam. It is an alloy of iron 64, nickel 36, and its expansion is not quite nil, but one-twentyeighth that of plain steel and survey tapes may be used if made of invar without any need for temperature correction.

Chapter VI deals with jointing and materials for the same, and a warning is sounded against attempting to remedy a leak by the spanner—a risky proceeding unless done by a man of experience with a new joint at a pressure much below the normal. Once set, it is criminal to carry out such tightening of a joint under pressure.

The next chapter treats of suspension and support by sling rods and brackets, and gives a table for suspension springs of ¼in. to ⅝in. steel such as are suitable to give a slightly elastic suspension at each hanger. Such springs should be ferruled as a guard against overload. A section deals with vibration. Rollers, good in theory, fail in practice very frequently. They ought to be self-clearing of dust in our opinion, and their axles ought to run on raised paths without control except at the end of the possible run. They should not run in bearings, which may rust up.

It is probably better practice to have rubbing-strips secured to the pipe, the strip to run on a fixed bracket. Such strips have considerable friction yet are free to move while not allowing vibration.

In Chapter VIII exhaust pipes are treated, and a caution is given as to the dangers of all pipes under external pressure, or filled with vacuum as it is quite usual to say.

On valves it is said, and we are glad to note it, that valve cases or bodies should be of steel. Otherwise this chapter appears to be a description of the valves of one maker. The conical ajutage valve, first described in the columns of the Elec. Rev., is here credited to the Messrs. Hopkinson. What they did was to put in the lower projection to make an eddy preventer, but the original invention of conical ajutage valves was not theirs, but was made by an engineer on the ground that the use of full-sized valves was too costly, and that steam would pass rapidly through small-way valves without serious pressure loss.

The Calculus for Engineering Students. By J. Graham. London: E. & F. N. Spon, Ltd. Fourth Edition—Price 5/- net.

The processes of differentiation and integration dealt with under the designation of "The Calculus" were devised independently by Newton and Leibnitz as the simplest and most appropriate means of dealing numerically with problems of velocity and acceleration, of particles singly or aggregated into the masses we call material bodies, that is to say, of reducing them to forms susceptible of calculation. Every engineer has to solve such problems in his professional work, and the engineering student therefore has to learn to solve them. By restricting the field of his operations within somewhat narrow limits he may solve a considerable number of such problems by what mathematical teachers of a past generation used to call elementary methods, but which were in reality incomparably more laborious than the simple and more appropriate methods of the calculus. But the Cambridge teachers had made a fetish of the calculus. It was the formal portal giving entrance to the Higher Mathematical Analysis. Cambridge students were classified into men who understood the Differential Calculus and the men who did not, and before they were allowed to enter these sacred portals they were compelled to learn and practise the many complex and devious methods devised by teachers for avoiding the use of the far simpler methods invented by the two great master builders of modern dynamics. The sacred ground was further fenced against the common herd of practical men who studied dynamics, not as a system of mental gymnastics, but for the purpose of applying their knowledge to the more prosaic end of earning their bread by applying their knowledge of nature to the satisfying of the material wants of their fellows. For the elementary text-books of dynamics were written for the elementary work of the mathematical schools, while the more advanced treatises were to all intents and purposes mere exercises on the calculus, largely taken up with the solution of problems devised merely as such exercises, and bearing no relation whatever to the observed laws of nature. Long and strenuous efforts on the part of Professor William Thomson, afterwards Lord Kelvin, and Professor Tait, admirably seconded by James Clerk Maxwell and others, ultimately overthrew this artificial system, took us back to Newton's methods, and brought the calculus down from the strictly guarded pedestal on which it had been posed as an object of veneration to make it once more a useful tool for the study of nature, as intended by its makers.

Books of the type of which the present volume is a very excellent example are among the fruits of this work. It is written for the average type of engineering student who has no aspirations towards becoming a mathematician, and who studies the calculus solely with the view of acquiring such a working knowledge of it as will enable him to carry out such calculations as he may expect to have to deal with habitually in his professional work, and to follow intelligently such professional treatises and

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original papers as he may find it to his advantage to study. And the student who works through this little volume will very seldom find himself at fault in either respect. The present edition has been so much enlarged and so extensively re-written in the light of the author's ever-growing experience of the requirements of his engineering pupils as to make it practically a new work, and yet better than a new work, for every page, both of text and of examples to be worked out by the reader bears evidence to its being no mere compilation, but a true growth, developing in response to the stimuli furnished by the needs of the engineering students at the Finsbury Technical College.

Two brief introductory chapters recapitulating algebraical, trigonometrical, and geometrical formulæ and results of primary import to the students of the calculus, must be regarded by him merely as recapitulations, and not as sufficing for foundations of his knowledge of the subjects. Nine chapters are then devoted to the development of the simpler aspects of differentiation as required by the average engineer, followed by six on integration. Chapter XVIII deals with the expansion of periodic functions, so essential to the electrical engineer, in which Fourier's Theorem is very simply dealt with as a tool for use, omitting, of course, all demonstration of its validity and of the limitations of its use, which the engineering student must take on trust from the mathematician unless he continues his mathematical studies to the extent of becoming himself a mathematician. Then follow chapters of practical applications, with a useful one on the use of Hyperbolic Functions, and five chapters on the simpler types of differential equations with which the engineer mainly has to deal, and which can be dealt with by the aid of a merely elementary mathematical equipment. Two chapters on applications of the calculus to functions of more than one variable, including problems of maxima and minima, a collection of well selected miscellaneous examples, and a good index, conclude a little handbook which may be confidently recommended, both to the average engineering student who will rest content with the knowledge of the subject which can be acquired by conscientiously working through it, and to the exceptional student, who may use it with advantage as a stepping-stone to a deeper and wider study.

G. W. de T.

MECHANICAL CHARGING OF BLAST FURNACES.

By N. KAPP (Birmingham.)

(*Abstract of Paper Contributed to the* Iron and Steel Institute, *September*, 1914.

In order to convey large quantities of material in a given time, the conveyor must run continuously in one direction without stopping, the empty vessels returning to be refilled. The only way to get a continuous stream of charging material from the bunkers to the hoppers without recharging is to split up the charge into a number of small units, and to run them in an unbroken line past the coke-ovens and bunkers, up to the hoppers, and back again to the charging stations.

The chain conveyor is bound to one plane. If it travels up to the furnace mouth and down to the charging platform, it cannot travel sideways as well. But the bunkers or coke-ovens are probably situated in quite another part of the ground, and to reach them the conveyor would have to pass round many corners. This applies more especially to old existing plants in which new methods of conveyance are to be installed. In the case of such works, which will be the most usual case in England, the conveying plant must possess the greatest adaptability to the local conditions. The advantages of a bucket conveyor can, however, be retained by splitting up the chain into separate detached links, and supplying each link with motive power of its own. Such an arrangement is the electric telpher. Here we have a means of conveying material from the most distant and inaccessible places in an unbroken line to the furnace mouth.

The principle of the plant is the same as the old miner's tub pushed by hand, the men who pushed them being replaced by small electric motors which act entirely without supervision from the moment they are sent on their way from the coke-ovens and ore bunkers to the moment they arrive at the hopper platform and range up round the hopper. All that is left for the men to do is to knock up a catch and empty the skips into the hopper, pull a switch and send the empty cars on their way back to the bunkers.

I will confine my description to the Bleichert system of electric telphering for charging blast-furnaces.

The telpher consists of a traveller fitted with an electro-motor, which receives current (usually direct current at 110 volts) by means of a bow collector and a line wire. The skip is suspended from the traveller by a couple of hangers, and is slung in pivots in such a manner that it is in unstable equilibrium when full, and therefore upsets as soon as the catch is knocked up. When empty, however, it is unstable in an inverted position, which makes it very easy to right the skip and throw in the catch. The working of the line being entirely automatic, it is necessary for the safety of the cars to introduce a block system, similar to that on a railway, but entirely self-acting.

For this purpose the telpher line is divided into a number of sections, each section receiving current over a switch. The switches are of a drum type, and are turned by the passing of a car in such a manner as to cut off the current from the section it has just left. At the same time the switch gives current to the section which was deprived of current before, so that there is always a dead section behind every car, and no second car can approach closer than the length of one block section. The number of these sections and block switches depends upon the output of the line. Greater output means more telpher cars and more sections, so that the cars can move closer together. Herein lies a great advantage of this system, namely, the ease with which a telpher plant can be extended if a greater output be desired. To double the output subsequently, all that is necessary is to cut the line into twice as many sections, put in twice as many block switches, and run twice as many cars as before. The limit to the extension is given by the shortest possible distance allowable between two cars. Experience has shown that this distance is about 12 metres on an open track. At the charging stations or in a siding, 3 metres are ample: 12 metres are, however, necessary where there are points and crossings, to give time for these to work before the next car is ready to enter them. Otherwise a great deal of unnecessary stopping and starting would occur all along the line.

The block switches, which effect the blocking and releasing of the cars (fig. 1), are no different in principle from those to be found in every hotel bedroom, one at the door and one

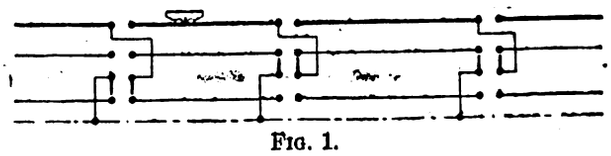

Fig. 1.

over the bed. If we switch on at the door, we can switch out at the bed, and *vice versa*. This is just what the car does. It switches off the section it has just left, and switches it on again when it reaches the next section. By means of this simple switching system it has been possible to solve the most complicated problems of interblocking at switches and crossings, of automatically turning the points, and so forth.

The principle underlying the block system in a siding is as follows (fig. 2):—

If the line *a* is cut out by a car turning switch A, it must

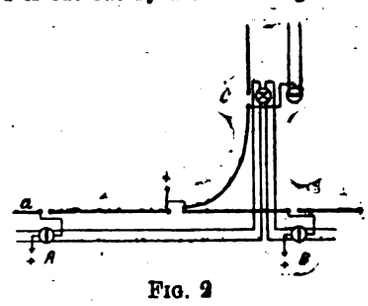

Fig. 2

be given current again when the car reaches switch B, or, if the points are set accordingly, when it reaches switch C. The supply of current to *a* must therefore be controlled from two places, B and C.

C is an ordinary reversing switch. Suppose B and A are in step: and supposing a current to pass from B to A *via* C, using the upper lead, then this current will be cut off on a car passing switch A, which throws the switch blades on to the lower lead. In order again to supply current to A, the switch blades of B may be thrown on to the lower lead by the car passing B, or the upper and lower leads may be crossed against each other by the car passing C. In that case the current will pass from the upper lead at B through the reversing switch into the lower lead at A, and into the line.

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The switch gear is totally enclosed, and thus unaffected by weather conditions. The greatest advantage of this system, however, lies in its safety. Should a switch become defective by breakage or some such cause, the contacts can never jam in such a manner as to give current to a section that should be blocked. They can only fail to release a section which has already been blocked by the previous car, and thus cause a stoppage of cars all along the line, which will immediately be noticed.

At the bunkers and charging stations the line is divided into a number of short sections, so that a number of empty skips can wait for filling just outside the stations. Each car, as soon as it is charged, is sent on its way by giving current to the section on which it stands by means of a pull switch. As soon as it turns the block switch at the end of this short charging section, all the cars waiting outside the station move up by one section.

The most important part of the plant is the ropeway incline, and a very neat method of automatically coupling the cars to the running rope is the automatic gripping device invented by Adolf Bleichert. The principle underlying this invention is that of letting the weight of the car act directly on the grip of the rope. Fig. 3 shows the principle, omitting constructive details.

The gripping jaws are like the jaws of a nut-cracker. One arm of the nut-cracker goes to the traveller, and the other carries the load. The pressure on the rope is therefore directly

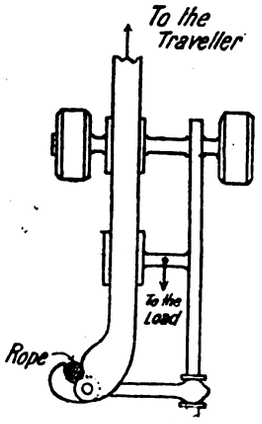

Fig. 3.

proportional to the weight of the skip. When the rope is to be released, the weight is taken up by a couple of rollers in connection with the one lever arm, and the jaws open and release the rope. With this system it is immaterial whether the rope used is thick or thin, and therefore the gripping power becomes no smaller when the rope is old and has decreased in diameter owing to stretching.

At the foot of the incline, where the telpher car is automatically attached to the rope, the suspension rail is bent slightly downwards, so that the car cannot fail to move forwards with the speed of the running rope at the point of coupling, which prevents a sudden load coming on to the rope. As soon as the latter is gripped, and the car starts on its way up the incline, there is no further need for electric power, and the line is interrupted until the top of the elevator is reached, where the cars are automatically uncoupled, and run on under current. It once happened that a car was admitted into the incline by a careless workman before the ropeway had been started up. Consequently the car was held back by the rope and left under current until the armature burnt out. In order to safeguard against such an occurrence again, the line is now interrupted before the point of coupling and the section at the beginning of the incline supplied with current over a special fuse, so that the motor cannot burn out.

Recently a further safety device has been added to each car, in order to prevent the burning out of an armature, which might occur from such causes as overloading the skip, or in the case of automatic discharge, allowing the pile to grow to such a height that the cars get stuck in it, whilst the motor is under current. An ordinary fuse is no good in this case, as it would have to be large enough to take the full starting current, which is about three times the normal current; but

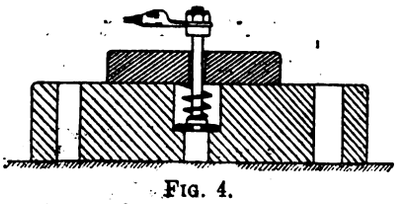

Fig. 4.

three times the normal current continuously would be sufficient to burn out the armature. A thermostatic time fuse is therefore used, the action of which depends on the heating of the motor casing. The principle is illustrated in fig. 4.

The current from the negative motor brush passes to earth over a fuse of some metal, which melts at 60° to 80° C. A good contact is ensured by a spring. If the temperature of the motor casing exceeds a given value, the fuse melts, and the plunger contact drops into a well, where it has no connection to earth, and the motor current is interrupted.

In the case of charging by telpher the ore is stored in bunkers. These are cross divided into a number of cells from which the ore may be drawn into telpher skips running on several lines underneath the bunker. If several different kinds of ore are smelted, as is usually the case, the different sorts are stored next to each other, each kind running across the bunker. Such an arrangement is convenient, as each class of ore is kept to its special portion of the bunker, and not scattered over it in various places, and charging the bunker by rail is thus facilitated.

At the entrance and exit of the bunkers the various telpher tracks join up by points to one suspension rail, which takes the charge to the "charge siding" (fig. 5). Each furnace has its particular siding where the charge is built up by admitting the correct number of skips filled with ore and flux, *a*, *b*, and *c*, for each furnace, until the charge is complete. This is done by one man, stationed in a signal and switch box at the

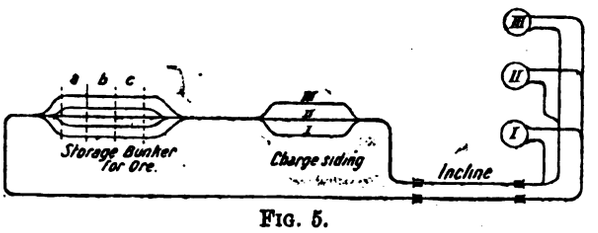

Fig. 5.

entrance to the siding. As soon as the charge for one furnace is complete, the whole train is sent up to the hopper at once. The cars automatically grip the rope on the incline, at a distance from each other regulated by the block switches. On arriving at the furnace mouth where they are needed, they range up in a siding one behind the other, from which position they can be brought forward separately by means of a pull switch, and emptied into the hopper at any desired point. From here the empty skips are sent back to the bunkers on the "down" track, thus completing the loop. It will be seen that one charge never interferes with the working of another, as the motion is continuously a forward one. It is obvious that an arrangement such as this allows of a very thorough supervision of the composition of the charge thrown into the furnace, as building-up the charge is in the hands of one responsible person, and does not depend in the least on the rest of the men.

Another method besides the ropeway for hoisting the telpher skip to the furnace mouth which has been found to be very successful where the height of the furnace is not very great is the spiral elevator. The principle of this is that of a spirally-bent suspension rail, up which the telpher cars are pushed by means of a vertical bar, which is made to revolve in the spiral and press against a roller at the rear end of the cars. The bar revolves continuously, and the cars are admitted at the correct moment for the bar to carry them to the top. This is done by interblocking in the following manner:—

The last block section is placed a little before the spiral, the line entering the spiral being always under current to ensure the car moving right forward into a position where it may be caught by the revolving bar.

In order to prevent a collision between the revolving bar and the telpher car entering the spiral, two separate blocking devices are arranged for the car and the mechanism of the spiral respectively. Considering the block system for the telpher first: the last block section is cut off from the supply on a car passing switch T. (fig. 6), and will only be signalled free again when the car has passed switch O that is at the foot of the incline up the spiral, when it will be carried away by the mechanism of the spiral, and make room for the next

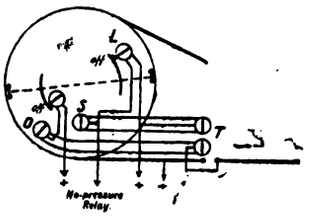

Fig. 6.

car. In order to prevent a car moving into the spiral just at the moment when the revolving bar might collide with it, the supply to switch T and the block section passes through a switch worked by the mechanism of the spiral, which cuts off the current when the bar sweeps through the dangerous zone. By this means the entrance for the cars is made safe, for a car cannot pass switch T unless the passage is free, and once it is on the live section behind T, it must travel forward to O, where it will be caught by the revolving bar. It might, how-

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ever, happen that owing to some accident, say a fuse blowing, the car passes switch T, and then stops between T and O in the path of the revolving bar. In this case it becomes necessary to stop the spiral automatically to prevent a collision. The block system for this is as follows: The motor for driving the spiral is provided with a no-pressure cut-out, and the current for holding up the no-pressure relay is supplied from two independent sources, first over the two block switches T and S, and secondly over a switch L, operated by the spiral arrangement. This switch L is always switched in except when the bar passes through the dangerous zone. During this time the no-pressure relay must take its current from T over S. If, however, a car happens to be standing between T and S at this moment, that is, standing in a dangerous position, the two block switches T and S will be out of step and no current can flow. Consequently the no-pressure relay will drop out and the spiral mechanism stop, as soon as the bar comes into the dangerous zone.

The spiral for conveying the empty skips downwards needs a special arrangement for drawing the cars forward at the right moment, so that they may rest behind the revolving bar which guides them down. The live wire is interrupted about 1½ feet before the entrance to the spiral, so that the speed of the car will be greatly diminished in travelling over this short dead section against the brakes. At the end it is caught by a hook, which prevents it running freely down the spiral. The top of the revolving mechanism is provided with an outrigger of a peculiar curved shape, so constructed as to catch a projecting lug on the traveller, and draw the car forward as it revolves. The hook, which hitherto held the car back, is raised by a saddle-shaped angle iron engaging with a roller on the hook. As the car is guided into the spiral it slides into position behind the revolving bar, and is now ready to start on the descent. The curved outrigger is so constructed that the pressure on the car is always in the direction of motion of the latter, so that there is no tendency for the car to jump the rails. Moreover, the curve is extremely gentle at the first impact, so that the traveller is moved forward only a little for a big movement of the outrigger, and gradually speeded up on entering the spiral. By this means there is no jar on the mechanism, nor sudden load on the driving motor of the elevator when a car enters the spiral on the descent.

COAL-CUTTING MACHINERY AND THE OUTPUT OF COAL.

The total output of minerals from the mines in the United Kingdom for the year 1913 was 301,611,353 tons, of which 287,411,869 were coal; 2,585,763 fireclay; 7,709,624 ironstone, 3,280,143 oil-shale, and 623,954 sundry minerals. A further 18,604 tons of coal were obtained from open quarries, so that the total output of coal was 287,430,473 tons, which is an increase of 27,014,135 tons on the year 1912, and is the highest output ever recorded. The year 1912, however, is probably not a fair comparison, as the national strike took place that year when practically the whole of the mines were stopped for nearly six weeks. Compared, however, with the year 1911, there is an increase of 15,538,574 tons.

The total number of persons employed in the 3,289 coal mines was 1,127,890, being an increase of 38,800 over those employed during the previous year. Of these, 909,834 were males employed underground, while 211,483 males and 6,573 females were employed above ground.

Compared with the year 1873 it is interesting to note that the output of minerals under the Coal Mines Act is more than doubled, being in 1873, 143,041,246 tons, and 301,611,353 tons in 1913. It is, however, noteworthy that though mining conditions have undoubtedly improved, both on the surface and below ground, yet the output per underground worker per year is less by 40 to 50 tons per annum. For instance, the average number of men employed below ground during the years 1873 and 1882 (both inclusive) was 403,281, for an average output of 152,221,629 tons, giving an average output per worker of 377·4 tons, whereas for the year 1913 the average output per underground worker was only 331·5 tons. For the 10 years 1893 to 1902 the average was 366·7 tons, while for the year 1911 the average was 331·1 tons, and for 1912, the year of the strike, it was only 310·8 tons. No doubt one cause of the reduced output may be due to the mines being older, and to the better seams being exhausted, but the introduction of improved mining conditions and the use of coal-cutting machinery one would have thought would have counterbalanced the effect due to this cause, and one can only come to the conclusion that it is mainly due to the Socialistic teaching of the men's leaders and legislative interference in hours and wages. The output for the different districts is given in the following table:—

Quantity and Value of Coal Raised.

		Tons.	Value. £	Increase over 1912, tons.
No. 1 District—	Scotland	42,456,516	20,514,873	+ 2,937,887
No. 2 ,,	Northern Division	58,675,687	30,643,973	+ 5,266,438
No. 3 ,,	Yorkshire	72,951,841	33,422,308	+ 8,069,904
No. 4A ,,	Manchester	11,289,296	5,975,728	+ 873,132
No. 4A ,,	Ireland	82,521*	50,654	— 7,786
No. 4B ,,	Liverpool and North Wales...	16,841,549	8,355,251	+ 947,373
No. 5 ,,	South Wales...	56,830,072	33,744,202	+ 6,713,808
No. 6 ,,	Southern Division	28,284,387	12,524,158	+ 2,212,525
		287,411,869	£145,631,147	+27,013,271*

*This increase does not include the coal from quarries, but from mines only. The total increase, including that from quarries, was 27,014,135 tons.

The increase in the output of coal has led to a considerable increase in the use of coal-cutting machinery, the coalfield of Scotland again leading the way with an increase of no less than 105 machines, and an increase of 1,592,982 tons of mineral produced by their aid.

The following table shows the position of coal-cutting machinery in the various inspection districts:—

District.	Type of machine.	Electricity. No. of machines.	Electricity. Tons of coal cut.	Compressed air. No. of machines.	Compressed air. Tons of coal cut.
Scotland.	Disk ...	484	5,646,675	133	1,440,741
	Bar ...	191	1,878,081	8	63,821
	Chain ...	16	88,157	—	—
	Percussive	2	1,415	33	83,610
	Rotary heading	7	—	2	1,074
		700	7,614,328	176	1,589,246
Northern Division.	Disk ...	56	649,202	68	581,835
	Bar ...	31	361,316	15	152,285
	Chain ...	44	288,278	9	45,297
	Percussive	3	1,628	436	1,458,183
	Rotary heading	—	—	3	707
		134	1,300,478	531	2,238,307
Yorkshire.	Disk ...	146	1,750,162	183	2,559,899
	Bar ...	83	1,028,943	54	657,912
	Chain ...	102	1,143,577	34	272,128
	Percussive	—	—	71	187,215
	Rotary heading	—	—	—	—
		331	3,922,682	342	3,677,154
Liverpool and North Wales.	Disk ...	5	59,500	75	798,351
	Bar ...	15	188,939	16	240,225
	Chain ...	3	37,158	1	3,599
	Percussive	—	—	66	195,190
	Rotary heading	—	—	—	—
		23	285,597	158	1,237,365
Manchester and Ireland.	Disk ...	3	22,361	46	317,483
	Bar ...	6	27,892	12	47,996
	Chain ...	4	58,090	3	17,728
	Percussive	—	—	135	152,779
		13	108,343	196	535,986
South Wales.	Disk ...	2	15,730	3	18,258
	Bar ...	31	200,336	54	351,718
	Chain ...	3	26,912	3	8,916
	Percussive	—	—	19	17,849
		36	242,978	79	396,741
Midland and Southern Division.	Disk ...	29	315,115	13	229,300
	Bar ...	20	131,244	6	88,855
	Chain ...	21	217,103	7	86,090
	Percussive	—	—	74	149,558
	Rotary heading	—	—	5	2,386
		70	663,462	105	556,189

The above tables give only the quantity of coal cut, but in addition the machines were employed in cutting other mineral such as ironstone, fireclay and oil-shale.

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Thus, in Scotland, the electric machines are credited with 112,963 tons and the compressed-air machines with 18,915 tons. In the Northern Division 6,464 tons, in Yorkshire 8,694 tons, both by compressed-air machines; whilst in the Southern Division the electric machines obtained 59,481 tons, and compressed-air machines 33,925 tons of ironstone. Hence we have a total of 1,307 electric-driven machines responsible for 14,310,312 tons of minerals and 1,587 compressed-air machines with an output of 10,289,256 tons. The larger number of compressed-air machines with the smaller output is due to the great number of small percussive machines.

With regard to the extended use of electricity in mines, the following table gives the aggregate electrical horse-power used for different purposes :—

Inspection Division.	No. of mines.	Surface.						Underground.					Gross total.
		Winding.	Ventilation.	Haulage.	Coal washing and screening.	Miscellaneous.	Total.	Haulage.	Pumping.	Portable machinery.	Miscellaneous.	Total.	
No. 1. Scotland ...	319	2,208	4,607½	3,042½	6,611½	9,809	26,278½	26,533½	43,393⅜	20,628	2,806	93,361½	119,639⅜
„ 2. Northern ...	272	7,327	15,046	10,470	11,635½	20,358½	64,837	34,510½	37,592⅜	3,764⅜	3,554	79,422	144,259
„ 3. Yorkshire ...	320	1,204	7,027	2,663	19,704½	25,356⅜	55,954⅜	27,055	13,691⅜	8,131½	2,367⅜	51,245⅜	107,200
„ 4A. Liverpool & N. Wales	62	95	1,180	405½	1,307½	1,557¾	4,495¾	6,486	4,997½	398	1,019	12,900½	17,396¼
„ 4B. Manchester & Ireland	73	110	979	293	1,311	2,695½	5,388¾	3,446	3,706½	264	546	7,962½	13,350½
„ 5. South Wales	294	22,951½	17,529½	13,340½	8,390½	28,369½	90,581½	38,412	50,948⅜	764	1,111⅜	91,236½	181,817⅜
„ 6. Midland & Southern	132	150	777	1,213½	3,221	3,779	9,140½	15,484½	17,246	1,754	809½	35,294	44,434½

Then, again, with regard to electric safety lamps, it is interesting to note a distinct extension of their use, though there is very considerable room for improvement as the following figures will show. In Scotland out of a total of 37,991 safety lamps 1,160 are electric, in the Northern Division of 134,140 lamps 6,662 were electric; Yorkshire had 25,004 out of a total of 228,769; Liverpool 385 out of a total of 67,510; Manchester 1,216 out of a total of 47,370; South Wales 2,716 out of a total of 188,495, and the Midland and Southern Division 680 out of a total of 73,549. We believe a reversal of these figures would add very considerably to the safety of our mines.

WAR ITEMS.

Mr. Eck and the Union Electric.

The correspondence that has been proceeding in our "War Items" respecting Mr. Justus Eck's explanation of his own and his company's position has brought us further communications this week, but, as intimated in our last issue, we are unwilling to devote further space to personal attacks and rejoinders. In our judgment, they do not either appeal to the general interest or make for edification. It is unfortunate that in our issue of September 4th, what was no doubt a slip of the pen in a somewhat lengthy sentence in Mr. Eck's letter made it appear that the majority of his directors during the 14 years' existence of the company, and to-day, were British-born subjects. Another writer has since fallen into the error of describing Mr. Eck as a director of the Union Electric Co., Ltd., which the reference-books and the Somerset House Files show that he is not. Mr. Eck has then fallen into the error of attributing a letter written and signed by Mr. Sydney Evershed to the latter's firm, who, as a matter of fact, have nothing to do with the correspondence. Now, if we were to permit this sort of thing to continue, it would become extremely difficult for the plain man to disentangle the skein and discriminate between accuracy and inaccuracy, or to tell one false coin from another. As we have already stated, public sources of information relating to companies are available for anybody in search of it. We confess to feelings of regret at the absence of that readiness to make the *amende honorable* which one expects from gentlemen who fall into *lapsus linguæ* in debate or *lapsus calami* in Press controversy. As the correspondence has chiefly resulted from the aforesaid slip of the pen, we think that the matter may be considered closed.—Eds. E.R.

"Capturing" German Trade.—In the course of an article on the necessity for ascertaining, in respect to the hardware trade, what the public will accept in place of what they have been using, the *Ironmonger* urges manufacturers to appoint a small but responsible roving commission, whose members shall visit all the big towns and get the retailers to come to their headquarters in each place to express their views:—"Many would welcome such an opportunity, and would even bring with them samples. The opinions expressed should be taken down in shorthand, transcribed, and forwarded to the secretary of the associated makers. The reports would be analysed and the results, along with the samples, submitted to a general meeting of the makers concerned in the venture. The effect of such a scheme would be to obviate overlapping of effort; it would facilitate the distribution of production among the works, as obviously those present at the meeting would pick and choose what suited their plants, and it would have the advantage of eliminating patterns likely to prove unsaleable and profitless, and of checking the undue multiplication of patterns. There ought to be no wasted energy by duplicating designs if the scheme were properly worked. The growth of manufacturers' associations during recent years has made such proposals quite practical, and it only requires a little initiative in each to start such a scheme a-rolling in every trade the Germans have invaded."

Electrical Trade Outlook in South America.—In the course of a valuable series of articles on "British *versus* German Trade in Latin-America," a Special Commissioner who visited South America several years ago for the *Engineer*, writes in that journal's currrent issue as follows:—

"Owing to the immensely favourable river systems of South America, the three most important of which—the Orinoco, the Amazon, and La Plata—occupy the larges portion of the continent, the opportunities offered to pioneers of the electrical trade are especially valuable. Of these opportunities the Germans have availed themselves to the utmost, and so well and so carefully have they studied the markets that in practically every one of the 20 different Latin States of South and Central America can their electrical plant and apparatus be found installed and affording satisfaction. Apart from this portion of the world, quite one-half of the electrical appliances and accessories trade is in the hands of German firms, and a large percentage of these have their head-quarters or agencies in London. In Argentina manufacturers of electrical apparatus will find a continuous demand for storage batteries, and of these, up till now, the United Kingdom and Germany have possessed a practical monopoly. What is there to prevent us from enjoying the whole of it in future? With regard to insulators, of earthenware, china and porcelain, we also hold a good share of the market; but Germany and the United States have both run us fairly close. Wire and cable, amperemeters, volt-meters, electric light carbons, loom insulators, insulating tubes, commutators, fuses, dynamos, electric motors, vulcanised fibre, switches, arc lamps, electric meters, batteries, battery jars, portable lamps, rheostats, electric ventilators, bells, under-ground cable accessories, and telephone apparatus have all been supplied by the United Kingdom, Germany, and the United States, and, to a lesser degree, by France and Belgium. The whole market not alone in Argentina, but in Brazil and Chile, is a most valuable one, and should be seriously cultivated by British manufacturers of these specialities. . . . Hydro-electric projects are now in view in such countries as Mexico, Argentina, Paraguay, Costa Rica, Brazil, and others of the South and Central American States, which only await a change in the political condition of things to put them—at least in part—into execution. Many millions of pounds sterling are to be expended upon these projects; the combined electrical industry of no single country could effectively deal with the whole, or even with the greater number, of the different undertakings, but the race will go to the most enterprising among the contractors the earliest in the field.

"At least three of the most important of the schemes referred to were already being negotiated for by German electrical firms, such as have already sent plant and machinery to practically every part of Brazil and Argentina, and whose plans for ousting all other competitors from the field were singularly complete. It is now almost impossible that the firms referred to can carry out their obligations; in one case, at any rate, the principal machinery is ready, but it has not been shipped. In view of the complete collapse of German shipping arrangements, and the impossibility of obtaining the assistance of any other transport, this machinery cannot be delivered. It has not been paid for, and the loss will fall entirely upon the shoulders of the contractors.

"Our only competitors in this valuable market are the Swiss, and, generally speaking, they operate through the medium of German houses having branches in South and Central America, and citizens of the United States. But, as has been indicated, the the amount of business pending is so large and so costly, that combination rather than competition should be the spirit in which

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manufacturers of this country and the United States should approach the conduct of the enterprise.

". . . Manufacturers and contractors on this side that they will not find the Latin-American markets in the same placid and accessible condition as those to which they are ordinarily accustomed. Just as the European war and its disastrous consequences have disturbed and incommoded our own economic state, so have the Republics mentioned suffered, and are suffering. It is inevitable, even for some time to come after the war has been ended, and the 'reckoning' has been paid, that business should remain stagnant and monetary matters stringent. But that is no reason for abstaining from 'getting right there,' as our friends the Americans put it, now. If we await the turn of the tide, and hesitate to risk anything because the skies are dark and the situation uncertain, we cannot expect, and we should not deserve, to succeed when the clouds disperse and the sun of prosperity again shines out. Now is the time to lay our plans."

German Electrotechnical Works.—The *Ironmonger* publishes the following announcement which was issued by the Association of German Electrotechnical Works just before the turning of the tide in France and the rout of the Austrian armies:—"After our great successes in the various theatres of war, many municipal authorities will ask themselves whether the negotiations which had been broken off by the declaration of war, for the granting of concessions for electrical undertakings, or the formation of joint undertakings between local authorities and the Association, should not be resumed. It will certainly be to the interest of the communities to discontinue these negotiations. If Germany is successful in the war, quite different factors will have to be taken into account when electrical concessions are granted than existed before the war. The conditions of the money market will be considerably improved, and the boom in trade which may be expected will also have a material influence on the economic future of the existing electrical works. Public authorities will therefore be wise in maintaining for the present an attitude of reserve."

A Power Company and the Prince of Wales's Fund.—Below we print a copy of a letter recently addressed by the Cleveland and Durham Electric Power, Ltd., to the Mayor of Middlesbrough. It will be observed that the company is doubling the employés' contributions to the Prince of Wales's Fund, instead of giving a lump sum contribution. We understand that the scheme was warmly taken up by the employés, and that the average voluntary contribution per man per week is 10d.

"The Mayor of Middlesbrough,
"Town Hall, Middlesbrough.
"*Prince of Wales's Fund.*

"Dear Alderman Bruce,

"I have pleasure in sending you herewith, as a first donation to the Prince of Wales's Fund, a cheque for £56. I hope to send you a like amount each month during the war.

"This sum is made up by voluntary weekly contributions of the staff and employés of Cleveland and Durham Electric Power, Ltd., and its allied companies, to which the company is adding a like sum voted by the directors, who prefer to double the employés' contributions—in order to encourage them to give as much as possible—rather than vote a lump sum contribution. Although the employés are scattered over Durham County and the North Riding of Yorkshire, and in places so far apart as Consett, Bishop Auckland, Hartlepool, Thirsk and Malton, it was thought desirable that their contributions should go to headquarters, viz., Middlesbrough, and be sent in total to you.

"My directors, in addition to doubling the monthly contributions of the employés, have further decided as follows:—

"1. To pay married men on service full wages, less Government pay.

"2. To pay single men on service half wages, less Government pay.

"3. To give special consideration and aid to dependants on single men on service.

"4. To keep all situations open.

"There will therefore be no call on any public funds by the employés of the company.

"Up to date about 13 per cent. of the staff and employés are on active service.

"*For* Cleveland and Durham Electric Power, Ltd.,
(Signed) "Arnold B. Gridley, *Manager.*
"*September* 21*st*, 1914."

Mr. Seabrook's Brother Killed.—We are sure that large numbers of our readers will desire to express their sympathy with Mr. A. Hugh Seabrook, of Marylebone, on the death, which occurred on September 10th, while on duty in France, of his youngest brother, Lieut. J. H. Seabrook, aged 30, who, at the outbreak of the war volunteered as a dispatch rider. Lieut. John French Blake commanding the 5th Signal Troop, R.E., writing of the circumstances under which Lieut. Seabrook fell, says:—

Lieut. Seabrook was killed while carrying out his duty. He had done splendid work for us as a motor cyclist dispatch rider, and was immensely popular with all. . . . We were in touch with the Germans early in the morning, and moved to turn their flank. I sent Lieut. Seabrook to the headquarters of the 2nd Army with a message before this, and when he returned to the point of dispatch we had gone. He was told by another of my motor cyclists where we had gone, and which road to take, but he appears to have missed his way, taken a wrong road, and run straight into the enemy. The end must have come very quickly and painlessly, as he was shot in the head—two other bullets also found their mark.

Blackpool Illuminations.—The autumn season electrical illuminations of the Blackpool Corporation include a design representing the flags of the Allies, and at the foot appear the words, "A Call to Arms. Your King and Country Need You."

A Plea for the Single Man.—From what we can gather there is a disposition in certain quarters to treat the single man who throws up his position and enlists in the service of his country, as though he was merely doing as he should do, and was entitled to no consideration beyond a pat on the back. If that were so, then what should we have to say of the millions of young men of eligible age who are remaining at home with posts and salaries and wages secure in consequence? Either we must admire and treat with fairness and consideration the former, or have what amounts to contempt for the latter. We prefer the former of these courses, deeming the young man who has broken into his professional prospects as deserving of consideration wherever an employer is in a position to give it. Now if we think of this matter in relation to electricity supply, we find the argument strengthened. Not only are municipalities and electric supply authorities generally well able to carry such a burden as half salaries would impose, but we believe it is a fact that in a number of works the staff remaining at home are doing harder and longer service while their *confrères* are away, rendering it possible to avoid filling, even temporarily, all the places of those who have joined the Colours, and so keeping down salaries and wages account. In the case of married men it is the fact that there are dependents, whether wife or children, or both, which regulates the amount of the allowance, but there are hundreds and thousands of single men who have dependents upon them. Nobody has any right to probe into their private affairs—why should they be required to disclose all about the financial standing of their parents, grandparents, and other family or other connections when they elect to serve the country? To our way of thinking many a single man is deserving of far better treatment than he is receiving, whether he has or has not dependents, considering the sacrifice that he is making, and our view is that half wages to electricity supply men should be guaranteed, their places, of course, being kept open as far as possible. It would be interesting to know what our electricity supply works generally are doing in such cases, also what course is being pursued to get over the difficulties consequent upon the absence of employés.

British Aluminium Employes.—The British Aluminium Co., Ltd., report that up to the present 453 men—equivalent to 20 per cent. of the company's employés—have joined the forces. At the Kinlochleven, Larne and Milton Works and at the head office, the response has been both prompt and enthusiastic, some 40 per cent. of the total employés at Kinlochleven alone having volunteered, the number including practically all those who were eligible. In addition, about 200 of the men employed at the company's Milton (North Staffs.) rolling mills are being drilled nightly on the company's premises by their mates who happen to be old soldiers, and both here and at Larne—where the Ulster Volunteers are busy recruiting—more men are joining daily. The places of those who have been called up are being kept open, temporary provision being made in the meantime by drawing men from industries which are slack during the war, or from those who are otherwise unfit for service. Financial provision is being made for the staff in accordance with their responsibilities, and the families of all married employés serving with the Colours, or others dependent upon them, are being paid 10s. weekly, those residing on the company's premises doing so rent free for the present. Every effort is being made to keep the company's various plants fully occupied.

Trade Openings in Sweden.—The *Financier* suggests that British manufacturers and merchants wishing to obtain a market in Sweden should write to the Secretary, Swedish Chamber of Commerce in London (Inc.), 5, Lloyd's Avenue, E.C., for names of importers and advice on commercial conditions in Sweden, &c. The Chamber receives daily a large number of inquiries from Swedish importers who have hitherto purchased from Germany and Austria.

Birmingham Trade.—According to the *Financial Times*, Mr. H. W. Sambridge, President of the Birmingham Chamber of Commerce, states that for the moment the local trade is better than might have been expected after two months of strenuous warfare, and it is improving. Unemployment is a little in excess of the average. Financial difficulties are not so pronounced, but what is urgently needed is complete re-establishment of the foreign exchanges. As it is, the export trade is being crippled.

The Trade Opportunity in Italy.—The Milan correspondent of the *Times*, in referring to the German efforts to re-establish commercial relations with Italy, urges British exporters to realise that indignation against German methods gives every facility to British enterprise at the present moment. "It is absolutely necessary for firms to send representatives to the spot speaking either Italian or French, and ready with quotations in Italian currency and weights and measures calculated for delivery. Italy is prepared to do business. An influential person in the industrial life of Milan has expressed surprise that so far he has not seen any English traveller to make the most of a propitious moment. 'Why,' he said, 'if the positions were reversed, we should be crowded out in our towns by German travellers.'"

Board of Trade Assistance.—Among other pamphlets of the special series issued by the Board of Trade Commercial Intelligence Department is one giving particulars of the exports of rail locomotives for Germany and Austro-Hungary, together with selected notes regarding opportunities for this class of trade in different parts of the world. Another return similarly covers fire-proof bricks, retorts, crucibles, &c.; a third deals with building and furniture fittings, including locksmiths' wares.

Prisoners of War in Germany.—Very many people in this country have been placed under a debt of gratitude to Mr. J. A. F. Aspinall, general manager of the Lancashire and Yorkshire Railway, and a Liverpool gentleman who was detained in Germany with him, for furnishing to the Army Council the names of a number of British prisoners who are interned in Munsterlager, Hanover. Mr. Aspinall returned safely to England some days ago.

(*Continued on page* 467.)

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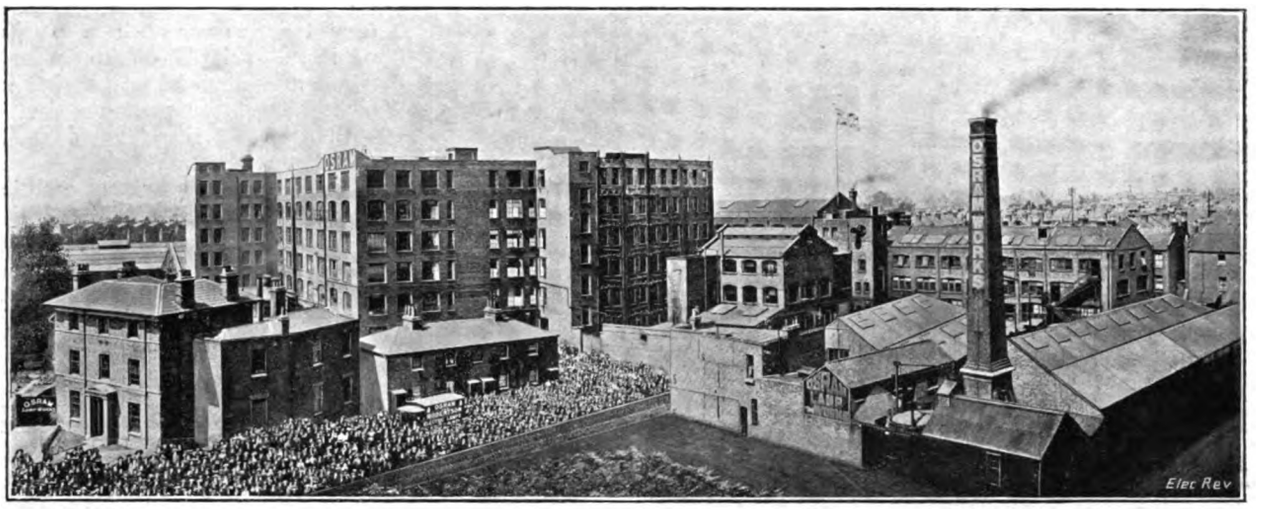
THE OSRAM LAMP WORKS.

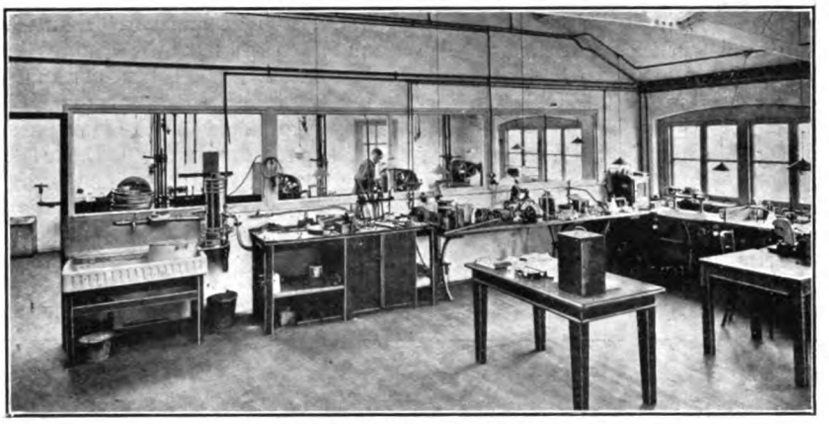
As mentioned briefly in our last issue, a Press inspection of the Osram Lamp Works was held last week by invitation of the General Electric Co., Ltd.



Exterior of the Osram Lamp Works, Hammersmith, W.

The Osram is the most familiar of the many named tungsten lamps used in this country, and the throwing open of every department of these large works to the Press and incidentally to the British public, was a step which we feel sure will meet with great appreciation at the present time.

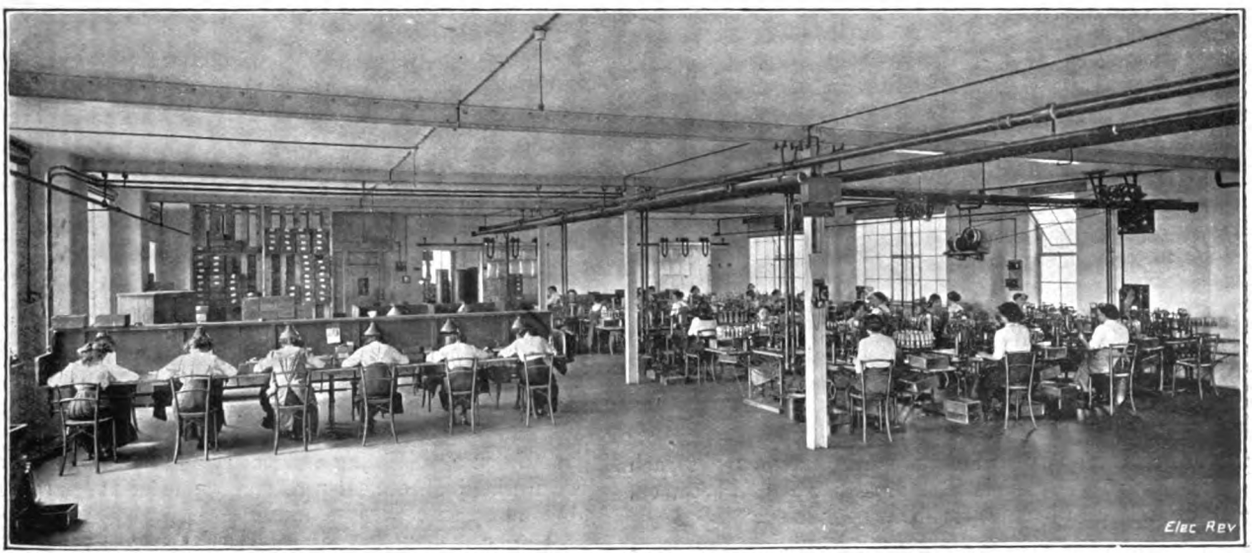
Adjoining the older Robertson (Carbon) Lamp Works of the same company at Brook Green, W., the Osram Works occupy a large modern six-storied building and give employment to some 1,500 hands; the latest plant is provided not only for the ordinary processes of lamp making, but also for the manufacture of the tungsten filaments from the powdered metallic oxide, and since the usual sources of supply of the latter material on the Continent are now unavailable, the company has taken the necessary steps and will in future manufacture the oxide from the tungsten ore.



Tungsten Wire Drawing.

All the glass bulbs, supports, &c., required in the making of both Osram and Robertson lamps are obtained from the company's glass works at Lemington-on-Tyne, which were described in our issue of September 18th last; and since the outbreak of war these works have given assistance to other lamp factories whose usual sources of supply are cut off.

The first step in the manufacture of the tungsten for filament making is one of chemical reduction resulting in a



"Foot" Making for Osram Lamps.

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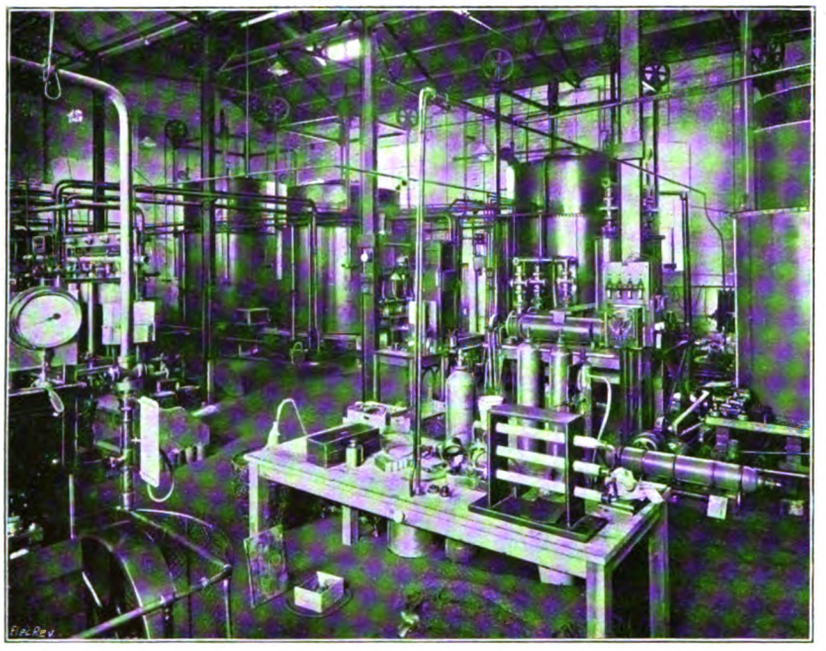
fine metallic powder which is formed into thin rectangular bars by compression in a hydraulic press.

These bars, which are of a fragile character, requiring careful handling, are subjected to great heat in a hydrogen flame in a tubular furnace, and are subsequently treated in an electric furnace, being again heated in an atmosphere of hydrogen, from which they emerge considerably shrunk in size, but strong though somewhat brittle in character. The next process is that of swaging down to the requisite size for drawing, and the bars or rods treated in a hydrogen furnace are rapidly inserted into rotary hammers gradually reducing the bar into a long thin rod of ductile tungsten, of about $\frac{1}{3}$ mm. diameter.



The Hydrogen Plant, Osram Lamp Works.

In the following drawing processes these rods are passed through a succession of diamond dies, both the dies and wire being heated and lubricated with graphite during the operation; a very gradual reduction in size occurs at each die, until wire as small as ·001 mm. diameter is obtained, being wound on to bobbins for filament making.*

The general processes of lamp making are fairly well known to our readers; first the glass stem or spider is formed from tube and rod which are cut into the requisite lengths by machines, the tubes being subsequently automatically flanged at one end, while the rods are shaped to carry the filament supports.

The next step is the bringing together of the flange, centre rod and leading-in wires — the latter being formed of copper with a portion of platinum welded on to make the hermetic seal with the glass; the nickel filament supports are then fixed —the upper ones rigid and the lower ones flexible.

The upper ones are cut and looped by machine and inserted by hand, but, in the case of the lower ones, an ingenious machine has been introduced to replace hand work and insert a set of supports at one operation.

The next operation is the delicate one of winding the filament on the supports, which is performed by hand, the cage being then ready for insertion in the lamp bulb.

This is done after the bulb has been attached to the exhausting stem and the flange stem of the cage is then welded to the bulb.

The exhausting department at the Osram Works, of which we give a view, is a sight well worth seeing; although the methods adopted are the usual ones, the scale on which they are carried out is impressive.

Six or eight bulbs are exhausted at one time, sealed-off and then pass to the testing department, where samples from each batch of lamps are put through life tests extending from 600 to 2,000 hours, photometric tests of candle-power are made and the lamps suitably marked. Finally, the lamps are capped; the caps, made by the company, are cemented on and the leading-in wires soldered, special machinery being employed in this connection.

At every stage in its making the lamp is subjected to rigorous inspection in order to ensure a high standard of manufacture, this being a necessary and obvious precaution, when the final result depends on the efficient carrying out of so many successive processes.

Filament Winding Department, Osram Lamp Works.

The company has installed the necessary plant for manufacturing half-watt lamps, and some of the processes were shown to the visitors, but owing to the

* A good description of the manufacture of tungsten filament wire appeared in the Elec. Rev. of April 3rd last.

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dislocation of labour caused by the war, it has been found necessary to concentrate for the time on ordinary tungsten lamp-making.

A feature of the Osram Works, which cannot but strike those acquainted with the conditions of labour prevailing in the average factory, is the exceptional provision made for the health and comfort of the worker; no better object lesson in this direction is needed than a visit to the works at Brook Green.

The Osram Lamp Works are the largest of their kind in this country, and are now capable of turning out upwards of 13 million lamps a year. In conclusion, our thanks are due to the General Electric Co. and to Mr. Christopher Wilson and his colleagues for the facilities which they kindly placed at our disposal on the occasion of our visit.

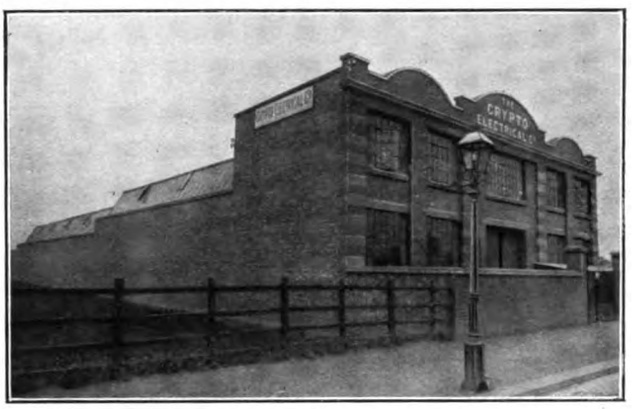
Exhausting Air from Lamp Bulbs.

THE CRYPTO ELECTRICAL CO.'S WORKS.

Some eleven years ago Messrs. J. G. & C. R. Shaw took over what was then quite a small electrical department of the Crypto Works Co., Ltd., of Clerkenwell Road, London, E.C., a firm principally engaged in the manufacture of gears for bicycles. Almost immediately Messrs. Shaw decided to manufacture electrical apparatus only, and took a small factory in Bermondsey, employing at the commencement about a dozen men. This was vacated for larger premises within two years, owing to the expansion of business, and, due to the same cause, the adjoining buildings on either side were subsequently absorbed.

These additions, however, proved insufficient to meet the growing business of the company, and it was then decided to build a new factory, with which end in view freehold land was bought at Willesden and the requisite buildings put up.

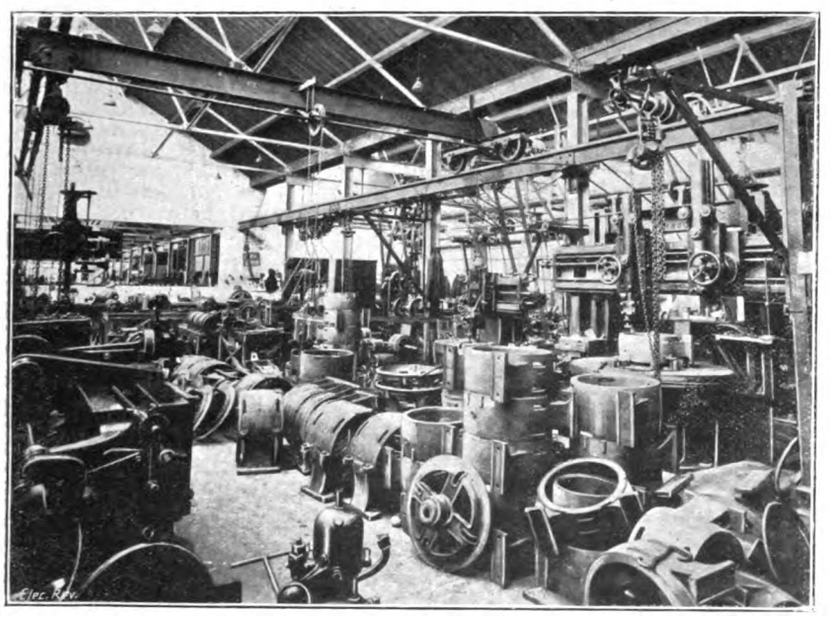
It will be seen that the works at Acton Lane, Willesden, are practically new, in fact, the removal from the company's Bermondsey premises—which will in future be used only for repair work—is not yet completed. The new premises are practically all built on one floor, with the exception of the offices, and include machine, winding and erecting shops, a tool room, test rooms, and stores both for parts and finished machines.



The Crypto Co.'s Works, Willesden.

As many of our readers are aware, the firm have for some years been successfully identified with the small motor industry, and at the present time 72 different types of alternating and direct-current machines are being made, starting from $\frac{1}{16}$ B.H.P. and ranging up to 20 B.H.P., the largest standard size made by them. All the work is done to jig and productions are standardised as far as possible; machines are put through in batches, the finished parts and material required for erection being drawn from stores. The latter have been organised on modern lines, with labelled bins and racks containing all the numerous finished and semi-finished parts; each rack or bin contains a stock card giving exact particulars of its contents and furnishing an immediate check on stock generally. Adjoining these general stores is the main machine shop—a continuation of which forms an erecting shop and second machine shop, equipped with smaller tools.

In addition to numerous lathes, drilling, planing, and milling machines, the equipment includes a large and three medium sized boring mills for machining shells, &c., a Churchill grinder for commutators and shafts, turret lathes for small repetition work, keyseaters, &c. For grinding



The Main Machine Shop, Crypto Electrical Works.

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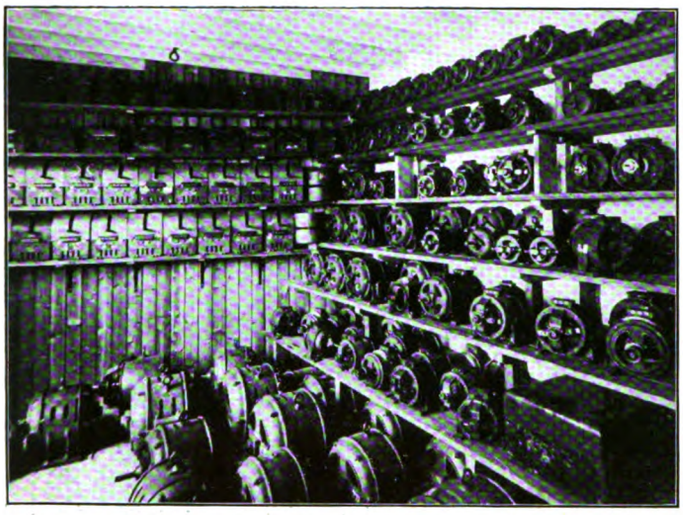
small tools each section of the works is provided with a grindstone, but the large and special tools are dealt with in the tool room, which is equipped specially for this class of work.

The firm's smaller standard machines are built up with cast-iron shells, and steel pole pieces welded in; in the larger sizes cast-steel shells are employed. Standard commutators are built by the gross, all insulations of the mica type being prepared in the works. Ball bearings are now a very usual requirement and are frequently fitted.

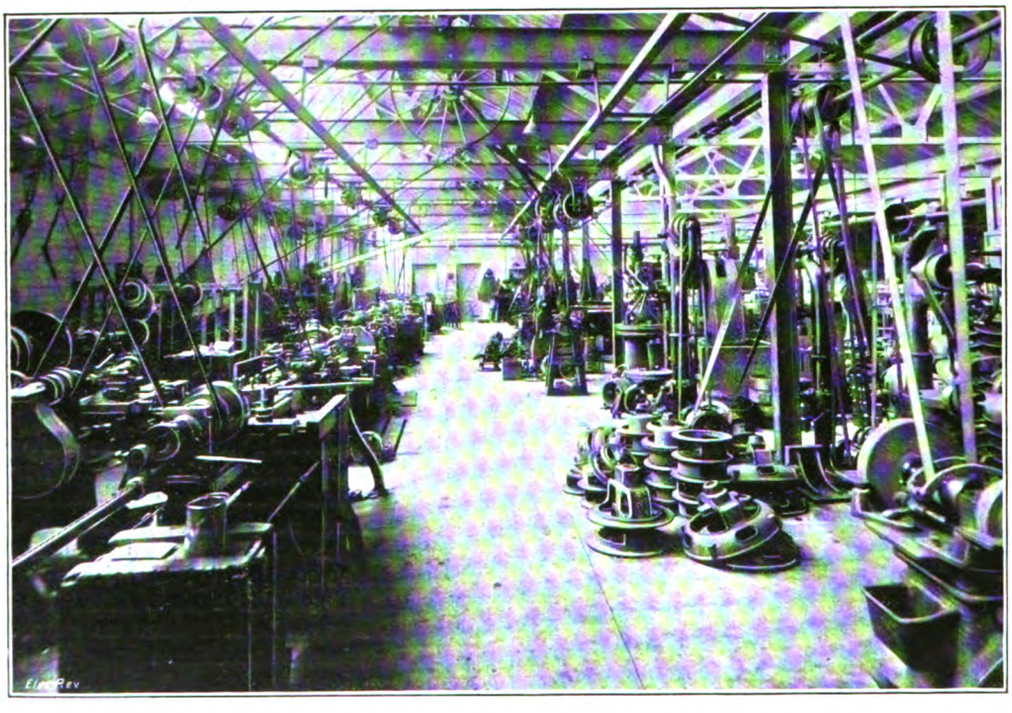


Stores of Finished Crypto Machines and Starters.

Special departments are devoted to direct and alternating-current winding and testing. In the former an equipment of coil winding and taping machines is provided, and it may be noted that all armature and field coils are subjected to two distinct impregnations and three separate bakings with a view to ensuring high insulating qualities.

All commutators are fitted to shafts before the armatures are wound, with a view to saving damage to the winding in handling, and stocks of wound armatures of all sizes are kept in order to facilitate the rapid completion of orders.

In all, about 14 different types of brush gear are made for the various machines, and special benches are set apart for this work, as also for the fitting and assembling of motor starters which the firm supplies for its motors.



The Light Machine and Assembling Shop, Crypto Works.

In the A.C. department a variety of single and polyphase motor and starter work is dealt with; recent improvements which have been effected in the methods of winding and construction of the spider enable the firm to turn out a remarkably cool-running machine—in fact, a 10-H.P. single-phase motor which we saw on test, showed a full-load efficiency of 88 per cent., power factor ·88, and a temperature rise of only 22° F. after four hours' running.

A special store-room is provided for alternating-current motors, ready for immediate dispatch, this supplementing a larger finished stores in which several hundred direct and alternating-current machines are kept.

In addition to the simpler types of machines which constitute the bulk of the Crypto Co.'s business, several special types of small motor-generators and converters have been developed for cinematograph work, charging accumulators, &c.; another machine which has been largely adopted for testing purposes is a variable frequency alternator—a single armature machine giving a high output for the size of frame employed.

In addition, we may mention the firm's variable speed interpole motor giving a speed variation of 3 to 1, the Crypto petrol-electric sets, polishing motors, auto-transformers and small switchgear; the company endeavours to maintain a high standard in its work, and, indeed, supplies machines to both the Admiralty and War Office. We understand that since the outbreak of the war the Crypto Co.'s stocks of machines have been heavily drawn on, and that, in view of the firm's organisation, present and future prospects are particularly bright.

In conclusion, we are indebted to Messrs. Shaw and to their works manager, Mr. J. Smith, for assistance in the preparation of this short article.

Brown Coal in Victoria.—Whilst reading his inaugural address to the Victorian Institute of Electrical Engineers on June 4th, the president, Prof. Henry Payne, dealt with the question of the local fuel supply. Pointing out that in Victoria the supply of black coal appeared to be limited to a few decades at the present output, he said that whilst further coal supplies might come to light, it behoved them not to overlook the immense stores of energy lying dormant in the brown coal deposits around Melbourne, bores having revealed beds of tremendous thickness at no very great depth and underlying an area of many hundred square miles. It would appear that the main reason that had hitherto prevented the utilisation of brown coal was that they had been hidebound in the production of energy through the medium of black coal, all their boilers being designed therefor. It was true that brown coal was of smaller calorific value than black coal, and that it contained a considerable percentage of moisture which seriously detracted from its heating efficiency when burnt in the ordinary way for steam generation, but the presence of even such large quantities as 30 per cent. or 40 per cent. of moisture might be advantageous in generating producer-gas, by which medium it was quite possible to deal effectively with the brown coal deposits in the generation of energy. There did not appear to be any fundamental reason why all the power required, not only for Melbourne's needs, but—if need be—for the whole of Victoria, could not be readily found. Such could be supplied from a central station on the site of one of these huge brown coal deposits, and the transmission of this energy to distributing stations presented no insuperable engineering difficulty. The problem of dealing with brown coal had been solved in Germany, where the deposits were being worked in many districts; the economic mining of Victoria's brown coal deposits should not be insuperable. These sources of energy were very valuable, pointing, as they did, to a continuance of cheap fuel supply for a considerable period of time.

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WAR ITEMS.

(*Concluded from page* 462.)

Trading with the Enemy.—The British Engineers' Association has issued a report on this subject expressing dissatisfaction at the policy of the Government and giving particulars of a protest made by it to the Government. The printed document gives the Association's definition of an alien for the purposes of trading, and recommendations which the Council makes to its members. The Association has collected and filed particulars relating to the constitution of a considerable number of firms in this country who have interests in Germany and Austria, and it is open to investigate the constitutions of firms whose names are submitted by members.

An Inquiry Bureau.—The Employers' Parliamentary Council is stated by the *Times* to have decided to assist members of the Association under existing circumstances by the establishment of a temporary inquiry bureau, whereby members buying and selling goods could be placed in connection to their mutual advantage; arrangements in this connection were to be made whereby the scheme should be worked in co-operation with the one recently instituted by the Board of Trade.

Arc Lamp Carbons.—The Electrical Engineering and Equipment Co., Ltd., inform us that their works in Switzerland are working day and night, and they are fully capable of executing orders for any quantity of all kinds of arc lamp carbons as heretofore. The difficulty in procuring raw material has been overcome, and they are experiencing very little inconvenience as regards shipments.

The County Company's Men.—About 25 per cent. of the total staff of the County of London Electric Supply Co., Ltd., representing 75 per cent. of those eligible, have left for war service. The company have arranged to keep the whole of the men's places open for them and to continue pay, and special arrangements have also been made to assist the wives and dependents of all members of the staff on service.

Active Service Allowances.—The Anchor Cable Co., Ltd., Leigh, are giving £1 to every employé who enlists, and are looking after their dependents during their absence.

The Cleckheaton Electricity Committee has decided to make an allowance of 5s. per week to the wives of men in their employ who are on active service, and 2s. per week for each child under the age of 14 years, the vacated positions to be kept open for the men upon their return.

The Naval Disaster.—Mr. Samuel Hulme, a Naval Reservist who has been employed at the Bury electricity works, was one of those saved from H.M.S. *Hogue*, which was sunk by a German submarine. Mr. Tom Kay, son of Mr. J. Kay, Dundee Lane, Ramsbottom, near Bury, chief electrician on the *Hogue*, was also saved.

Power Station Sleepers.—The Commanding Officer of the Preston District has expressed his appreciation of the action of the Corporation Tramways Committee in allowing recruits to use the cars without charge, and in providing sleeping accommodation at the power station for a number of recruits.

BUSINESS NOTES.

Trade Announcements.—Messrs. J. W. Brooke and Co., Ltd., of Adrian Works, Lowestoft, have purchased the drawings, patterns, machining jigs and templates for the Hesse reversing gear, recently manufactured by Messrs. Hesse & Savory. They will immediately make and stock a series of these gears.

Messrs. Schaffer & Budenberg, Ltd., of Broadheath, near Manchester, are transferring their entire Manchester business to Broadheath, and all communications should be addressed to them there. At the new works they will have greatly increased facilities for the manufacture of their specialities.

Mr. F. Marchant, electrician, has commenced business at 63, Ravensbourne Road, Bromley (Kent).

Messrs. Haslam & Schontheil, Ltd., of Cardiff, announce that the title of the firm has been changed to Haslam & Stretton, Ltd, the alteration being necessitated by Mr. Theodore Schontheil, who is a British-born subject, having adopted the surname of Stretton. The business will be carried on entirely as heretofore.

The offices of the Lighting Press Syndicate have been transferred to 37 and 38, Strand, W.C. Mr. A. J. Greenly is now managing both editorial and business departments. His advertising business has also been transferred to the same address.

Messrs. Simplex Conduits, Ltd., announce that the telephone numbers of their Liverpool branch have been changed to "Royal 4726 and 4727."

Messrs. David Anderson & Co., Ltd., lighting engineers and contractors, of 18 and 20, Farringdon Road, E.C., who are about to open a new electrical department, invite manufacturers to send their latest catalogues.

Messrs. Laing, Wharton, Ltd., announce that their offices, showrooms and workshops, have been removed to Mildmay Park Works, Mildmay Avenue, London, N., where they are laying down additional plant and tools for making their various electrical lines.

Book Notices.—The Bonecourt system of surface combustion is described in a booklet recently issued by Messrs. Bonecourt Surface Combustion, Ltd. After a quantity of general technical data, and a report of a lecture by Prof. W. A. Bone, a detailed description of the principles and applications of the system is given, from which it appears that the Bonecourt methods are already coming into vogue in connection with a number of industrial processes, such as enamelling, forging and annealing furnaces, heating apparatus of various kinds, and the generation of steam. A battery of three boilers fired with ammonia-recovery producer-gas is in course of erection in this country, and the Bonecourt boiler is also being used for waste-heat recovery in connection with gas engines and steel furnaces, and for oil-firing, while the use of coal in these boilers is being experimented with. Tests on the boilers are included.

Every Briton's War Book is a booklet issued by the Motherland League (price 6d.) as an alphabetical store of general information on all points connected with the war; it is well calculated to serve this purpose, though, as a first edition and no doubt hastily prepared, it does not at present cover all the points on which one seeks enlightenment. For examples, the Declaration of London, and the words howitzer and mitrailleuse, are missing, and misprints such as Bransbuttel, Landstrum, are met with. It is stated, too, that Germany uses an electric searchlight which is strapped round a soldier's waist, and illuminates over 18 miles! Some maps are given, and the second part of the book is devoted to a survey of the military, naval and material resources of the European Powers. It is an extremely interesting production, and cheap at the price.

What Every Private Soldier Ought to Know is the name of another little war book; it is the work of Lieut.-Col. Sir Frederick Ponsonby, and is published by Polsue, Ltd., price 2d. Its purpose is indicated by its title, and is admirably fulfilled by its contents, which consist of useful hints for men on active service.

"Engineering Workshop Drawing." By H. J. Spooner. London: Longmans, Green & Co. Price 1s. 6d. net.

A "Key to the London Telephone Directory" has been issued by Messrs. Stone & Colquhoun, of 92, Victoria Street, Westminster, price 2s., which classifies subscribers' numbers in numerical order. The number and exchange only of a subscriber are often known, and in this case the key supplies the means for discovering his name.

Catalogues and Lists.—British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester.—Supply list No. 102/5, of 14 pages, giving tabulated voltages, candle-powers, prices and other particulars relating to their British-made "Auriga" drawn wire lamps, half-watt lamps of standard, projector, sign, train lighting, steamship, and other types, including candle lamps, head lights, motor-car and motor-'bus lamps, and hand lamps.

Mr. Harry J. Booker, 51, Tothill Street, Westminster, S.W.—Circular giving a specification and illustrations of British-made standard motors and dynamos.

Messrs. Crompton & Co., Ltd., Chelmsford.—Twenty-page list (C2) containing full descriptive information and a great deal of tabular data together with clearly shown prices, of continuous-current motors of the protected type for various voltages and ranging from 1·65 H.P. to 50 H.P. Dimensions are also stated.

Messrs. James Keith & Blackman Co., Ltd, 27, Farringdon Avenue, London, E.C.—Twenty-eight-page booklet, fully particularising the Keith centrifugal steel plate fans, belt and motor-driven.

Messrs. Belling & Co., Derby Road, Edmonton, London, N.—Thirty-two-page illustrated pamphlet containing descriptive information and prices of many useful and attractive designs of Belling electric fires for household service. A special pattern consists of a combined heater and afternoon tea-tray. A number of pages are also devoted to designs of fires for industrial purposes, for factory and ship service. A separate leaflet gives prices, &c., of boiling-rings, grillers and combined griller-oven; and an interesting 8-page publicity booklet contains notes and neat sketches illustrating the applications of the electric fires in the modern home.

Liquidations and Dissolutions.—Perth Electric Tramways, Ltd.—A meeting of creditors will be held at 30-31, St. Swithin's Lane, E.C., on October 26th, to hear an account of the winding up from the liquidators, Messrs. C. Wren & F. A. Holyfield.

Ch. Mellier & Co., decorators, upholsterers, electrical engineers, &c., Mellier House, Albemarle Street, W.—Messrs. Godfrey Durlacker and Edward Benjamin have dissolved partnership. Mr. Durlacker will attend to debts and continue the business under the same style, and at the same address.

Bennett & Whitehead, electrical engineers, Hartlepool and West Hartlepool.—Messrs. Robt. H. Bennett & Vernon M. Whitehead have dissolved partnership. Mr. Bennett will attend to debts.

Consolidated Diesel Engine Manufacturers, Ltd.—The first meeting of creditors is called for October 8th, at Bankruptcy Buildings, Carey Street, W.C. In the course of a lengthy summary of the company's affairs, Mr. H. Brougham, the Senior Official Receiver and Provisional Liquidator, after stating the history of the undertaking, says:—"The failure of the company is attributed by Foord (the secretary) to insufficiency of working capital, excessive expenditure and the locking up of the company's money through making advances to the old company. Ellis (a director) is of opinion that it has been brought about by (*a*) the old company failing to repay the company's loans; (*b*) increased cost of oil and consequent decrease of sales of engines, which, together

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with the Balkan troubles, did not permit of Carels Frères making sufficient profit to pay the dividend expected; (*c*) excess in the cost of building the works; and (*d*) the inability of the company to raise money, as had been expected, on the shares in Carels Frères. On the application of the Official Receiver, Sir W. B. Peat was, on July 7th, 1914, appointed special manager of the company until the appointment of a liquidator. At the date of the making of the winding-up order the affairs of Carels Frères required immediate attention, inasmuch as it was reported that their bankers had given notice to close the account at the end of July, and that the enforcement of the notice and failure to find further capital would probably result in the liquidation of the firm. The special manager (by his partner) attended at Ghent, inquired into the position there, and had interviews with members of the Carels family with a view to preserving the interests of the company which had thus become threatened. The special manager subsequently reported that Carels Frères at the end of April, 1914, up to which date the accounts of the firm for the preceding 10½ months had been made up, disclosed a very heavy trading loss, and as their business mainly depended on orders received from the company, Carels Frères was in a threatened condition and the company's shareholding in jeopardy. From the special manager's report it would appear that, in addition to the bank claim amounting to about £45,000, there were liabilities on debenture loans (without security) by the Carels family of £100,000, and other loans made by the same persons to finance the firm amounting to about £65,000, and that there were no means of raising moneys upon the firm's assets by mortgage, as the consent of the debenture-holders would first be required before security could be given in front of their debentures. The report further shows that Messrs. Carels had, it seemed, for some time past been seeking for outside financial help, and they were, in the result, able to put a proposal before the special manager providing for sufficient capital to be brought in to provide an amount for working capital and discharge the loan liabilities, preferred shares being substituted therefor. It was further reported that the assistance would come from certain foreign banks of standing and a Belgian financial firm who were expectant of developing the business in a new direction. The matter being urgent by reason of the bank notice expiring at the end of July, the matter was made the subject of an application to the Court, and the report came before the judge on July 28th for consideration on an application by the Official Receiver for leave to enter into negotiations with the Carels family for the reconstruction of Carels Frères in accordance with the foregoing proposals. The judge made the order as asked, and in pursuance of its authority the special manager pursued the negotiations with the persons concerned in Belgium, but they have of necessity been broken off in consequence of the war. It is impossible in the condition of affairs on the Continent to form any estimate of the future, but advices have been received that the Messrs. Carels are striving to preserve their assets so far as the distressing state of matters in their country will permit. The liabilities to creditors unsecured include £9,961, the balance due to Carels Frères, £1,293 directors' and managing committees' fees, £3,866 due to the consulting engineers, £430 solicitor's charges, and £214 accountants' charges. The balance is in respect of goods supplied, work done and usual trade expenses. The creditors fully secured hold (*a*) mortgage on the company's land, buildings and fixed plant at Ipswich, estimated to realise £110,000, against loans and interest amounting to £28,650; and (*b*) a charge on the office furniture in London, estimated to realise £300, against judgment debt and costs amounting to £208. This charge is under an order of Court directing the withdrawal of an execution levied at the company's offices on the June 18th, 1914, the day after the date of the presentation of the petition. The other liabilities include, possible claims amounting to £1,317 in respect of uncompleted contracts for the supply to the company of materials and the execution of work in connection with the erection of the works at Ipswich; £2,954 balance of the cost of the railway siding at Ipswich, which, previously payable by annual rent, falls due on the liquidation of the company; and £4,000, the estimated amount of claims for damages for breach of agreements with employés. The sum of £100 is also included as a nominal amount of liability in respect of two uncompleted contracts for the supply of iron ore to the company and in respect of a possible claim by the Ipswich Corporation under an option agreement with the company for the purchase of further land. The amounts which the land, buildings and fixed plant (charged to fully-secured creditors) and stock-in-trade, &c., are estimated to realise are based on the assumption that they will be sold collectively. The investments in shares include the company's share interest in the old company, not estimated to realise anything; and in Carels Frères, estimated to realise £143,244, which estimate is based on a valuation made by Messrs. Wheatley Kirk, Price and Co., of that company's business in March last, together with a report by Messrs. Josolyn Miles & Co. The book debts include the sum of £69,120 owing by the Diesel Engine Co., Ltd., which is estimated to realise only £25,000. The special manager reports that no practicable steps to dispose of the Ipswich works can, in view of the war, be taken, but meanwhile they have been temporarily let on weekly terms to the military authorities for the accommodation of troops."

The Leskole Co., Ltd.—This company is winding up voluntarily, with Mr. A. H. Crowe, of 31, Great James Street, W.C., as liquidator. A meeting of creditors is called for October 6th.

Deed of Assignment.—George Braulik, electrical engineer, 8, Lambeth Hill and Maiden Lane, E.C.—Particulars of claims must be sent by October 10th, to the Trustee, Mr. G. E. Corfield, Balfour House, Finsbury Pavement, E.C.

Palmer's Shipbuilding Electrification.—At the annual meeting of Palmer's Shipbuilding and Iron Co., Ltd., at Newcastle-on-Tyne, on September 26th, Mr. G. Mure Ritchie, the chairman, in moving the adoption of the annual report, stated that the directors had realised the imperative necessity of bringing the steel and iron departments into line with modern requirements and conditions. They had formulated a scheme, and had already submitted it to the debenture-holders. The scheme provided for the installation of gas-cleaning plant, modern gas engines, gas producers, and other appliances for utilising profitably the gas which now escaped from the blast furnaces. It included a complete electrification scheme which would embody the provision of gas-driven alternators capable of supplying the needs of the company's shipyard, engine works, blast furnaces and steel works. When this plant was installed it would use large volumes of gas which now went entirely to waste. The total cost was estimated at about £250,000.

LIGHTING and POWER NOTES.

Aberdeen.—Street Lighting.—The Lighting Sub-Committee has decided at a special meeting that during the war all arc lamps shall be replaced with incandescent lamps, and that the number of lamps lit shall be materially reduced.

Arbroath.—Rating Appeal.—The Arbroath E.L. and Power Co. last week appealed against the valuation of the electricity works. The assessor's valuation was £1,215, the Parish Council asked the Court to fix the amount at £1,470, and the company asked that it be reduced to £500. The Court finally fixed the amount at £1,100. Mr. Collins, the company's representative, stated that the matter would be carried to the High Court.

Aylesbury.—Proposed Loan.—The U.D.C., not being able to obtain a loan on reasonable terms for the E.L. scheme, has resolved to secure an advance of £21,233 for one year from Lloyds' Bank at 5½ per cent. interest, subject to the Council being able to take up such sums as it may from time to time require.

Bacup.—Street Lighting.—The lighting of the two main thoroughfares, Newchurch Road and Rochdale Road, has been converted from gas to electricity, some 200 50 and 100-c.p. lamps being employed. The alteration is so satisfactory that further extensions are contemplated.

Ballyconnell.—The power house of the Ballyconnell E.L. and Power Co. is now complete. The machinery is being erected, and it is expected to be able to supply energy early in October.

Bath.—Year's Working.—The annual report of the year's working of the electricity department shows a deficit of £1,981, as compared with £1,445 in the previous year. The total revenue was £24,039; total working expenses £13,098, against £11,846; and gross profit £10,941, or £661 in excess of the previous year.

Belfast.—New Power Station.—After considerable discussion, the City Council has referred back to the Committee the recommendation of the latter, that the reports of Sir John Snell and Mr. Pratten, regarding the building of a new power station, be adopted.

Sir John Snell's report points out the imperative necessity of providing further plant to meet the load of 1915-16, and advises the adoption of the three-phase H.T. system for all future plant and transmission. He advises the Corporation on no account to remodel or permanently extend the present station, and suggests the purchase of a 3,000-kw. turbine plant, and a second 1,000-kw. rotary converter, without delay.

The estimated cost of this work, which would be completed by next autumn, is about £49,000. Further sections of the report go to show that the maintenance of the plant, the organisation of the staff, and the business side of the department are in a satisfactory condition.

Mr. Pratten's report is on very similar lines; he considers that there are two and a-half years in which to establish a new works, and suggests certain additions to the present works in the meantime.

Blackburn.—Works Extension.—The Electricity Committee has just secured 60 acres of land at Whitebirk, between the railway and the canal, for extension purposes.

Messrs. Henry Livesey, Ltd., Greenbank Bobbin Works, were summoned last week for allowing black smoke to issue from their works chimney, and a representative of the firm stated that there would be no repetition, as they were going to electrify their plant.

Blackrock.—Overhead Wires.—The U.D.C. is applying to the B. of T. for permission to use overhead wires for the purpose of electricity supply throughout the district, with a few exceptions.

Bradford.—Workhouse Lighting.—The North Bierley B. of G. has obtained the sanction of the L.G.B. to an expenditure of £1,260 on a scheme for electric lighting at the workhouse.

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Brentford.—Infirmary Lighting.—The Engineering and Works Committee of the Guardians has considered a specification from Mr. P. E. Ryecroft with reference to the experimental lighting of part of the infirmary with electricity.

Brymbo.—L.G.B. Inquiry.—An inquiry was held last week into the applicaton of the P.C. for a loan of £300 for electricity purposes, viz., street lighting. There was no opposition.

Cleckheaton.—The U.D.C. Electricity Committee has granted the request of the Spenborough Citizen Volunteers for the installation of electric light in the Whitcliffe Mount School drill field, in order that outdoor drilling might be continued in the evenings.

Clones.—E.L. Scheme.—The U.D.C. has approved of the agreement with the E.L. Co. for public lighting at 5d. per unit, also for the supply of power for the new sewage lift at 4d. per unit, with £5 per annum for supervision.

The B. of G. has decided that the installation of the electric light at the workhouse shall be proceeded with at once.

Continental Notes.—Norway.—The municipal authorities of the parish of Time, in the neighbourhood of Stavanger, have decided to buy the Folland Waterfall with the view of harnessing it and of erecting an electrical works. A loan of £14,000 is going to be taken up for this purpose.

Dolgelly.—Workhouse Plant.—The L.G.B. has sanctioned the scheme for installing certain electric plant at the workhouse, at a cost of £153.

Eastleigh and Bishopstoke.—E.L. Scheme.—The U.D.C. has decided to obtain a report from Dr. J. A. Purves, of Exeter, at a cost of 10 guineas, on the question of lighting the district by electricity.

Fleetwood.—Street Lighting.—A report as to the cost of improving the lighting of Lord Street is to be prepared by the Electricity Sub-Committee.

Greetland.—E.L. Scheme.—It is hoped to begin the electric lighting of the Upper Greetland township early in November.

Heywood.—Year's Working.—According to the borough treasurer's statement, there was a loss of £4,611 on the working of the electricity undertaking for the year ending March last; on the tramways a profit of £85 was realised.

Holmfirth.—New Power Station.—The B. of T. has sanctioned the Council's application for powers to construct a generating station, but the consent of the Board has not yet been obtained as to the method of supplying current.

India.—The question of electric lighting in the city of Agra and civil lines has been under consideration by the municipality, with the result that Messrs. Martin & Co., of Calcutta, agents for Messrs. Crompton & Co., are to carry out the scheme, work on which was to commence immediately.

Isle of Man.—New Generating Station.—Application has been made to the House of Keys for authority to erect an electrical generating station at Glen Auldyn in connection with projected chemical works. It is proposed to utilize the river there for power purposes.

London.—Stepney.—The Electricity Committee, owing to shortage of carbons, is reducing the number of arc lamps in use and replacing some of them with half-watt lamps.

It is proposed to give a limited bulk supply of 600 or 700 kw. during peak load hours and 1,500 kw. at other times to Shoreditch, arrangements to be made with Poplar to give Stepney a stand-by supply during the winter. The price to Shoreditch may be slightly increased owing to the necessity of running the older Stepney plant.

Kensington.—Street Lighting.—The B.C.'s experiment with half-watt lamps proving a success, the engineer has drawn up a scheme, with specially-designed lanterns necessary to supersede all the arc and certain other electric lamps used for street lighting in the borough. The total cost will be about £395. Owing to the inadequate supplies of carbons for street lighting, the Council is being recommended to approve the engineer's scheme.

Poplar.—Arrangements have been made by the Electricity Committee to give a stand-by supply of 2,000 kw. to Stepney. In view of the increased cost of carbons for arc lamps, the electrical engineer has expedited the change over from arc to incandescent street lamps on the Isle-of-Dogs.

L.C.C.—A conference of representatives of Borough Councils owning electricity works was to be held to-day to discuss the question of London's electricity supply in view of the promotion of legislation on the subject in 1915. The L.C.C. and representatives of the City Council, and the Lambeth and Camberwell B.C.s are to discuss the same matter on October 7th.

The City Council announces that the new scheme of lighting in the City streets is practically complete.

Mexborough.—Plant Extensions.—The extensions at the electricity works have just been completed, the additions comprising a boiler house, engine house, pump house, stores and offices. The new plant installed comprises a 750-h.p. Howden turbine, running at 3,000 r.p.m., and coupled to a 500-kw. Siemens generator. In the basement there is a surface condensing plant. Sufficient room has been allowed in the new buildings to admit of additional plant being installed if required in the future. The capital value of the extensions is £11,000, and the total capital cost of the electricity undertaking now stands at £35,000.

Montgomery.—E.L. Scheme.—The T.C. has deferred for 12 months consideration of the proposed electric lighting scheme.

Morecambe.—Promenade Lighting and the War.—Owing to the increased cost of carbons the Electric Light Committee has asked the Finance Committee to contribute £100 to meet the increased expenditure, but this has been refused. The Council has decided, in accordance with the suggestion of the Admiralty, that only one-half of the promenade arc lamps shall be lighted in future, and that the remainder shall be extinguished at 11 p.m.

Oakworth.—Proposed E.L.—The District Council has decided to grant an interview to the Yorks. Electric Power Co. to discuss the proposals in regard to the supply of electricity for power and lighting purposes.

Oldham.—The Electricity Committee has decided to receive a deputation from the Lees and Springhead District Councils, who have asked the Corporation to consider the supply of electricity in their districts.

Portishead.—New Power Station.—The Clevedon, Portishead and District Electric Supply Co., Ltd., has applied to the B. of T. for sanction to construct a generating station at Long Ashton in connection with the Portishead electric light scheme, and to the use of overhead lines for the transmission of current at a pressure of 550 volts to the South Liberty Colliery, Bishopsworth.

South Africa.—A Government inquiry has been held into the application of the Victoria Falls Power Co. for certain amendments of details of power. The application was that there should be no power at Driehoek, that the Simmer Pan allocation of 42,000 kw. should remain as before, and that the Brakpan figure should be increased to 45,000 kw.

Southampton.—A special meeting of the Council is to consider the report of Sir John Snell and Mr. E. Edmonds, the consulting experts, upon the Corporation electricity undertaking. The cost of the report, including fees, expenses and printing, was £594.

Southport.—Electrical Exhibition.—An Electrical Exhibition is being held by the Corporation, which has arranged with the local electrical contractors to undertake installations at 10s. per lamp, either on the deferred payment system (20 quarterly payments) or by cash payment, with a special discount of 10 per cent.

Stoke-on-Trent.—Loan Sanction.—The L.G.B. has sanctioned an expenditure by the B. of G. of £220 for an installation of telephones and electric bells.

Annual Report.—There was a loss on the past year's working of the combined electricity works of the borough of £6,162. The total revenue was £52,560. The net loss was £5,139, to which £1,023 was added on account of capital expenditure paid out of revenue. Extraordinary repairs to plant, increase in rate assessment, and the higher cost of fuel have been responsible for the loss.

Swinton and Pendlebury.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £1,571 for electric lighting of public streets.

Thorne (near Doncaster).—Prov. Order.—The R.D.C. has decided to support the Yorkshire Electric Power Co.'s Bill.

Todmorden.—Year's Working.—The borough treasurer's statement shows a loss of £1,144 on the working of the electricity undertaking for the last financial year.

Troon.—E.L. Scheme.—The T.C. has been informed that the promoters of the electric lighting scheme hoped to be in a position to supply electricity in the district early in November.

Walsall.—New Loan.—The T.C. has postponed the application to the L.G.B. for sanction for a loan of £23,595 for extensions to the electrical undertaking.

West Ham.—The borough electrical engineer has been asked to draw up a scheme for installing electric light at the proposed sanatorium at Langdon Hills.

Whitworth (Lancs.).—The L.G.B. has intimated to the D.C. that a loan for the electricity sub-station scheme cannot be sanctioned until plans, particulars and amended estimates of the cost have been submitted, and these are now being prepared.

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TRAMWAY and RAILWAY NOTES.

Aberdeen.—The T.C., at its next meeting, is to consider the proposed acquisition by the city of the Aberdeen Suburban Tramway Co.'s undertaking.

Blackpool.—P.A.Y.E. Cars.—The Tramways Committee has decided to introduce the "pay-as-you-enter" system for top-deck passengers.

Coventry.—The Corporation is recommended to obtain powers in connection with the Bill about to be promoted in Parliament, to construct double lines of tramways along the proposed new streets from Broadgate to Hales Street, and from Burges to Fleet Street.

Croydon.—Recruiting Car.—We have received from Mr. T. B. Goodyer, the Corporation tramways manager, a view showing how a rail watering car on his system has been adapted with a view to helping forward local recruiting. The car is covered with recruiting notices, and at night rendered attractive with some 150 32-c.p. lamps.

Golcar.—The U.D.C. has decided to ask the Huddersfield Corporation on what terms it would be prepared to take the tramways to Golcar.

Halifax.—Annual Report.—The accounts of the Corporation tramways department for the past year show a total revenue of £109,650, and working expenses amounting to £73,272, leaving a gross profit of £36,377. The net profit was £13,642. The motor-omnibus account shows a deficiency of £172 upon the year's working, excluding any charges for sinking fund or depreciation. There was, however, a balance of £480 on the tire account, leaving a credit balance of £308.

Japan.—The growth of electric railway systems continues (says a Consular report from Osaka). There are now within a radius of 50 miles of Osaka close on 250 miles of double track in operation and 80 miles more under construction or proposed in the near future. Several inclined cable tramways are on the tapis. The growth of light railways has been slower, the mileage of single track being under 50 miles. Another 50 miles are under construction. Numerous plans are projected, but hitherto have been held up by the difficulty of finding capital.—*Financier.*

London.—Bethnal Green.—The L.C.C. is about to undertake the reconstruction of the tramways in Grove Road.

Stepney.—The B.C. is recommended to oppose the proposal to reconstruct the track work of the old horse tramway in Burdett and Grove Road, as there is reason to apprehend that the L.C.C. has in view the installation of the overhead system of traction, and the L.C.C. is to be informed that the B.C. is of opinion that the reconstruction should be such as to make it available for the adoption of the underground conduit system.

The Metropolitan Electric Tramways Co. has abandoned the proposed railless traction system from Tottenham to Walthamstow.

Newcastle.—The Tramways Committee has decided to seek Parliamentary powers to run through traffic between Newcastle and Gateshead across the high-level bridge.

Southampton.—The B. of T. has consented to the proposal of the Council to lay a double line of tramway in lieu of the existing single line in Bridge Street. The tramrails for a considerable distance towards Bitterne will shortly have to be relaid.

Stirling.—The T.C. has resolved not to proceed further with the negotiations regarding the proposed electrification of the tramway system and its extension to Bannockburn.

Tramway Receipts and War.—The official returns of 60 of the principal tramway undertakings of the United Kingdom for the week ended September 19th show total receipts of £226,838, or £7,747 less than in the corresponding week of last year.—*Standard.*

U.S.A.—Electric Vehicle.—The report of the Electrical Bureau of the City of Philadelphia, states that the time required in repairing troubles on the underground system has been very much reduced by the use of an electric truck, the number of hours in which the underground circuits were out of service having been cut down in 1913 about 40 per cent. as compared with 1912. The cost of operation in 1913 was a little less than for 1912, even with the greater amount of work. The forces employed were 20 as compared with 21 in 1912.

Wallasey.—Annual Report.—The accounts of the Corporation tramways department for the year ended March 31st show receipts £63,150, compared with £57,458 during the previous year. The passengers carried numbered 13,105,204, an increase of over a quarter of a million. Out of the profits £7,750 has been credited to the district fund in aid of the rates.

TELEGRAPH and TELEPHONE NOTES.

Cable Repaired.—The Direct Spanish Telegraph Co.'s cable between Falmouth and Bilbao, which had been interrupted, has been restored.

Cable Tariffs.—The deferred-rate system, which had been suspended by the Eastern cable companies, was resumed on October 1st.

Since our leading pages went to press, the Postmaster-General has announced that in future, all letters and figures in the address, text, and signature of telegrams for places served by the Eastern companies, will be counted together, each figure being reckoned as two letters, and the total divided by ten will be taken as the number of chargeable words, any surplus group of less than ten letters being charged as one word.

Cable Cut.—Cable communication between Sweden and Germany was interrupted on September 30th.

Corea.—There has been a marked development in the telephone system in Corea during the past few years, all the large cities and towns being now provided with exchanges. According to a recently-issued official report there are at present in Corea 45 telephone exchanges, including 21 special exchange offices, the total number of subscribers being 9,469. The aggregate length of the telephone wires in use is stated to be 12,260 miles.

Russia.—In a recently issued report on Russia, one of our Consuls states that some 20 radio-telegraph stations have been erected by the Chief Department of Posts and Telegraphs at various places on the Russian sea coasts. They are all equipped with the newest Marconi and Telefunken appliances, and are of three types:—(1) For roadsteads, of 0·5 kw.; (2) shore, for communicating with shipping, 1 kw.; and (3) high-power stations from 1 kw. upwards. The majority of the stations are of the second type, with waves of 300 and 600 m. and a working radius of 300 km. Most Russian stations can also send out 420-m. waves.

United States.—A special licence has been issued permitting the wireless station at Sayville, Long Island, to operate for regular commercial communication with Germany for a period until January 1st, 1915 This, says Reuter, is the only U.S.A. wireless station capable of direct connection with Germany.

Wireless in Warfare.—It is suggested that the German cruiser *Emden*, which has been so successful in capturing British ships in the Bay of Bengal, has been receiving information regarding the movements of shipping from the Telefunken stations in the Dutch East Indies; these are, of course, on neutral territory, but are probably worked by German officials.

Wreck of the "Buccaneer."—The crew of the cable steamer *Buccaneer*, which was lost while on a voyage from Mauritius to Tamatave in the Indian Ocean, reached Plymouth last week. There were 61 on board the cable ship when she ran ashore and became a total wreck. All were saved, although one boat capsized, the occupants having a narrow escape.—*Financial Times.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—November 25th. Victorian Railways. 25 battery signal machines for operating signals. Contract 27,479. Contractors' Room, Railway Offices, Spencer Street.

Adelaide.—November 11th. Portable desiccating plant, petrol motor driven, for Postmaster-General. See "Official Notices" to-day.

Perth.—November 18th. 249 accumulators and power board, for Postmaster-General. See "Official Notices" to-day.

Brisbane.—November 4th. Paper-insulated lead-covered cable; insulators; ironwork, &c.; cast-iron pipes; iron or steel poles and fittings; galvanised-iron wire; and covered wire, for Postmaster-General. See "Official Notices" to-day.

December 15th. Switchboard, common battery, automatic or semi-automatic, for the Postmaster-General. See "Official Notices" September 25th.

Colwyn Bay.—October 20th. Turbo-alternators and condensing plant; boilers, stokers, pumps, &c; switchgear; cooling tower; crane; power station cabling and wiring; cables; rotaries and transformers, for the U.D.C. See "Official Notices" Sept. 25th.

Heywood.—October 17th. Corporation. Converting plant, A.C. and D.C. switchgear and cables, battery booster, E.H.T. overhead line, E.H.T. switchgear for sub-station. See "Official Notices" September 25th.

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Hornsey.—October 9th. Two rotary or motor converter sets, &c., for the T.C. See "Official Notices" September 18th.

Leicester.—October 17th. Corporation. Steel plate, girders, steel troughing, &c., for the Tramways and Electricity Committee. Specifications from the Borough Engineer.

Littleborough.—October 12th. U.D.C. (1) Removal of transformer kiosk and gear and connection of mains to new sub-station; provision of additional cables, road work, &c. (2) Transformers, equipment and switchgear, for new sub-station. See "Official Notices" September 25th.

Manchester.—October 6th. Supply of a car-wheel tire boring mill. Specifications, Mr. J. M. McElroy, General Manager.

October 6th.—The Tramways Committee is inviting tenders for scrap materials, comprising miscellaneous copper, gun-metal and brass, &c.

South Africa.—Johannesburg.—October 9th. Ten single-truck double-decked electric tramcars, for Municipal Council. Specifications, &c., may be seen at Commercial Intelligence Branch of Board of Trade.

Stockport.—October 4th. B. of G. Tenders for electric lamps of British manufacture by a British firm. Forms from Union Offices, Shaw Heath, Stockport.

Swansea.—October 5th. Corporation. Lighting installation at Police Station. See "Official Notices" September 25th.

Taunton.—Corporation. October 2nd. 1,500 to 2,000 tons of coal for use on chain-grate stoker, for the Electricity Committee. Particulars from Mr. A. J. Howard, Borough Electrical Engineer, St. James Street.

Warrington.—October 13th. Sub-station ironclad switchgear for Tramways Committee. See "Official Notices" to-day.

CLOSED.

Australia.—The following tenders have been accepted:—

Commonwealth P.M.G.'s Department:—

Two generating sets for radio-telegraph station, £608.—Shaw Wireless, Ltd.

Postmaster-General's Department, Sydney:—

Fifty-five miles twisted pair wire, £264: 42 miles ditto, £138 12s.; 25 miles three twisted conductor wire, £168 15s.; 4 miles ditto, £17 18s.—British Insulated & Helsby Cables, Ltd.

Western Australian Tender Board:—

Insulated Wire Cable, Nos. 1 to 8, Railway Department.—Couche, Callender and Co.

Metropolitan Board of Water Supply and Sewerage, Brisbane:—

Electric jib crane, £520.—J. R. Toole & Co.

Preston Municipal Council, Victoria:—

Supply of meters.—Australian General Electric Co.

—*Tenders.*

Blackpool.—The contract for the electrical installation at the Savoy Hydro., now being erected between Uncle Tom's Cabin and the Gynn, has been secured by Mr. R. Barron of Fleetwood.

Burslem.—The B. of G. has accepted the tender of Messrs. J. Barnett & Co. for a year's supply of electrical fittings, at £57.

Cleckheaton.—The Electricity Committee has accepted the tender of Messrs. Baldwin & Co., for a new isolating valve.

Heston and Isleworth.—The U.D.C. has accepted the offer of Messrs. Browett, Lindley & Co., Ltd., to replace the defective Uniflow engine at present in use at the electricity works by a triple-expansion engine suitable for driving the dynamo now coupled to the existing engine, at an additional cost of £200, and to make arrangements to have foundations laid in a new position and extensions of pipes, &c., made for connecting the new engine.

Ilford.—Messrs. Pritchetts & Gold, the Council's contractors for the supply of plant for the Goodmayes sub-station, have, owing to the war, been unable to deliver the glass containing cells for the battery. Under the circumstances, the Electricity Committee has accepted the firm's offer of wood lead-lined boxes, at a cost of £175 extra on the contract.

The electrical engineer and the chairman and vice-chairman of the Electricity Committee have under consideration a letter from the Sloan Electrical Co. stating their inability to supply arc lamp carbons of Conradty's manufacture, and offering to supply from stock; also, a communication from the Board of Trade calling attention to the shortage of carbons, and making certain suggestions in relation thereto.

The Electricity Committee has accepted the tender of Mr. Geo. T. Walker, at £490, for the erection of workshops at the electricity works.

London.—Stepney.—The B.C. Electricity Committee reports that owing to the regular supplies of coal under contract having ceased on the outbreak of the war, the following offers had been accepted on August 5th:—

A. Blackmore & Co., 100 tons Ibstock Nuts, at 14s. 9d. per ton; W. Cory and Son, Ltd., 300 tons of Washed Peas, at 13s. 6d.; Dinham, Fawcus & Co. 200 tons Scotch Washed Peas, at 15s.; E. Foster & Son, 300 tons Ibstock Nuts D/S, at 15s. 6d.; Harris, Hardman & Co., Ltd., 400 tons Hillhouse Washed Peas, at 18s. 9d.; Harrisons (London), Ltd., 200 tons Gedling Slack, at 16s. 6d.; 300 tons Kilburn Manners Peas, and 150 tons Rutland Peas, at 19s. 6d.; Kerr and Son, 100 tons Nailstone Nutty Slack, at 11s. 6d.

The Committee reports that with a view to supplementing the Council's stock of coal, the following offers were accepted on September 8th and 17th:—

W. H. Bowater, Ltd., 150 tons Clifton Peas, 15s. 7½d.; A. Blackmore & Co. 100 tons Lanarkshire Peas, 14s. 7d., 100 tons Lanarkshire Peas, 14s. 1d.; Cory Bros. & Co., 60/70 tons Clifton Peas, 16s.; 200/300 tons Glascote Nutty Slack, 12s. 6d.; 200 tons Nailstone Slack, 12s. 3d.; Charrington, Sells, Dale, 200 tons Bestwood Peas, 15s. 3d.; Dinham, Fawcus & Co., 200/300 tons Scotch Peas, 16s.; Shipping and Coal Co., Ltd., 600 tons Cowpen Nuts, 15s. 9d.; Edge, J. 200 tons, Griff (Warwickshire) Peas, 15s. 9d.; 250 tons Cossall Screened Peas 16s. 6d.; 200 tons Clifton (Notts.) Peas, 15s. 4d.: Foster, E., & Co., 200/400 ton Walsall Washed Beans, 16s. 8d.; Harris, Hardman & Co., 300 tons Hillhouse Washed Peas, 16s. 8d.; Hudson, J., & Co., 200 tons Bankness Washed Peas 15s.; Harrisons (London), Ltd., 400 tons Kilburn Manners Peas, 16s.; Hudson, J., & Co. 100 tons Bankness Peas, 14s. 7d.; 200 tons Bankness Washed Peas, 14s. 1d.

The following tenders were received for 50 tons of moulded pitch:—

		Per ton.
T. Crow & Sons	(recommended)	£1 19 6
J. Smart & Son	.. .. ..	2 5 0
Forbes, Abbott & Lennard, Ltd.	.. .. ..	2 11 2
Grindley & Co., Ltd...	.. .. ..	2 12 6
Gillespie & Beales	.. .. ..	2 17 0

The Committee reports having purchased 9,200 pairs of Henrion flame arc carbons, at £72.

The Electricity Committee reports that owing to the difficulty experienced in obtaining supplies of arc lamp carbons, arrangements had been made for fixing on some of the existing lamp columns half-watt lamps, in connection with which the following tenders had been received:—

		Per lamp.
Edison & Swan U.E.L. Co. ..	(recommended)	£1 0 0
Drake & Gorham (Mazda lamps)..	.. .. ..	1 0 0
,, ,, (Osram lamps)..	.. .. ..	1 1 7
British Westinghouse Electric & Manufacturing Co.		1 0 0
Electrical Co.	.. .. ..	1 0 0
Siemens Bros. Dynamo Works. ..	.. .. ..	1 0 0
British Thomson-Houston Co. ..	.. .. ..	1 1 7
General Electric Co...	.. .. ..	1 1 7

The Committee also reports having obtained 70 Wimbledon fittings, without reflectors, for use with above lamps, at 21s. 6d each, from the Foster Engineering Co., and considering it advisable to extend the erection of fittings similar to those in use in Cable Street, the offer of the Universal Electrical Manufacturing Co. to supply 70 fittings, at 37s. each, had been accepted; and also the offer of 10,000 pairs of yellow flame carbons, at £15 5s. per 1,000 pairs, from the G.E. Co., Ltd., had been accepted.

For the protection of the windows at the Limehouse electricity station with wire guards, the tender of Mr. W. Badger, for £71, is recommended for acceptance.

Southwark.—The General Electric Co., Ltd., has been given an order for the supply of 45,000 pairs of 7 × 8 and 8 × 9 mm. carbons to be delivered as and when required during the next 12 months, at £8 7s. 10d. and £9 12s. 2d. per 1,000 respectively. The tender of the same firm is recommended for acceptance for the supply of 20 Angold magazine flame lamps. Owing to the war, the electrical engineer has ordered from the Electrical Equipment and Engineering Co. one mile of 3/20 cable, at £14 10s.; one mile of 7/20, at £26; one mile of 7/22, at £16 5s.; one mile at 7/18, at £32; and one mile of 7/16, at £48 10s.

Rochester.—Amongst orders recently received by Messrs. Venner Time Switches, Ltd., is one for 73 time switches for the Kent Electric Power Co., for Rochester.

Southampton.—The following tenders have been accepted by the Electricity Committee:—

William Rickard, Ltd.—Cable, £96.
Union Cable Co., Ltd.—Small size H.T. cable, £122 per mile.

Stockport.—The B.G. has accepted the tender of Messrs. McClure & Whitfield for the electrical installation at the hospital extension, at £74.

Tottenham.—The Council has accepted the tender of Messrs. N. E. Keen & Co., of Westminster, of £10 for the maintenance of electric fittings. The only other tender, £41, was received from Mr. J. H. Golding, of Stoke Newington.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, October 3rd. Visit to Textile Department, Royal Technical Institute, Salford.

Greenock Electrical Society.—Thursday, October 8th. At 7.45 p.m. Visit Hunter Place sub-station.

Electro-Harmonic Society.—Friday, October 9th. At 8 p.m. At Holborn Restaurant. Smoking concert.

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NOTES.

Institution and Lecture Notes.—Institution of Marine Engineers.—On Monday, September 21st, a demonstration was given of the Amalgaline system of metal jointing, by Mr. Harden, the inventor of the process. In marine work, the principal uses to which the system is applied are the flanging of pipes, the seaming of lead used in refrigerating chambers and general sanitary work. The process is now in general use among shipbuilders. It was described in our pages some years ago.

Junior Institution of Engineers.—The Council has elected the Marquis of Graham as president for the year 1914-15, in succession to Sir Boverton Redwood. The Vickers Prize, consisting of a Gold Medal and Premium, has been awarded to Mr. James Richardson, for his paper on "High-Power Diesel Engines." Mr. Richardson has also secured the Institution Medal for the same paper.

The following are the announcements for the month of October:

October 9th.—8 p.m. Informal Meeting at 39, Victoria Street, S.W. Mr. Wm. P. Durtnall, on "The Barrier of Ignorance," illustrated by lantern.
October 12th.—8 p.m. At the Institution of Electrical Engineers, Victoria Embankment. Paper by Mr. Wm. Scott Taggart, M.I.Mech.E., on "Cotton Spinning."
October 16th.—8 p.m. Informal Meeting at 39, Victoria Street. Mr. W. T. Dunn, on "The Latest in Home Lighting."
Visit of Sheffield Local Section to the Works of Messrs. Mellowes and Co., Sheffield.
October 23rd.—8 p.m. Informal Meeting at 39, Victoria Street. Lecturette by Mr. H. N. Munro.
October 30th.—8 p.m. Informal Meeting at 39, Victoria Street. Lecturette by Mr. R. Rankin, A.M.I.E.E.

Excellent progress has been made with the Local Sections in Birmingham, Manchester and Sheffield. The membership has considerably increased during the year, and the Committee of each Section is arranging a full and interesting programme for the coming session.

Inquiries.—Manufacturers are asked for of bone or imitation ivory press buttons; brass or german silver springs and screws for wood electric bell pushes, both flat and pear shape; "clear Oyster glasses"; and cheap porcelain cones, 1½ in. to ¾ in. diameter, threaded top and bottom.

The Officer Commanding Royal Engineers, Shoeburyness, would be glad to know of any electric reading or recording tide gauge that is on the market.

All kinds of plant for making metallic-filament lamps are asked for, to start the industry in a neutral country.

Suppliers of "Fontaine bleu" sand for making glass bulbs are asked for.

Manufacturers of machines for winding armatures, winding wire on bobbins, and winding silk, &c., on wire are inquired for.

The Electro-Harmonic Society.—The first Smoking Concert of the season will be held at the Holborn Restaurant (King's Hall), on Friday next, October 9th, commencing at 8 o'clock. Mr. A. Hugh Seabrook will preside. The preliminary programme is as follows:—Vocalists: Mr. Anderson Nicol (tenor), Mr. Thorpe Bates (baritone); Mr. Walter Montague (novel instrumentalist and humorist); Mr. Walter Churcher (humorist); Mr. Ernest Hastings (entertainer at the piano). A professional orchestra from the London Symphony, Philharmonic, and the King's Private Band. At the piano, Mr. Bernard Flanders, A.R.A.M. The programme will include national anthems, patriotic songs and nautical and patriotic selections.

Tungsten Extraction.—At the meeting of the Mawchi Tin and Wolfram Co on Tuesday, it was stated that in order to supply the Sheffield steel makers, arrangements were in progress for the extraction of tungsten from the ore in this country. Hitherto the tungsten used in the manufacture of special steels has come from Germany.

Engineer Units of the Royal Naval Division.—The Board of Selection will continue to interview applicants until the end of this week. Applicants (who must have had actual experience of constructional work) are required to attend in person at 2, Savoy Hill, W.C., between 10 a.m. and 1 p.m., or between 2 p.m. and 4 p.m. (Saturday, 10 a.m. to 1 p.m. only.)

Enemy Patents.—The following statement has been kindly sent to us by a firm of chartered patent agents, who desire to remain anonymous:—It is officially announced that "all persons resident, carrying on business or being in our Dominions," may pay any fees necessary for obtaining the grant, or for obtaining the renewal of patents, or for obtaining the registration of designs or trade marks, or the renewal of such registration *in an enemy country*; and also may pay into the British Patent Office in London on behalf of an "enemy" any fees payable on application for, or renewal of, the grant of a British patent, or on application for the registration of British designs or trade marks, or the renewal of such registration.

The German, Austrian and Hungarian Patent Offices have issued various temporary rules and indulgencies to safeguard certain rights of applicants and patentees which might otherwise have been jeopardised or lost by reason of delays arising out of the hostilities.

Switzerland, though not a belligerent, has likewise provided for special extensions of time for payments and for other matters.

The United States Patent Office, whilst it has no authority to extend the time of filing applications delayed "because of the unsettled condition of European affairs," will probably present the matter to Congress with a view to the obtainment of legislation to remedy the disabilities arising out of such delays.

Canadian Inquiries.—A Winnipeg firm offers to co-operate with United Kingdom manufacturers of electrical goods, hardware, &c., wishing to enter the Western Canada market. A Montreal company, dealing in electrical supplies, wants to get into communication with British makers of tungsten and carbon electric lamps, street and other fittings for same, and arc lamp carbons. Further particulars (names, &c.) respecting these inquiries, can be obtained at the Commercial Intelligence Branch of the Board of Trade in London.

Charge of Stealing.—At the Mansion House Police Court on September 29th, Alexander Farquhar, 39, foreman spinner, was charged, before Sir John Knill, with stealing quantities of copper, brass and zinc, the property of his employer, Mr. David Assersohn, electrical engineer, of 31, St. Bride's Street. Prisoner was charged further with feloniously inciting Frank Brenner, an apprentice, to steal the property of his employer. Prisoner, who expressed regret for what he had done, was committed for trial.

Fire Patrols for Factories.—The British Fire Prevention Committee desire it to be known that a certain number of reserve firemen (over 35 years of age), of good character and experience, are available from the Committee's Special Fire Service Force, to do either part time, or full time watch or patrol service on factories and works engaged upon Government emergency orders. Applications should be addressed to the Registrar, British Fire Prevention Committee, 8, Waterloo Place, London, S.W.

Appointments Vacant.—Junior engineer-in-charge (£2), for Darlington Corporation electricity works. Particulars are given in our advertisement pages.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. Banbury, shift engineer at the Barnes U.D.C. electricity works, having joined the Army, Mr. Kieffer has been appointed to succeed him until his return.

Mr. A. J. Dobson, meter superintendent at Croydon, has been appointed to a similar position at Hull, recently advertised.

In the absence, on active service, of Lieut. G. C. Milnes, electrical engineer to the Lancaster Corporation, Mr. Pearson has been placed in charge of the station. Mr. Milnes is serving with the 5th King's Own Regiment.

The following increases of salary are to be granted to the undermentioned employés at the Ilford electricity works:—Mr. J. R. Wilson, first charge engineer, £165 to £170; Mr. G. E. Williamson, second charge engineer, £130 to £140; Mr. A. Glazier, third charge engineer, £127 10s. to £135; Messrs. P. E. Smith and T. O. Reynolds, meter inspectors, £1 10s. to £2 per week each.

The marriage took place at Vaynor Parish Church, on September 21st, of Mr. Edward Rowlands, of the staff of the Merthyr Electric Traction and Lighting Co., and Miss Annie Dix, eldest daughter of Mr. S. Dix, of Merthyr.

Mr. R. W. Jolly, of the staff of the Blackpool electricity department, has joined the Royal Engineers.

Tramway Officials.—Mr. W. R. Lorrimar, who has left the staff of the Hull municipal tramways department to go into business for himself in the city, has been presented by his colleagues with a silver inkstand.

General.—Alderman William Thompson, chairman of the Blackburn Electricity and Tramways Committee, has agreed to be nominated for the mayoralty of the borough.

The office staff of the British Insulated and Helsby Cables, Ltd., Helsby, have presented a case of cutlery to Mr. A. E. Smith upon the occasion of his marriage.

Mr. H. J. Groves Webb, engineer and departmental manager of the Electrical Co., Ltd., Charing Cross Road, W.C., has joined the Royal Naval Division (Engineer Units) and is in the Naval Camp at Martin Mill, near Walmer.

Mr. Charles Bright, F.R.S.E., delivered a very timely and interesting address on "A Nation's Awakening," at the Leigh Institute on September 18th. A full report is appearing in the *Tonbridge Free Press*.

From an announcement appearing among our advertisements, it will be observed that Mr. Edward Albert Uffelmann, of Epsom, has adopted the surname of Edwards (Edward Albert Edwards).

Obituary.—Mr. R. Hope-Jones.—We regret to announce the death of Mr. Robert Hope-Jones, M.I.E.E., which occurred suddenly at Rochester, New York State, on the 13th ult. Born in 1859 at Hooton Grange, Cheshire, he was the third son of William Hope-Jones, a pioneer of the Volunteer movement and founder of the 1st Cheshire Rifles, whose annual camp was always held on the estate. The "Hope" represents the Liverpool banking family after which Hope Street and Hope Hall were named. Of musical parents, he was a musician to the finger-tips, and we hear of his playing the organ for occasional services at Eastham Parish Church when he was nine years old. But his life was one

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long struggle against ill-health and financial worry, the temperament of the artistic inventor and the successful commercial man being as difficult to harmonise as oil and water. His courage in surmounting these obstacles is described as superhuman, and the mass of inventive work achieved under such disadvantageous circumstances was enormous. After an apprenticeship at Laird Bros., Birkenhead, 1876-1882, he became chief electrician to the Lancashire and Cheshire Telephone Co., Ltd., leaving them in 1889 to develop his invention of the megaphone, a method of increasing the power of the human voice through the application of a compressed air relay. Though then unsuccessful in its application, the principles he enunciated are now used in connection with gramophones. For this purpose he had established a small workshop close to St. John's Church, Birkenhead, of which he was the voluntary organist and choirmaster. Here began his epoch-making inventions in organ building. The improved electro-pneumatic action, the movable console, the high wind pressures, the percussive attack, the double touch, the stop-switch and the stop-keys instead of draw-knobs, startled the organ world, and St. John's Church was visited literally by thousands of organists from all parts of the kingdom. Thanks to liberal financial support from such men as Mr. Thomas Threlfall, then chairman of the Royal Academy of Music, and Mr. J. Martin White, ex-M.P. for Dundee, an organ-building works was established in Birkenhead, and many fine examples of his art were erected such as those in St. George's, Hanover Square, St. Michael's, Chester Square, and Worcester Cathedral.

Mr. J. Hamer.—The death occurred on September 24th, after an operation, of Mr. Joseph Hamer, electrical engineer, of Broad Street, Halifax, and formerly of Sowerby Bridge. Deceased, who was in his 57th year, had been in business at Halifax since 1884, and was a member of the local Electrical Contractors' Association.

CITY NOTES.

Dundee, Broughty Ferry and District Tramways Co.

At the meeting of this company, Mr. George Balfour, moving the adoption of the report, which recommended a dividend of 2½ per cent. for the year, said the directors regarded the result of the year's working as entirely satisfactory. The receipts for the year amounted to £13,986, being an increase of £683 over the preceding year, but expenses, chiefly in coal and maintenance charges, had also increased. The gross profit was practically the same as last year amounting to £6,328. The Dundee Corporation, under the powers conferred on them by the Companies' Act of Parliament, had intimated that they intended to acquire the portion of the company's tramway from Craigie Terrace to Belsize Road, a route length of, approximately, 7 furlongs, and an arbiter had been appointed by the Board of Trade to fix the price to be paid by the Corporation. The company was preparing its claim and would take all steps necessary to support it.

Drake & Gorham, Ltd.

The directors' report for the year ended June 30th, 1914, shows that after payment of all charges, including bonuses due to staff, and making provision for contingencies, there remains a net profit of £8,215, which, with £1,716 brought forward, makes a total of £9,931, which it is proposed to appropriate as follows:—Dividend at the rate of 4 per cent. per annum £5,000, writing down goodwill £3,000, and carrying forward £1,931. After careful consideration the directors have decided not to defer payment of dividends to the shareholders as they appreciate the necessity for maintaining the circulation of money. They gratefully acknowledge the kind support given by many clients during this critical time, which has enabled them to provide employment up to the present for those who have not been able to enlist, and to make provision for dependants of employés who are serving their country. The retiring director, Mr. Elwin H. Story, does not seek re-election.

The dividend paid in 1913 was 5 per cent. per annum, requiring £6,250, £4,000 was written off balance of underwriting commission, and £1,716 carried forward.

La Plata Electric Tramways Co., Ltd.—The directors announce, says the *Financial Times*, that the approximate result for the half-year to June 30th, 1914, shows an available balance of £7,931, as against £9,706 in 1913, and after allowing for debenture stock and other interest, but without any further contribution for reserves or renewals fund, there would remain a balance of £5,212. Having regard to the provision to be made for paving and other payments on capital account and to the existing stringency of the money market, the directors have decided not to pay an interim dividend on the preference shares, but to await the final accounts for the year.

Folkestone Electricity Supply Co., Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum (3s. per share), less income-tax, on the ordinary shares for the half-year to June 30th.

County of Durham Electrical Power Distribution Co., Ltd.—The directors announce that they have decided not to declare an interim dividend on the preference shares.

Buenos Ayres.—The *Financial Times* says that the general stagnation of business in Buenos Ayres, together with the torrential rains, have hit the tramway business pretty hard. Still the report of the South Electric Tramways Co. (Compania de Tramways Electricos del Sud) for the year ended June 30th last is a fairly hopeful one, and the directors are able to recommend the distribution of a 4 per cent. dividend on the ordinary shares. The receipts from tickets have fallen from $1,137,603 in the preceding year to $1,119,190, which works out at a decrease of 1·62 per cent. Unfortunately at the same time the accounts had to bear the extra expenditure entailed by the opening of the branch to the Plaza Constitucion, which took place at the beginning of April, the very time when the excessive rains were beginning to make people keep indoors in the towns, as well as cause the disastrous floods in the country. The extra expenditure consequently was not balanced by the extra takings in the way of fares which had been legitimately hoped for, the outgoings increased from $834,681 to $839,878, and the working coefficient from 73·37 per cent. to 75·04 per cent. The directors are confident that this very high rate will be reduced in the immediate future, for they propose to make a reduction in fares from which they expect the tram business will derive considerable benefit. The company's assets are stated at $6,532,552, the paid-up capital being $3,805,690.

British Radium Corporation, Ltd.—This corporation, at an extraordinary general meeting held in London on 23rd inst., resolved to increase its capital from £40,000 to £50,000. Sir Francis Fox, who presided, said that the new works were now practically completed, and would, he hoped, continue to work at their full capacity in the manufacture of radium salts, uranium and other products.

Hurst, Nelson & Co., Ltd.—The directors report that the accounts for the year ended July 18th, subject to audit, will enable them, after setting aside the amounts required for the dividend on the preference shares payable in November and May next, and placing a substantial sum to reserve, to recommend a dividend of 5 per cent. on the ordinary shares. A year ago 2½ per cent. was paid on the ordinary shares.—*Times*.

South Metropolitan Electric Light and Power Co., Ltd.—Warrants for interest on the 4½ per cent. first mortgage debenture stock for the half-year ended October 1st, have been posted.

Kalgoorlie Electric Power Co., Ltd.—A dividend on the preference shares at the rate of 4 per cent. per annum for the six months ended September 30th, 1914, is announced, payable on October 16th.

NEW COMPANIES REGISTERED.

Derby Lamp Works, Ltd. (137,759).—Registered September 23rd, by Ralph Raphael & Co., 17, Coleman Street, E.C., with a capital of £85,000 in 116,500 profit participating cumulative preference shares of £1 each and 274,000 ordinary shares of 5s. each. Objects:—To carry on in the United Kingdom, the Colonies, India, or elsewhere, the business of manufacturers of electric lamps, filaments and radiators of all kinds, stoves, meters, fittings, apparatus and appliances connected with electricity, water, oil, gas or otherwise; electrical, telegraph, telephone, mechanical and consulting engineers; wholesale or retail manufacturers of, and dealers in, chemicals, drugs, preparations, oils, paints, colours, varnishes and other compounds used by photographers, dyers, chemists, druggists or drysalters, &c. The signatories (with one share each) are:—C. B. James, Holme House, Norbury, Surrey, accountant; W. Lee, 19-20, Avenue Chambers, Bloomsbury Square, W.C., director; J. Bransbury, 3, Pancras Lane, E.C., solicitor; A. Beard, 18 Station Road, Annerley, S.E., clerk; C. Burton, 37, Surrey Street, W.C., advertising contractor; C. H. Frost, 3, Pancras Lane, E.C., clerk; J. Clifford, 2, The Mall, Wembley, Middlesex, clerk. Minimum cash subscription, seven shares; the first directors (to be not less than two or more than nine) are W. Lee and H. How; qualification (except the two directors nominated in writing by the liquidator of Metalite, Ltd.), £500; remuneration, £100 each per annum (chairman £50 extra) and a percentage of the profits. Registered office, 9-10, Pancras Lane, E.C.

Parana Tramways Co., Ltd. (137,776).—Registered September 24th, with a capital of £75,000 in £1 shares, to acquire, use, work, dispose of, and turn to account, any tramways, railways or running powers, to generate, purchase and supply electricity for light, heat, motive and traction power and other purposes, &c., and to enter into an agreement with J. G. White & Co., Ltd. The subscribers (with one share each) are:—H. W. Stacey, 60, Trentham Street, Southfields, S.W., accountant; W. E. Hurry, 34, The Avenue, Highams Park, near Chingford, registrar; H. H. Clubb, 61, York Road, East Ham, clerk; F. J. Birch, 2, Castleton Road, Goodmayes, company secretary; O. S. Penton, 9, Lee Park, Blackheath, S.E., cashier; F. R. Simmonds, 204, Lyndhurst Road, Wood Green, N., clerk; F. W. Payler, 3, St. Stephen's Road, Lewisham, S.E., book-keeper. Minimum cash subscription, seven shares; the number of directors is not to be less than three or more than seven; the first are to be appointed by the subscribers; no qualification required for first directors; others, £500 shares, debentures or debenture stock; remuneration as fixed by the company. Solicitors: Julius, Edwards and Thomas, 8, Old Jewry, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Sloan Electrical Co., Ltd. (61,528).—Capital, £15,000 in £1 shares (5,000 pref.). Return dated July 17th, 1914, 5,000 pref. and 2,754 ord. shares taken up, £1 per share called up on 1,254 ord., £1,254 paid, £6,500 considered as paid on remainder. Mortgages and charges: Nil.

Naylorgraph, Ltd.—Debenture dated September 16th, 1914, to secure £250, charged on the company's undertaking and property, present and future, including uncalled capital, if any. Holder: J. M. Hunt, Fairlawn Park Road, Southborough, Kent.

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STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange business continues steadily to expand. Day by day the number of members who come up to Throgmorton Street is augmented by fresh arrivals who have scarcely put in an appearance hitherto, since the end of July. They are attracted by hearing that business is far from being dead. Some firms even boast that they are making income beat expenditure, but this, perhaps, must be taken in conjunction with comparatively light office expenses. Most brokers, for instance, are obliged to maintain relatively heavy charges for office accommodation and its incidentals, which is a source of outgoings that does not so greatly trouble the jobbers, two or three of whom can share a room, a clerk and a telephone, without putting any undue strain upon either of the three.

At the same time, business is very different, of course, from what may be described as normal. It would be waste of space, for instance, to re-set-up the two pages of price lists usual to this part of the Electrical Review. The quotations would be appropriate so far as buying prices are concerned, but since in many stocks it is still a matter of difficulty to find buyers, the re-establishment of regular price lists must still be delayed. If, however, there are readers who would care to see prices regularly, we will do our best to get an actual dealing price and to embody it in the various selections of quotations which we have been enabled to give since the war began.

The Home Railway market continues to show reviving vitality. A good many people are urging that investors have become so sick of losses incurred through the placing of capital in securities hailing from abroad that they must perforce turn to domestic channels for employment of their surplus cash. Prices have undergone extremely severe shrinkage from the best figures touched this year; and while there has been substantial recovery from the worst, the bullish argument is that plenty of scope remains for further advances.

The Underground group is in some favour with what may be termed its usual body of buyers, who, during the past week, have been picking up such amounts of Metropolitan Consolidated, District Ordinary and Underground Electric income bonds as are held to show the presence of the small capitalist. To the the Stock Exchange, these comparatively slender transactions are of little value, save for the indication which they afford of the trend of public opinion. The quotations have improved, notwithstanding quietude and dullness in the Consol market, where the price of the Funds has eased off to 68½, below which figure members are not allowed to deal amongst themselves, on behalf of clients.

Telegraph and Telephone descriptions are very quiet, showing no important changes from the figures given here last week. The feature is the strength of Marconis. The parent shares have risen to 1⅛, at which price there are supporters as these notes are being written. The firmness is based upon the current impression, already quoted here, that the company is doing extremely well in connection with Government work; and although the Government itself is working the concern, it is thought that the shareholders cannot fail to derive substantial benefit from the business brought by the war. American Marconis, after being down to 8s. 3d., have recovered to 9s.; while Canadians, which were none too readily saleable a few weeks ago, are now a tolerably good market in the neighbourhood of 4s. 6d. The Eastern group is unchanged, and the Anglo-American section has been attracting the attention of the speculative investor.

Amongst Electricity Supply shares there has been comparatively little doing during the past week. No pressure to sell, coupled with not much demand for shares, have combined to reduce the market to a state of stagnation. The companies, from all that we can hear, are doing better than might have been expected, having regard to the state of war, from which it may be inferred, reasonably enough, that a comparatively slight amount of attention would brace prices materially. Metropolitans within the past few days have changed hands at 3 and 3¼. South Metropolitan Preference can be sold at 22s. 6d. There are several buyers of Debenture stocks. South London Debenture, for example, is quoted at 98, and Chelsea Debenture at 90½. Possibly sellers could get these figures for the stocks.

British Columbia Electric Deferred stock at 94 is 12 points down since the Stock Exchange closed, and the 5 per cent. Preference, at 96, is 6½ lower. There is a small scrap of the Company's Preferred Ordinary on offer at 93, or a shade cheaper, this being some 9 points below the price ruling at the end of July.

Mexican utility shares and bonds are scarcely dealt in. The news from the country is bad, and the fresh revolution dashes to the ground the hopes which had been reared upon the elevation of Carranza to the direction of affairs—and, it was hoped, to the permanent handling of the reins of Government. This seems to be knocked on the head by the latest intelligence, and most securities connected with Mexico have gone back. There are still a few hardy buyers of Mexico Tramways bonds, who are prepared to give 73.

Argentine Tramway 5 per cent. Debenture stock is on offer at 93¼, free of stamp and fee, which is only 7¼ points higher than the price of the company's 4 per cent. First Debenture stock. Buenos Ayres Lacroze Extension Debenture changed hands the other day at 90, and the Consolidated Debenture at 84, these prices being practically identical with those of two months back. Toronto Power Consolidated Guaranteed Debenture stock has come on offer at 90, free; there is a dividend due on November 1st.

Brazilian Tractions rose to 52, but reverted later to the round 50. The shares are moving a good deal in sympathy with the general tone of markets. It would be interesting to know what proportion of the company's Common shares were held in Belgium, but, judging from experience, in the absence of such information, it would not be safe to draw rash conclusions from the known liking of Belgian capitalists for these shares.

British Westinghouse Preference have risen to 1⅞-1½, and, as may well be supposed, all the Armament shares are steady. The feature is the strength of Birmingham Small Arms, the price of which has risen to 55s., which is 12s. 6d. higher than the price was on July 30th. The Company has just issued a glowing report, and there has been substantial buying of the shares in various provincial centres, from Birmingham to Cardiff. Vickers at 34s. 6d., and Armstrongs at 38s. 9d., keep firm. There is a continuance of inquiry for Rubber shares, thanks, of course, to the demand experienced for the raw material in connection with stores and with tires for motor vehicles of all kinds, mostly military and commercial.

MARKET QUOTATIONS.

Owing to the war, the prices given below are, of course, only nominal.

Wednesday, September 30th.

CHEMICALS, &c.		Latest Price.	Fortnight's (inc. or Dec.
a Acid, Hydrochloric	per cwt.	Nom.	..
a " Nitric	"	"	..
a " Oxalic	per lb.	"	..
a " Sulphuric	per cwt.	"	..
a Ammoniac Sal	"	"	..
a Ammonia, Muriate (large crystal)	per ton	"	..
a Bleaching powder	"	"	..
a Bisulphide of Carbon	"	"	..
a Borax	"	"	..
a Copper Sulphate	"	"	..
a Lead, Nitrate	"	"	..
a " White Sugar	"	"	..
a " Peroxide	"	"	..
c Methylated Spirit	per gal.	"	..
a Potassium, Bichromate, in casks	per lb.	"	..
a Potash, Caustic (88/90 %) ..	per ton	"	..
a " Chlorate	per lb.	"	..
a " Perchlorate	"	"	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	"	"	..
a Shellac	per cwt.	"	..
z Sulphate of Magnesia	per ton	"	..
a Sulphur, Sublimed Flowers ..	"	"	..
a " Recovered	"	"	..
a " Lump	"	"	..
a Soda, Caustic (white 70/72 %) ..	"	"	..
a " Chlorate	per lb.	"	..
a " Crystals	per ton	..	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£88	..
b " Wire, in ton lots (1 to 14 S.W.G.)	"	£112	..
b " Sheet, in ton lots ..	"	£112	..
p Babbitt's metal ingots	"	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¾d.	¼d. dec.
c " Tube (brazed)	"	9¾d.	¼d. dec.
c " " (solid drawn) ..	"	8¼d.	..
c " Wire, basis	"	7¼d.	¼d. dec.
c Copper Tubes (brazed)	"	9¼d.	¼d. dec.
c " " (solid drawn) ..	"	9¼d.	¼d. dec.
g " Bars (best selected) ..	per ton	Nom.	..
g " Sheet	"	Nom.	..
g " Rod	"	Nom.	..
d " (Electrolytic) Bars ..	"	£56	£3 dec.
d " " Sheets ..	"	£74	£3 dec.
d " " Rods	"	£62	£3 dec.
d " " H.C. Wire	per lb.	7¾d.	¼d. dec.
f Ebonite Rod	"	8/6	1/- dec.
f " Sheet	"	8/-	1/- dec.
m German Silver Wire	"	1/7	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	2/9½	1¼d. dec.
l Iron Pig (Cleveland warrants) ..	per ton	50/11½	1/11½ dec.
l " Wire, galv. No. 8, P.O. qual.	"	£16	..
g Lead, English Pig	"	Nom.	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7	..
e Mica (in original cases) small ..	per lb.	1d. to 2/6	..
e " " " medium	"	3/- to 5/-	..
e " " " large ..	"	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	"	Nom.	..
p Phosphor Bronze, plain castings	"	1/1 to 1/3½	..
p " " rolled bars & rods	"	1/0½ to 1/3	..
p " " rolled strip & sheet	"	1/2½ to 1/5½	..
e Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	£141	..
g Tin, Block (English)	"	Nom.	..
n " Wire, Nos. 1 to 16	per lb.	2/3	1d. dec.
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh's (Vieille Montagne bnd.)	"	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

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PROBLEMS OF INDUSTRY.*

By "A WOULD-BE REFORMER."

Are the ability and resources of this country competent to carry its responsibilities? Though this question is for decision by the future, we have to find an answer now, and have no real choice as to what that is. We must answer in the affirmative, and make it our business to see that they are competent. But the question of how best to use our resources, and a doubt whether we are doing all that should be done, are continually before us.

The foundation of the national structure is national character, but everyone knows that this is a foundation to be built on with method, discipline, organisation, education, purpose, and many other materials. Here we are told that Germany is outbuilding us, and that we must change our methods, or be content to resign our position in the world.

We have before us Mr. J. J. Hill's recent speech at the National Foreign Trade Convention in the U.S.A., in which he severely criticised British industrial methods, especially in recent legislation, and predicted grave disaster for us in the near future. It is hard for us to accept this bewildering lesson. Can it be that the next generation to that which built the submarine cable system, the ocean steamship lines, the Lancashire cotton industry, the shipyards, fifty other things, is collapsing rapidly and disastrously through want of business methods? In what is it, how is it that we are failing? Or is it possible that Mr. Hill misunderstands the conditions, and we are not failing at all? Can so famous a prophet, with so loud a voice, so impressive a manner, so skilled in finance, though it is only American finance, be wrong?

We have had more than one lesson recently to teach us that not every prophet of woe is a Cassandra. A very few years ago we were scared by dismal calculations of the amount of combined nitrogen in the world, only to be increased by the clover bacillus, and the limited area in which wheat could be grown. Since that time nitrogen compounds have been formed from the air on a scale which can be extended without limit; new strains of wheat have come into use which will ripen in the short sub-Arctic summer; Canadian and Siberian wheat fields have been opened up; irrigation and dry soil culture have brought deserts into cultivation. Could the irony of false prophecy go further?

Let us not be too much frightened by the prospect of disaster from other people's prosperity, but remember that it was impossible for us to remain the workshop of the new world to the extent that we were of the old world from which we were the first to rise. Prosperity does not consist in being bigger than other people, nor even in any given rate of expansion, but in having control of our circumstances and responsibilities. Nevertheless, however we may suspect the spirit in the mouths of these prophets, we do well to consider carefully what they utter.

In the last resort the maintenance of national position may depend on military strength, but every year makes clearer that war between highly organised states is a desperate remedy, and that national competition is in the main one of industrial efficiency and material resources. This is the position Mr. Norman Angell has developed. To a mere onlooker it would seem that the susceptibility of injury of the German Empire increases much more rapidly than her power of inflicting it. Consider what deadly blows we could now, with little injury to ourselves, inflict on her sea-borne commerce, while in 1870 we could not have injured Prussia at all except at our own greater cost. Germany's very industrial activity compelled her to submit in the Moroccan conference when the French bankers withdrew their loans. Her attempt to obtain a position of overwhelming military strength has conspicuously failed, having resulted only in the consolidation of other States against her, so that her military position relatively to them is weaker now than it has been at any time since Jena, and is one of considerable peril. That peril is not the less because she is a standing menace to other nations. The military question does not concern us. It is mentioned here to be put aside, and to emphasise the point that the real problem is that of efficient industrial organisation, and it is of this that the warning is addressed to us.

The subject has been discussed from many points of view, which fall under three principal heads:—

1. The efficiency of the directors and staff of industrial concerns.
2. The organisation of the workers, and their relations to the directors.
3. Free Trade and Protection.

Under the first head falls the large subject of scientific and technical education, and to some extent the working of the Limited Liability Companies Acts. The second heading covers matters connected with Trade Unions, employer's liability, factory Acts, industrial insurance, and similar things. Taking them in the reversed order we will only observe of the Free Trade question that we suspect its practical importance to be greatly exaggerated, but it has occupied so large a space in recent polities that one can hardly leave it unmentioned. It is difficult to draw any definite conclusion from the cases of the U.S.A., Germany, and Great Britain, except that great commercial activity depends on quite other matters than taxation at the ports.

The second head, the problem of the relations between wage-payers and wage-earners, is the subject of that amazing speech of Mr. Hill's to which we have already referred. With some verbal alterations it might be put in the mouth of a confederate slave owner, or of a county member of 1830 defending a 40s. duty on wheat. "Only a purblind nation can dream of basing its future on anything less commanding than equality or superiority in the elements of production; including, of course, the wages of labour, and the remuneration of capital." Yes! Low wages and high remuneration. Again: "Widespread and long-continued industrial distress in England comes from attempting to hold markets against competitors, while maintaining a wage scale that does not permit her to meet their prices, and does not offer to capital an inducement to go into new fields of development, or even to remain where it has hitherto been occupied." Excellent! Let us re-enact the old Poor Law. Does Mr. Hill really think that the work of Zeiss and Abbe, of the Hamburg-America Line, of the Baden Aniline Co., is based on cheap labour? To lay down as axiomatic long and verbose premises in which the desired conclusion is implicitly assumed is the well-known method of public oratory. Of this Mr. Hill's speech is an excellent example, but it is not a very helpful contribution to our present problem of the contest between the employers and the trade unions, which we are meeting in a more advanced form than Germany has yet developed. The problem taxes our political capacity, but we do not believe for a moment that it will go near to ruin us. A working solution has been found in Lancashire, and this may be adopted in other places. The essence of the solution seems to lie in such an intelligence by the workers of the conditions of a business, that they are able to assent to the terms on which it is conducted, instead of being compelled to submit to them. This is clearly more difficult in such a business as a railway than in cotton manufacturing or gas-making, but should be capable of more extensive application than at present.

We turn to the question of the efficiency of the

* We print this article as it was written early in July, though some passages are already obsolete.—Eds. Elec. Rev.

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direction and staff, which is the root of the matter, and is closely connected with that of education. There seem to be two weak places in the existing system in England of directing and staffing business concerns. The one is that there is no large body of technically instructed men from whom the directors and staff can be recruited, and the other that there is not sufficient advancement of able men from the lower grades to higher ones inside the businesses. The two points are closely connected, but the second is to a large extent the effect of the Companies Acts, and our system of banking. The capital of British concerns is largely obtained on the Stock Exchanges, and is owned by bodies of persons generally ignorant of the business and interested only in the dividends, and a tendency to appoint directors to the boards who represent the purely financial interests of the shareholders is inevitable. The experience and ways of thought of these men are those of financiers. The technical men, the managers, engineers, and so forth are in an inferior position. The directors neither use quite the same language nor think quite in the same way as their subordinates. The energy and enterprise along technical lines which—judging from their trade journals—are the life of American businesses, are stifled; and the worst result of this is that the directors are not sufficiently in command of, or in touch with, their businesses to be able to recognise with certainty, and advance with decision, younger men of energy and ability who may be found in their service. It was a very true saying of Lord Melbourne that England is a great reservoir of capacity. No head of an English business who has a considerable number of men under him, and possesses sympathy and insight, should ever be at a loss to find a man capable at least of any piece of work or administration for which in the ordinary occasions of business a man may be wanted. For supreme occasions the supreme man may or may not present himself. But a financial director, of experience and capacity, often the successful head of some allied business, or representing the interest of an important shareholder, attending a board meeting every week or fortnight, careful to refrain from doing anything to affect the position of the manager especially in his relation with the staff—such a director knows little of the men and of whose ability he may be in sore need, and yet at the same time occupies the position in which alone the decision to advance the able men can be made. The question of the advancement of any given man, and the estimate of how he will fill the higher post, is so much a matter of personal judgment, and there is so good a chance of mistake, that a subordinate officer, even a general manager under a board, will rarely take the responsibility of urging such a step.

One is tempted to think that German businesses may have an advantage over ours in both these points. On one side their system of technical education should help to bring out the capable men, and enable them more readily to be recognised, and promoted to higher posts. On the other hand German businesses are financed to a large extent by bankers, not as here, where the banks merely make advances on security and have no interest in the way the money is used, but by bankers whose security is the prosperity of the concern itself. This should result in the choice of directors for their experience and knowledge of the particular business they are to conduct, and for the purpose of actively conducting it, and such men will be more easily found under the better educational system. Of course, these remarks are of limited application. The articles of association and shareholders' registers of Lancashire mills not unusually consist of a list of subscribers' names and amounts in a penny note-book, the directors being men of practical experience taken from the list. As a direct and businesslike method, this would be hard to beat. So anyone can call to mind large and important limited firms whose direction is of the highest order in intelligence and skill. Nor is any change suggested in banking methods. Though it might be well for industrial concerns that their invertebrate bodies of shareholders should be replaced by small committees of bankers, it would be bad for the banks. That is not banking business as we practise it. Nevertheless, though committees of financiers responsible only to general meetings of shareholders seem to conduct banking, insurance, and some other businesses satisfactorily, they are not satisfactory in industrial concerns; and we should like to see some system tried in which the business initiative lay with more technically qualified bodies than the present boards usually are.

We turn to the educational system. The basis of our educational system is almost purely literary and of immense antiquity. The syllabus of the large endowed schools and grammar schools founded from the 14th century onwards was exclusively the traditional classical system of the middle ages which held the universities. The only effect of the revival of Greek learning in the 16th century was to establish letters still more firmly as the one educational system, and this has never been displaced. The introduction of elementary Greek, geometry, and a little mediæval algebra hardly affects its character. Oxford and Cambridge still insist on a certain minimum of classical learning for all their students, a minimum so low as to be useless to anyone, especially to those who are to be scholars; so high as to involve a serious waste of time and effort by those who are not. This is not merely foolish tradition: the thing has meaning. Letters in the wider sense, literæ humaniores, is the method of human intercourse. The language and ideas in which men sympathise with, influence, rule, one another; the speech which the governors of the world have used, have been those of Aristotle and Cicero, not those of Euclid or Newton. It is interesting to note the men who to-day are chosen to be heads of Universities in the northern towns, where science would seem to be a predominant interest. Mr. Sadler at Leeds, Mr. Fisher at Sheffield, Mr. Hadow at Newcastle. Humanists of humanists. The very men whom More and Colet would have chosen for those posts. The function of English Universities has always been in the language of their bidding prayers "to bring up a succession of persons duly qualified to serve God in Church and State," and that implies a literary curriculum. Here we have the crux of the matter. The absorbing interest of the world is no longer the Church, scarcely the State, and few of us are to do our work in either. The great majority of us are to earn our living in business in some form, and in this democratic age the world is for us and not for our betters. The world's interest is industrial, and the appropriate training is scientific only in a secondary degree literary.

Now for a scientific training our secondary school system had at one time no resources at all, and no teachers were available. But things are changing fast, and serious attempts are being made to give the training required. All schools teach some science, and the equipment of some of the wealthier schools is excellent. Botany, horticultural and agricultural, is being taught in the County Council schools in country towns with admirable effect, its value and interests being of course readily intelligible in such places. The interest of the science schools in Oxford and Cambridge is now as great as that of the others, and considerably greater in other universities. It is certain that the change will go much farther; that pupils will learn more science, some much more; that universities will abolish their classical qualification for science students; that teachers will improve in skill and in numbers; that their schools will be thronged. Now, is this sufficient? Is the change proceeding along the right lines? Is it moving fast enough? Will it go far

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enough? One is tempted to ask: Is it in the German spirit?

It is clearly not in the German spirit. That a whole nation should act for a time as if all its members had but a single brain and a single purpose is not unknown in history, but such action has commonly been under the stimulus of war. Except perhaps in Japan, it is difficult to find a parallel to the intelligent, orderly, consciously directed, persistent movement of the German nation during the last seventy years. The whole people seem to have had the brain to imagine an ambitious ideal, and to understand what efforts and sacrifices were necessary to reach it. They have shown submission to discipline and long perseverance, and these in spite of, perhaps by the help of, an elevated and romantic individualism. A very important part, perhaps the most important part, of the German method has been the education of the people, and here the results have been extraordinary. In all branches of learning Germans have excelled. In accurate and minute scholarship, in historical research, in philosophy, in literary criticism, the German standard of achievement is the very highest, but it is in scientific training that they are admittedly pre-eminent. This is conspicuously the result of method and thoroughness, not of any peculiar originality. It is the mass of work done, and the number of workers trained that is imposing, rather than the actual advance in knowledge. Our chemists and glassworkers, to mention only two trades, are overpowered by the trained specialists whom Germany now commands; and there is no industrial occupation in which similar results may not be attained. Even in shipbuilding Germany promises soon to challenge our position.

On considering in detail how this has been done, one is immediately struck with the system of separate secondary schools for literary and for scientific or technical teaching. This division recognises, what seems to us to be evident, that scientific studies give an education which touches human life at a sufficient number of points, which is in a word sufficiently broad, to be a satisfactory training for the bulk of an industrial nation. Fifty years ago this could hardly have been held, certainly not one hundred years ago. Botany, already alluded to, illustrates this point. As taught now in country schools a better subject of education could hardly be imagined. The systematic botany of fifty years ago would have been little better as a mental stimulant than Latin verses or quadratic equations.

The step now required in this country is the establishment of a system of secondary schools having a curriculum definitely based on science, and recognition of it by the Universities as a normal course of education. Students would be taught to think in terms of physics, chemistry, and biology. Experiment and observation on the one hand, simplified mathematical process on the other, would be the educational methods. Literature, music, history, would be accessory studies. Study will be less irksome to both teachers and pupils as the subjects are more intelligible, while the average mental training will be stricter and more exact than is possible now. With experience and practice the elementary ground necessary to be traversed by beginners will be covered more rapidly and easily, wider ranges of the subjects will be possible, and the pupil's outlook and understanding of the interconnection of the whole will be increased. Education will be widened, not narrowed. Then from large numbers of young men trained from an early age to think in the terms and ideas which lie at the root of all industrial processes, we may look for those who have the special knowledge, as well as the natural ability, to direct our industrial concerns.

It is clear that we are moving in this direction slowly and not very directly, and are somewhat uncertain as to what we are doing. The County Council schools accidentally established in a moment of official abstraction by the whiskey clause dropped into the Act of 1902, controlled by Councils elected for fifty other reasons than educational interest; piloted by the devil of denominationalism in the deep sea of increased rates; superintended by directors of education, versatile and cultivated humanists; stimulated by the wheedling remonstrances and gentle encouragements of H.M. Inspectors—how shall these schools, any more than those under the Public School tradition, do for us what the Real Schulen have done for Germany? The schools themselves are good within the limits of the limited curricula; the heads are keen, thorough, conscientious; the teachers young, hardworking, ambitious; the children come from an intelligent race; the inspectors judicious, experienced, helpful. But there is no efficient, supreme direction; no head to set a continuous policy, to adjust means to a distant end, to adhere firmly to its course, to do for us in short what the German Government has done for its people. In a word, the single Will is wanting. Cannot the urgent necessities of industrial progress supply the driving power required to establish the schools we need?

TRADE STATISTICS OF JAPAN, 1913.

The following statement showing the imports into and the exports from Japan of electrical and similar goods during the year 1913 is taken from the recently issued official trade statistics; the figures for 1912 are given for purposes of comparison, and notes of any increases or decreases are added:—

	1912. Yen.	1913. Yen.	Inc. or dec. Yen.
Galvanised iron wire.—			
From Great Britain ...	370,000	233,000	– 137,000
,, Germany	2,385,000	2,043,000	– 342,000
,, Belgium	125,000	122,000	– 3,000
,, Austria	9,000	—	– 9,000
,, United States ...	608,000	41,000	– 567,000
,, Other countries ...	2,000	8,000	+ 6,000
Total	3,499,000	2,447,000	– 1,052,000
Rails.—			
From Great Britain ...	137,000	555,000	+ 418,000
,, Germany	671,000	1,197,000	+ 526,000
,, Belgium	575,000	211,000	– 364,000
,, United States ...	2,475,000	1,922,000	– 553,000
,, Other countries ...	81,000	201,000	+ 120,000
Total	3,939,000	4,086,000	+ 147,000
Posts for electric wire materials for buildings, etc.—			
From Great Britain ...	505 000	802,000	+ 297,000
,, Germany	383,000	832,000	+ 449,000
,, United States ...	1,174,000	1,146,000	– 28,000
,, Other countries ...	85,000	92,000	+ 7,000
Total	2,147,000	2,872,000	+ 725,000
Copper (pipes and tubes).—			
From Great Britain ...	156,000	251,000	+ 95,000
,, Germany	37,000	22,000	– 15,000
,, Other countries ...	7,000	14,000	+ 7,000
Total	200,000	287,000	+ 87,000
Insulated electric wire.—			
From Great Britain ...	2,622,000	491,000	– 2,131,000
,, France	15,000	2,000	– 13,000
,, Germany	2,485,000	1,419,000	– 1,066,000
,, Italy	4,000	—	– 4,000
,, United States ...	261,000	96,000	– 165,000
,, Other countries ...	1,000	3,000	+ 2,000
Total	5,388,000	2,011,000	– 3,377,000
Cranes.—			
From Great Britain ...	738,000	426,000	– 312,000
,, Germany	53,000	473,000	+ 420,000
,, United States ...	110,000	173,000	+ 63,000
,, Other countries ...	8,000	7,000	– 1,000
Total	909,000	1,079,000	+ 170,000

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Gas engines, petroleum engines and hot air engines.	1912. Yen.	1913. Yen.	Inc. or dec. Yen.
From Great Britain ...	989,000	577,000	− 412,000
,, Germany	167,000	359,000	+ 192,000
,, Belgium	7,000	7,000	—
,, Sweden	114,000	97,000	− 17,000
,, United States ...	55,000	80,000	+ 25,000
,, France	52,000	23,000	− 29,000
,, Italy	—	14,000	+ 14,000
,, Switzerland ...	—	59,000	+ 59,000
,, Other countries ...	6,000	—	− 6,000
Total	1,390,000	1,216,000	− 174,000
Steam engines.—			
From Great Britain ...	218,000	219,000	+ 1,000
,, Germany	45,000	223,000	+ 178,000
,, United States ...	98,000	27,000	− 71,000
,, Belgium	—	94,000	+ 94,000
,, Other countries ...	—	6,000	+ 6,000
Total	361,000	569,000	+ 208,000
Steam boilers.—			
From Great Britain ...	1,000,000	660,000	− 340,000
,, Germany	89,000	150,000	+ 61,000
,, United States ...	86,000	77,000	− 9,000
,, Belgium	—	89,000	+ 89,000
Total	1,175,000	976,000	− 199,000
Dynamos, electric motors, etc.—			
From Great Britain ...	1,323,000	1,035,000	− 288,000
,, Germany	1,199,000	1,460,000	+ 261,000
,, Italy	2,000	—	− 2,000
,, Switzerland	7,000	49,000	+ 42,000
,, United States ...	1,605,000	1,706,000	+ 101,000
,, Sweden	—	18,000	+ 18,000
,, Other countries ...	5,000	22,000	+ 17,000
Total	4,141,000	4,290,000	+ 149,000
Water turbines and Pelton wheels.—			
From Great Britain ...	59,000	37,000	− 22,000
,, Germany	790,000	613,000	− 177,000
,, France	7,000	4,000	− 3,000
,, Switzerland	15,000	—	− 15,000
,, Sweden	7,000	21,000	+ 14,000
,, Belgium	—	14,000	+ 14,000
,, Denmark	—	26,000	+ 26,000
,, Italy	3,000	13,000	+ 10,000
,, Other countries ...	—	1,000	+ 1,000
Total	881,000	729,000	− 152,000
Wattmeters.—			
From Great Britain ...	188,000	30,000	− 158,000
,, Germany	189,000	149,000	− 40,000
,, United States ...	147,000	80,000	− 67,000
,, Other countries ...	—	2,000	+ 2,000
Total	524,000	261,000	− 263,000
India rubber and gutta percha, crude.—			
From British India ...	282,000	479,000	+ 197,000
,, Straits Settlements	1,642,000	1,771,000	+ 129,000
,, Dutch India	146,000	18,000	− 128,000
,, Great Britain ...	461,000	818,000	+ 357,000
,, Germany	39,000	21,000	− 18,000
,, United States ...	321,000	200,000	− 121,000
,, Other countries ...	138,000	145,000	+ 7,000
Total	3,029,000	3,452,000	+ 423,000

The exports of electric machines and parts thereof from Japan in the years 1912 and 1913 were as follows:—

	1912. Yen.	1913. Yen.	Inc. or dec. Yen.
To China	7,000	2,000	− 5,000
,, Kwantung Province ...	171,000	249,000	+ 78,000
,, Philippine Islands ...	101,000	155,000	+ 54,000
,, Siam	1,000	1,000	—
,, Australia	4,000	10,000	+ 6,000
,, Hong Kong	28,000	13,000	− 15,000
,, British India	14,000	19,000	+ 5,000
,, Straits Settlements ...	5,000	2,000	− 3,000
,, United States	2,000	—	− 2,000
,, Other countries ...	7,000	19,000	+ 12,000
Total	340,000	470,000	+ 130,000

Yen = 2s. 0½d.

ELECTROLYTIC IRON.

By L. GUILLET, D.Sc. (Professor of Metallurgy at Paris).

(*Abstract of paper contributed to the* Iron and Steel Institute, *September*, 1914.)

The industrial manufacture of iron by electrolysis is a problem which has engaged attention for many years, but it is only within the last year that it has entered the practical stage.

Since 1910 the company "Le Fer" at Grenoble took out patents for the manufacture of electrolytic iron. In principle, the method consists in the use of a revolving cathode and a neutral solution of iron salts, maintained in the neutral state by the circulation of the liquid over the surface of the iron. The bath also receives periodic additions of a depolarising medium, such as oxide of iron, the object of which is to eliminate, at least in part, the hydrogen deposits on the cathode, which injuriously affect the material if present in too large a quantity. By these means it is possible to work with a current of high density (1,000 amperes to the square metre), and an iron of excellent quality is obtained. The process is applicable either to the production of very pure iron, which can compete with the best iron and Swedish iron, or to the direct manufacture of tubes and sheets in the finished state. It has emerged from the laboratory stage, and is now being put into operation on an industrial scale.

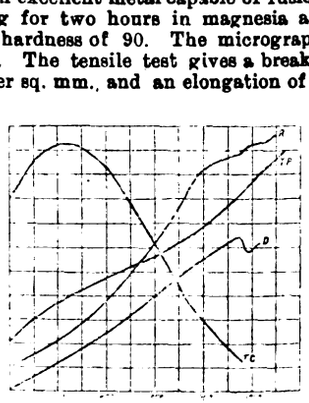
The works of St. Marie and Gravigny and the Bouchayer and Viallet Co. have acquired from "Le Fer" the options on a licence to manufacture sheets and tubes respectively. Messrs. Bouchayer and Viallet displayed commercial tubes at the Lyons Exhibition, and have just completed the work of a large department, which is about to begin the continuous manufacture of tubes.

The practical results obtained may be summarised as follows:—

1. With regard to the character of the metal. Using any pig-iron in solution, an iron can be obtained of the following average composition, after removal of the gases by annealing: Carbon 0·004, silicon 0·007, sulphur 0·006, phosphorus 0·008 per cent. By the aid of certain operations the percentage of phosphorus can be made very low. At the present time it is possible to guarantee phosphorus lower than 0·010 per cent. The pig-iron used in the production of the electrolytic iron in question had the following composition: Carbon 2·35, silicon 1·31, sulphur 0·07, and phosphorus 1·07 per cent. With a density of current of 1,000 amperes per square metre, the yield per KW.-year is 2 tons of metal, including the current for the accessory services, particularly for the rotation of the cathodes.

2. As regards industrial products. The manufacture of tubes is being proceeded with on an industrial scale. The metal deposited is extremely brittle and hard, due to the occluded hydrogen, and probably also to interstrain. Since the deposition of the iron takes place on a metal mandrel, the whole is annealed, and the finished article is easily withdrawn from the mandrel. The current practice of the Bouchayer & Vaillet Co. is to manufacture tubes of a length of 4 m., 100 to 200 mm. in diameter, and with a thickness of 0·1 to 6 mm. Their installation is capable of turning out at least 100 tubes per day. Apparatus is also in course of construction to enable the diameter of the tubes to be considerably increased. The manufacture of sheets is at present the subject of investigation. After annealing, the crude iron possesses all the requirements of an excellent metal capable of fusion.

After annealing for two hours in magnesia at 900°, the iron shows a Brinell hardness of 90. The micrographic structure is perfectly normal. The tensile test gives a breaking strength of 30·9 to 32·8 kg. per sq. mm., and an elongation of 40·2 to 42·1 per cent. in the direction of the axis of the tube. Further, the annealed tubes, when subjected to compression tests, can undergo deformation to an extraordinary degree without a sign of any fracture.



T C, Heating curve for thermo-electric force, referred to copper; T P, Heating curve for thermo-electric force, referred to platinum; R, Curve of electric resistance; D, Curve of expansion of electrolytic iron.

Fig. 1.

Measurements of electric conductivity were made on an iron of the following composition:—Carbon, indeterminable; manganese, nil; silicon, nil; sulphur, nil; phosphorus, 0·025; arsenic, 0·011. The mean of the determinations carried out with the Thomson bridge on four turned bars of electrolytic iron, 5·70 mm. diameter and 120 mm. long, after annealing, was 10·22 microhms per cm.^{3}

Similar determinations made on small rectangular unannealed bars of 5·1 × 6·1 mm. in cross section and 120 mm. long have given a value of 12·16 microhms per cm.^{3} at 20°.

On the other hand, Broniewski has obtained results of measurements on an electrolytic iron from the same source as that stated by the present author, which are shown in the accompanying fig. 1,

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which gives the heating curves for the thermo-electric force referred to copper (T C) and referred to platinum (T P), the curve of the electric resistance (R) and the curve of expansion (D) of the iron.

The curve of the thermo-electric force of the iron referred to copper (1 division representing 0·5 millivolt) shows a critical point at 730° C. The curve of thermo-electric force referred to platinum enables higher temperatures to be attained, but on a smaller scale (1 division representing 2 millivolts), and it shows a critical point at 1,020°.

The curve of the electric resistance of iron (1 division representing the electric resistance at 0°) shows between 750° and 850°, a perfectly continuous change of direction which it would be difficult to assign to a critical point. A discontinuity in the course of the curve is manifested at 950° and 1,020°, with a change of direction between these two temperatures.

The curve of expansion (1 division representing 0·002 of the length of the specimen at 0°) shows in the neighbourhood of 950° a maximum followed by a contraction.

The industrial applications of electrolytic iron fall into three principal categories:—(1) The direct manufacture of tubes; (2) the direct manufacture of sheets; (3) the preparation of pure iron as a raw material intended for fusion. There are various other uses of less importance, such as the preparation of rods of very pure iron for autogenous welding.

All present methods of manufacturing tubes present certain insurmountable difficulties when it is desired to obtain regular thicknesses of less than 6 mm. With the electrolytic process it is possible to obtain the most satisfactory regularity whatever the thickness, diameter, and length of tube. The tubes will withstand considerable pressures.

The sheet-iron is of first-class quality, capable of undergoing very considerable deformations in the cold. Tests on tubes and plates have been made in the draw bench, and it is surprising with what facility the metal can be worked. The material is therefore highly suitable for purposes of stamping, both in the form of plain annealed plates (black plates) and of tinned plate. Finally, on account of their purity, these sheets are specially adaptable for use in the construction of electric machinery. The efficiency of alternating motors and transformers, and also of direct-current motors, is increased by using this material in their construction. The use of electrolytic iron constitutes a real progress, both as regards hysteresis and permeability. In transformers the saving in weight of material is 33 to 40 per cent. The capacity of alternating motors can be increased by 50 per cent. running at the same temperature and occupying the same space. In direct-current machines 16 per cent. of iron can be saved.

Without doubt electrolytic iron will be able to compete successfully with Swedish iron for fusion. The quality is much more regular, and the crude metal, being very brittle, can easily be broken into pieces of any required size, however small, and, at the same time, it can be supplied in suitable thicknesses. The cementation of such products would be more regular than those ordinarily used. Tests made at various steelworks have shown that tools and special steels manufactured from this material give results at least equal to those obtained with Swedish iron. The cost price is the only remaining consideration.

The principal factors which make up the cost price are the electric energy and the pig-iron. It has already been mentioned that 2 tons of extremely pure iron can be produced per KW.-year. Using a current of 500 amperes per square metre, instead of 1,000 amperes, the voltage drops to about one-half, and the production per KW.-year is nearly doubled. Working with a still lower density, the yield can be even further increased. In countries where the cost of motive power is high, it would pay to work at 500 amperes or even less. It would then be possible to produce 3 to 4 tons, and even more, per KW.-year. If the cost of the unit be taken at 1 centime (0·1d.), an ordinary figure in the Alps, and using a current density of 1,000 amperes, the cost of current would not exceed 43 francs per ton of iron produced. Since pig-iron is used as the raw material, it may be reckoned that there is about 10 per cent. of waste in the form of sludge, graphite, &c. The price of the pig-iron would vary according to the locality, and in the mountainous country it would run at about 64s. to 88s. per ton. The price, however, would be higher in those localities where the electric current was cheapest, and *vice versâ*. The average outlay on pig-iron per ton of electrolytic iron would therefore be from about 72s. to 80s. To this would still have to be added the cost of labour, maintenance, cost of electrolyte, depreciation, and interest on the capital cost of the plant. These various amounts have not yet been definitely ascertained, but the total cost price, based on current prices for material and labour, of the electrolytic iron, in the condition in which it leaves the electrolyte bath, would probably not exceed £6 to £7 12s. per ton, according to the locality.

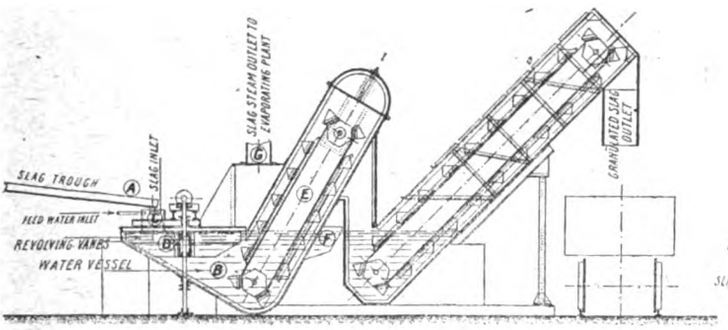

FIG. 1.—SLAG STEAM GENERATOR.

UTILISATION OF HEAT CONTAINED IN SLAG.

By W. L. JOHNSON (Middlesbrough).

(*Abstract of paper contributed to the* IRON AND STEEL INSTITUTE, *September*, 1914.)

Some four years ago Messrs. Bell Brothers began experiments with a view to using the steam produced from slag in a low-pressure turbine. The slag used was that produced in the manufacture of ordinary Cleveland iron.

The apparatus (fig. 1) for producing the steam consists of a wrought-iron circular vessel B. Near one edge of the top plate of the granulator B is the hole through which the slag is poured; on the underside of this top plate and round the hole a circular ring 4 in. deep is fixed, which dips into the water to a depth of 3 in., thus forming a hydraulic seal, and preventing the steam from escaping; inside the granulator are four vanes fixed on a vertical shaft D, which cause the water to rotate. The slag comes from the furnace along the trough or channel A. When the slag drops into the water it granulates, and its velocity causes it to sink a certain depth. It floats for a time, but the rotation of the water causes it to come to the surface inside the vessel, otherwise it would block up the slag entrance; the granulated slag is then lifted by the elevator E into a second seal F, and there becomes waterlogged, sinks through the seal, and is taken by a second elevator and dropped into trucks. The feed water is introduced along with the slag at C; the surplus water which drains from the truck is also pumped back to C by a small pump fixed to the side of the apparatus. The steam generated comes off at G; at first it was intended to use this steam direct in an exhaust steam turbine. After numerous experiments on blades of different metal, it was found that duralumin was affected very slightly, and a 50-KW. turbine with blades of this material was experimented with.

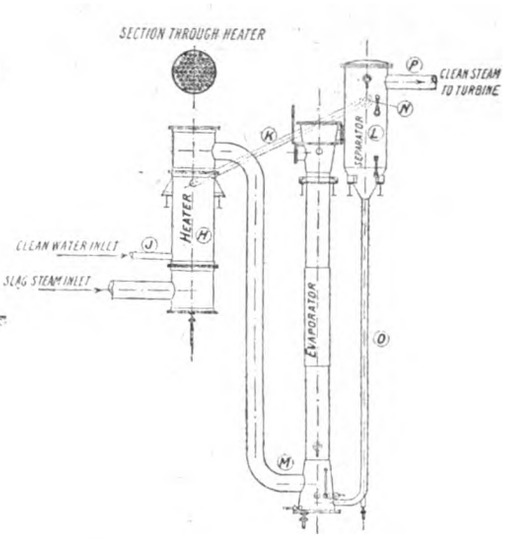

FIG. 2.—HEATER AND EVAPORATOR.

The steam produced contained about 0·5 per cent. by volume of incondensable gases, which were absorbed between the condenser and the air pump. The nitrogen was dealt with by the air pump. Under these conditions the plant ran for two months; at the end of that time the turbine was opened out, and the openings were found to be partly blocked up with fine sulphur, which had caused some wear of the blades.

The direct method was then abandoned, and a water heater and heat exchanger were introduced between the turbine and the primary generator. The water heater consists of an outer casing and tube plates with tubes $1\frac{3}{4}$ in. diameter fixed therein, placed vertically, the total heating surface being 156 sq. ft.

The calandria (a Kestner single-effect climbing film evaporator) consists of two parts, the calandria proper and the separator (fig. 2). The former is composed of a shell or casing containing the evaporating tubes, which are about 23 ft. long and $1\frac{7}{16}$ in. in diameter, and are fixed in upper and lower tube plates. The water is fed into the lower end of the heater H and J, and then passes from the upper end by the pipe K into the separator L. The dirty steam from the generator B passes inside the tubes of the heater, the clean water being on the outside, and the uncondensed remainder enters the calandria at M.

The water in the tubes is caused to boil by the steam with which they are surrounded, and as ebullition takes place a column of vapour rises up the centre of each tube. This vapour travels at a high velocity, carrying with it a film of water on the inner surface of the tubes. The water does not "climb" by capillary

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attraction nor by the liquid and the steam forming alternate links in the same way as in a Pohle air-lift. The operation is performed in a simple manner; the water begins to boil in the tubes, and is gradually drawn up in a complete film by the vapour itself. As a result of this action a certain amount of water is carried up into the separator L, which acts as a steam drier; this water and the feed water from the heater, which enters at N, flow down the pipe O, entering the calandria at the bottom. The clean steam is delivered by the pipe P to the turbine, which is connected with the condenser in the usual manner. The sulphur deposited in the tubes of the heater is brushed out, and that in the calandria is removed by occasionally filling the dirty steam space with a dilute solution of caustic soda and heating with steam. There seems to be very little corrosion of the tubes of the heater or calandria; and after four years of intermittent working the primary generator does not show any signs of undue corrosion, the shafts of the elevator having a very thin black skin on the surface only.

The heating surface of the calandria is 548 sq. ft. A vacuum of about 9 in. of mercury is maintained in the separator, so that the water boils at 90°-91° C. With steam from the slag at 100° C. and keeping a temperature in the calandria of 91°, the mean of 22 experiments gave 173 gallons of water evaporated per hour, and the average steam per hour condensed in the calandria and heater was 190·2 gallons. The feed water entered the heater at an average temperature of 24·6° C., and entered the calandria at an average temperature of 89°, that is, 91 lb. of clean water was evaporated for every 100 lb. of steam from the slag.

As the condensation of dirty steam takes place, the percentage of incondensable gases naturally increases. When the percentage gets above 7·5 the calandria begins to lose its efficiency, and it is advisable not to allow that percentage to be exceeded. In order to control it a small outlet pipe is arranged on the top of the calandria, where the incondensable gases are drawn off together with a small proportion of steam; with 0·5 per cent. of gas in the dirty steam there will be a loss of 6·6 per cent. of steam.

Experiments were also made to determine the amount of available steam from the slag by condensing and measuring it. The mean of seven experiments gave 1,017 lb. per ton of slag, and deducting 6·6 per cent. for escape with the incondensable gases there are left 950 lb., and 90 per cent. of this gives 855 lb. of clean steam available for the turbine. Since modern exhaust-steam turbines with a full load and a vacuum of 28½ in. can be guaranteed under the above conditions to use not more than about 27 lb. per H.P.-hour, this gives 31·6 H.P. per ton of slag per hour.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thomson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

19,595. "Electric switches." F. B. Holt. September 9th.

19,737. "Sparking-plugs for internal-combustion engines, and the manufacture of the same." A. A. Lines & H. G. Longford & W. A. Clark, trading as Sphinx Manufacturing Co. September 14th.

19,784. "Electric ignition mechanism for internal-combustion engines." C. C. W. Simpson. September 15th.

19,794. "Electromagnetic switches." British Thomson-Houston Co., Ltd. September 15th. (General Electric Co., United States.)

19,809. "Process for producing the lining of an electric induction furnace." G. Brustlein. September 15th. (Complete.)

19,818. "Electrically-driven clocks." F. H. Walker. September 15th.

19,849. "Treatment of materials for impregnating them electro-osmotically." Ges. fur Elektro-Osmose m.b.H. September 16th. (Convention date, September 19th, 1913, Germany.) (Complete.)

19,854. "Electric signalling systems particularly for use in mines." Sterling Telephone & Electric Co., Ltd., & H. W. Barclay. September 16th.

19,878. "Material for the insulation of electrical conductors." W. Teggin & London Electric Wire Co., and Smiths, Ltd. September 17th. (Complete.)

19,882. "Electric cable." C. J. Beaver & E. A. Claremont. September 17th.

19,886. "Sparking-plugs for internal-combustion engines." T. Crosbee & Sons, Ltd., and D. McGregor. September 17th.

19,891. "Interchangeable gas and electric light fittings." A. C. Eberhardt & E. A. Short. September 17th.

19,908. "Electrical conduit fittings." J. R. A. Hemming & A. E. Beck. September 18th.

19,931. "Means for attaching electric lamps to the handle-bars of motor cycles and like purposes." W. G. Craigen. September 18th.

19,942. "Metal working." British Thomson-Houston Co., Ltd. September 18th. (General Electric Co., United States.)

19,943. "Electric rheostats." British Thomson-Houston Co., Ltd. September 18th. (General Electric Co., United States.)

19,944. "Electrical system for transferring cars." T. F. Mullaney. September 18th. (Divided application on 10,619/14. April 29th.) (Complete.)

19,977. "Electric lighting and heating of railway or other vehicles." C. H. Vidal. September 19th. (Complete.)

19,984. "Semi-automatic telephone systems." Betulander Automatic Telephone Co., Ltd., W. Aitken, & D. C. Crowe. September 19th.

South Africa.—The Customs Authorities of the Union of South Africa have recently given a decision to the effect that "Wireless telegraphy apparatus" is to be classified under No. 114B of the Tariff, the general duty being at the rate of 3 per cent. *ad valorem*, and the whole of this being returnable in the case of British manufactures.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

19,606. Galvanic Cells. J. C. N. Eastick. August 30th.

19,676. Timing Apparatus for Making and Breaking Electric Circuits. K. F. Richmond. August 30th.

19,965. Electric Contact-makers or Switches, particularly those used in connection with Electric Motor Horns. W. A. Crosbee, F. S. C. Crosbee, and T. S. Rogers. September 4th.

20,011. Telephone Exchange Systems. M. L. Johnson. September 4th.

20,562. Safety Warning Signals for Railways. M. B. Cooper. September 11th.

21,428. Telegraph Instruments used in Block Signalling on Railways. R. R. Harper. September 23rd.

21,446. Tiles for Carrying and Protecting Electric Cables, Gas Pipes, Water Pipes and the like. A. J. Howard. September 23rd.

21,678. Construction of Electric Switch. Aldous & Campbell, Ltd., and C. F. Archer. September 25th.

21,735. Switching System for Handling Traffic in one direction only between two trunk exchanges, in each of which the connection of the concerned subscriber lines with the junction lines is obtained by means of an order wire service. C. R. H. Arntzenius. September 26th. (September 26th, 1912.)

22,149. Dynamo-electric Machines provided with Commutators. H. Mensforth. October 1st.

24,559. Electrolytic Apparatus. J. T. Niblett. October 29th.

24,949. Means for Cutting-out and Re-inserting the Resistance in Electric Motor-controllers of the Drum Type. F. M. Marvin. November 1st.

25,977. Electrically-operated Clock Mechanism. E. C. Clerc. November 12th. (November 21st, 1912.)

26,149. Method of Manufacture of Electric Insulation between two Metallic Bodies. S. G. Leach and H. F. Joel, Jun. November 14th.

26,198. Pulleys for the Trolleys of Electric Railways, Tramways, and like purposes. A. Welsh. November 15th.

26,361. Adjustable Electrical Resistances. W. Engelke & H. Bloodworth. November 17th.

27,018. Selective Electric Signalling. New Phonopore Telephone Co., & A. H. Nicholson. November 24th. (Cognate application, 29,046/13.)

27,475. Systems and Apparatus for the Automatic Control of the Speed of Vehicles moving on Line Trackways. P. J. Simmen. November 28th.

1914.

1,238. Electric Current Regulators. P. Fincato. January 16th. (January 16th, 1913.)

1,691. Electric Lamps and their Fittings. H. E. Sheward. January 21st. (March 4th, 1914.)

1,786. Fluid Rheostats. Igranic Electric Co. (Cutler Hammer Manufacturing Co.) January 22nd.

2,924. System of Synchronising Electric Clocks. C. E. O'Keenan. February 4th. (February 5th, 1913. Patent of addition not granted.)

3,219. Illuminating Devices. E. C. McKinnie. February 6th. (May 19th, 1913.)

3,963. Apparatus for Generating High-frequency Oscillations for Wireless Telegraphy or Telephony. J. A. Fleming. February 16th.

4,010. Production of Electrotype Matrices. J. H. Mullaly. February 16th.

6,350. Arc Lamps. W. E. Gray & W. Best. March 12th.

10,061. Electric Furnaces. A. L. J. Queneau. April 23rd.

12,012. Starting Transformers. Akt. Ges. Brown, Boveri et Cie. May 15th. (June 2nd, 1913.)

13,784. Electric Insulators. P. Raffi. June 6th. (September 22nd, 1913.)

16,619. Selectors for Automatic Telephone Systems. G. A. Betulander & N. G. Palmgren. July 11th.

Ultra-Violet Rays.—In view of statements sometimes made by the enemies of the electric light, to the effect that it is harmful owing to the presence of ultra-violet rays, the following extracts from a paper by Messrs. W. R. Ham, Ph.D., R. B. Fehr, M.S., and R. E. Bitner, B.S., in the *Journal* of the Franklin Institute, are interesting:—"The primary object of this investigation was to develop a photographic method whereby the absorption of ultra-violet light by various absorbing media could be determined quantitatively. It is a well-known fact that ultra-violet light (light of wave length less than 390$\mu\mu$) may exert harmful physiological effects on the eye and skin, but just how much of this harm is to be ascribed to general energy radiation, and how much to specific radiation, is a matter that has by no means been settled. It is generally agreed that the extreme ultra-violet rays (those of wave length less than 300$\mu\mu$) cause injury when in sufficient intensity. There are some who claim that the rays between 360 and 300$\mu\mu$ also cause injury. Nutting states in Bureau of Standards Circular No. 28 that the 365th line of the mercury arc contributes 80 per cent. of the 'fatigue effect' when this arc is used as a source of light. Whatever may be the extent of the extremely harmful region, there seems to be as yet no clinical evidence to show that the ultra-violet rays which get through glass (glass in general may be said to completely absorb all rays of wave length less than 300$\mu\mu$ from any source) are injurious, unless in greater intensity than is to be found in any commercial light source."

After describing the apparatus and methods employed, and giving the results of the tests, the authors say:—"There does not seem to be any glass which transmits below the 302nd line, and which does not therefore cut out what are generally conceded to be the extremely harmful rays."

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THE
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ELECTRICAL REVIEW.

Vol. LXXV.] CONTENTS: October 9, 1914. [No. 1,924.

	Page
Electrical Contracting	481
The Special Constable	482
Lead	482
Electricity in Warfare	483
Trading in Italy, by O. E. Allo	483
Correspondence—	
War and the Neutrality of Science	484
Seizing the Enemy's Trade	484
Arbitary Action of Public Authority	484
The War and South African Trade	484
New Electrical Devices, Fittings and Plant (*illus.*)	485
Legal	485
War Items	486
Reviews	490
Business Notes	492
Mr. R. W. Paul's Electrical Instrument Works at New Southgate (*illus.*)	495
The Arrol-Johnston Motor-Car Works (*illus.*)	498
Notes from Canada	499
Notes	502
City Notes	505
Stocks and Shares	506
Large Induction Motors: Some Features of Mechanical Design, by G. Moores (*illus*) (*continued*)	507
Trade Statistics of Italy	509
Application of Electrical Driving to Existing Rolling Mills, by L. Rothera	510
Foreign and Colonial Tariffs on Electrical Goods	512
New Patents Applied For, 1914	512
Abstracts of Published Specifications	512
Contractors' Column	Advertisement page xviii

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ELECTRICAL CONTRACTING.

"WHY so Many Contractors Fail" is the somewhat suggestive title of an article in a recent issue of the *Electrical Review and Western Electrician* (American). It suggests that failure among American electrical contractors is the rule rather than the exception, and the opening sentence of the article tends to confirm this impression, for it reads: "Eighty-eight per cent. of electrical men who enter the electrical contracting field fail for five reasons." This is the view of Mr. F. A. Good as expressed in an address delivered before the Electrical Clearing House of Louisville. This statement has set us wondering if anything like so high a percentage of British electrical contractors fail, and if the causes of failure are the same here as in America. Eighty-eight per cent. failures means only twelve per cent. successes, and although we have no data to go upon, we cannot believe that these figures represent anything like the conditions prevailing in this country.

Although it is not very clear (from the summary of the address given in the journal referred to) in what sense the word "fail" is used, we do not think it necessarily implies bankruptcy, but rather a failure to make an adequate commercial success of contracting.

It will perhaps not be unprofitable to glance at the causes of failure enumerated by Mr. Good, and to consider whether or not the same causes, or any of them, are at work over here. These are (1) lack of business training; (2) inability to estimate accurately the costs of jobs they undertake; (3) indulging in or suffering from unfair competition; (4) catering too much to the general contractors; (5) not taking into consideration the matter of overhead. We are not quite sure that we understand the meaning of the last word "overhead." It may mean standing charges, an item very frequently omitted by the small contractor, or it may mean contingencies, an item which varies with the character of the job. Dealing with this point, Mr. Good declared that "the overhead is usually overlooked by the electrical contractors who fail. Sometimes a gross profit addition to an estimate is large enough to cover, often it means that the net will be a loss instead of a profit. The overhead for each job is liable to differ from every other job, and the contractor cannot afford to take any chances here. This furnishes another occasion for study."

Whatever may be the precise significance of the expression, it really comes under cause number (2), viz., the inability of the average contractor to estimate properly—and this, again, is a result of the first of the causes enumerated. We can, therefore, reduce Mr. Good's five reasons for failure to three, of which, perhaps, the first—the lack of business training—is the chief.

There are a certain number of old-established electrical contractors to whom this stricture does not apply, but the numbers are being augmented year by year largely from the ranks of wiremen, who having worked for a time as journeymen—possibly under a contractor who knows very little about the technical side of the business—think they could do very much better "on their own." Now, some of these men know the practical and technical side of the wiring business from A to Z, and are capable of taking charge of the erection of an installation of practically any magnitude, but having had practically no business training, they do not appreciate that there is more in estimating for a job than in totting up the net costs of material and

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labour, and adding a sum, which to them appears quite a handsome profit.

The fact that any wireman, with practically no capital, can set up as a contractor owing to the readiness of electrical supply houses to give him credit for any material he requires, is, to some extent, responsible for the unsatisfactory condition of the electrical contracting side of the industry, with its large number of what might be called "wiremen contractors." For a time these men flourish whilst they can get just enough work to keep themselves and one or two labourers employed; and if they can make, say, a few pence an hour more than the standard rate of wiremen's wages they are satisfied. They have no standing charges to think about, and can therefore afford to take work at prices which are impossible to a contractor who has an establishment to keep up. Naturally this kind of competition must have its effect on prices generally, and whilst, for a time, the competition can hardly be regarded as unfair, because some of these men put in really sound work, the time comes when, owing to a variety of circumstances, the wireman contractor finds he must either quote higher prices, reduce the quality of his work, or give up contracting and become a journeyman again. Perhaps, owing to unforeseen contingencies—for which, owing to his lack of business training, he neglected to make provision—he has made a loss; or, owing to his success in obtaining orders, he cannot work on the jobs himself and must therefore pay somebody else the wages which hitherto have gone into his own pocket; or, in short, the question of standing charges, an item he has never understood and has therefore made no allowance for, has imperceptibly crept up until at last it has made itself felt, and, without really knowing why, our small contractor finds he is unable to put in the old quality of work at the old prices. And it is at this point that character comes in and plays its part, because there is a strong temptation for the contractor to attempt to continue his independent existence by cutting down the quality of his work, and thereby not only injuring himself but competing unfairly with reputable contractors, and casting a stigma on the trade generally.

That there is a lot of inferior work put in is evident from the ridiculous prices quoted for wiring new speculative buildings. These prices are sometimes below the actual cost of materials of good quality, to say nothing of labour. We heard recently of a row of new houses being "wired" by a small contractor at a very cheap rate, and the wiring, which passed a very high insulation test, was found eventually to consist of short ends of cables fixed in the ceilings and walls at the lamp and switch points. This, of course, was not discovered until the tenants' switches and fittings were erected, by which time the contracting firm had ceased to exist.

Notwithstanding isolated cases of this kind, we are of opinion that the electrical contracting branch of the profession is steadily improving, for which thanks are due to the Electrical Contractors' Association, among other influences. Then the status of the wireman has also improved, due, in some measure, to the evening trade classes in wiring and to the establishment by the City and Guilds Institute of a separate examination for wiremen. An increasing number of men sit annually for this examination, the number of candidates at the last examination being about 350, principally in England, but also including a few in New Zealand, India and South Africa. What is needed now is some means whereby a man who has passed the final wiremen's examination and served, say, three years under a member of the Electrical Contractors' Association or a firm of recognised standing, shall be able to show that he is a certificated wireman or electrician. Contractors recruited from the ranks of such men, after they have acquired a knowledge of the business side of the trade, should certainly be able to make a better showing than the 88 per cent. of failures of which Mr. Good speaks.

The Special Constable.

The special constable is now a familiar figure at nearly every power station in the metropolis. To some people it may appear odd that it should be necessary to ask the middle-aged city man to undertake the duty of a watchman; but while we have little doubt that important stations are adequately watched from within, it is impossible to be too careful in times like these. A city plunged in darkness is in a dangerous condition; and although the "specials" may not have hitherto effected any very remarkable captures, the knowledge that they are on duty night and day may have a deterrent effect upon the wily Teuton who wishes to benefit his country and his Kaiser. "They also serve who only stand and wait" is a maxim which has something more than age to commend it, though special constables guarding electric power stations have had something more than waiting to do, judging from the fact that one of them, named Telling, sustained such injuries while vigilantly protecting the Loughborough Junction station of the South London Electric Supply Corporation, that he is now in hospital. We note with satisfaction that the same men are generally being kept upon the same beat. Becoming familar with the persons who live near, or have business at a particular station, they are better able to spot a suspicious character. We hear from a reliable source that one special constable did make a capture of some importance not long ago. Noting a seedy-looking foreigner, he finally inquired whether he was a German. The man replied in the affirmative, and produced his card, which showed that he was more than five miles from home. He was promptly arrested and brought to a police station, where the magistrate imposed a fine of £20, or in the alternative two months' imprisonment. To the astonishment of those present, the seedy one immediately produced £20 in gold! He went forth on his way rejoicing; but he did not go far. He received a tap on the shoulder at the door of the station, and his footsteps were guided towards Olympia, where he is now interned until the conclusion of hostilities. When he asked for his money back, he was told that it would go towards his keep while he was a prisoner of war! The above incidents show that the Special is not idle or unnecessary; but we are sure that those who are responsible for the supply of light and power are not trusting solely to the amateur watchman. To guard the station may be advisable, but it is not enough. It were inadvisable and perhaps unnecessary to say more, for doubtless station engineers have taken every precaution which human foresight can suggest.

Lead.

The greatest interest centres upon the mining and smelting position in Australia, owing to the commanding importance of the Broken Hill region in respect of the supply of lead. There had been a good deal of doubt as to what was actually going on there, but it now appears, as the result of what may be regarded as official information, that the following mines are now working half time only—Broken Hill Prop. Co., North Broken Hill, Broken Hill South, and the Central Mine of the Sulphide Corporation and Amalgamated Zinc (De Bavay). The smelting and refining plant at Port Pirie of the Broken Hill Prop. Co. is running full, presumably in pursuance of an arrangement which was foreshadowed in a circular recently issued by the company to their shareholders stating that it was proposed to smelt lead concentrates for other companies operating in the field. From this it seems as if there would be an ample supply of Australian lead coming to Europe from the Port Pirie smelter. The restriction in mining operations is caused by the inability of German plants to take their deliveries, and the shutting off of such a first rank source of supply of raw material is bound to be felt sharply in Germany, in which country immense quantities were habitually put through the furnaces.

The mainstay of the market position as regards prices has lately been the pressing demand for early delivery metal for Russia. Some very large quantities have been bought for this account, and fair shipments have been made, but a part of the business which was put through safely has had, later on, to be cancelled owing to the impossibility of getting the necessary funds from Russia. It is no use Russia expecting English merchant houses and others to finance Russian purchases, with the money market in its present position, and it follows, therefore, that if all the business so far entered is to be actually

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accomplished, the requisite credits must be opened in London. Failing this there will necessarily be other cancellations. The reselling of some parcels which had been booked has already led to an easier tone in the market, and prices stand well below the best seen a few weeks ago, and the feeling is anything but confident as to the future even at the reduced level quoted to-day. The general trade buying is very small, and export business is necessarily restricted also by the state of war and the contraband schedule. It is possible to get permits to ship lead to certain parts abroad, but it involves certain formalities which do not tend to smooth the way for the trade generally, and it becomes more and more apparent that the restoration of comfortable conditions is likely to take a good time, even if the war ends as soon as some of the more optimistic think it may. The American position is really a source of considerable weakness, for over the Atlantic there is an all too clear lack of money, which is impelling the holders of material of all kinds to exchange it for cash. Hence the steady pressure of lead from trans-Atlantic quarters upon the English market, and the weakness caused thereby need cause no comment. American lead is to be got easily enough from a number of quarters now, and an uneasy feeling is set up by the plentiful nature of the offerings in this connection. If the Russian demand should disappear, it is probable that the only support of the market would prove to have been withdrawn.

Electricity in Warfare.

In view of the elasticity with which electricity is applied to all manner of uses in ordinary workaday life, it might be thought that modern warfare, which impresses into its service every conceivable means of worrying the enemy, would find it an invaluable agent of offence and defence in the field. It is but seldom, however, that we meet with any mention of electricity in the reports that reach us from the seat of war, the reason doubtless being that its services are only requisitioned when there is a generating station in working order in the vicinity. Thus, in several engagements where the local conditions allowed of it, wire entanglements have been charged with electricity at high pressure, with disastrous effects upon the unfortunate soldiers whose fate it was to run foul of them. It is trying enough to work amongst high-pressure conductors under normal conditions; the horror of rushing upon them in the dark, without hope of rescue, may be left to the imagination.

The only other application of heavy-current electricity appears to be the searchlight projector, but we do not hear much of this from the Front. It seems that, as in the early days of electrical science, it is as a means of communication that electricity is most fully utilised on the field of battle; field telephones were long ago developed to a high degree of excellence and efficiency, and have rendered priceless service in recent wars; now the combatants have at their disposal also the portable wireless telegraph, which, on a battle-front having an extent of 250 miles, must be of inestimable value in maintaining communication between the Commander-in-Chief and his widely scattered colleagues. To what extent wireless transmission from aerial scouts has been utilised we do not know, but in view of the progress that had been made before the war we can hardly doubt that it has been employed, at least by airships; the aeroplane does not lend itself so well to this purpose. The overland telegraph lines would certainly be destroyed by both sides in the course of their respective retreats, but every effort would be made during the advance to restore them, and many British telegraph linemen have been assisting in this work.

As regards the naval war, the situation is very different. The enormous advantages conferred upon our forces in all parts of the world by our vast network of cables, and still more by our wireless telegraphs, which enable us to keep continuously in touch with all our warships, cannot be overestimated; in this respect we possess an overwhelming superiority over our enemies. The use of searchlights also in fixed positions and on board ship presents no such difficulties as are met with in land warfare, and we can claim that electricity is an indispensable aid to the Navy.

TRADING IN ITALY.

By O. E. ALLO.

Having had some 12 years' experience as travelling representative, six years in Great Britain and six years on the Continent, principally in Italy, I should like to give some impressions of the scope for electrical trading in that country, of the Italian's character, and as to the preparations to be made with a view to starting business there.

As is generally known, nearly all of Italy's electrical power is generated by water power, locally called "white coal," at very high pressures (from 60,000 to 100,000 volts), and in some cases as far as 80 miles or more from the main distributing centre. This is the making of "Electrical Italy," as it allows amongst other advantages low generating costs to be attained.

Transmission lines running over great distances provide for the supply of towns and villages *en route*, as well as the supply of energy for the running of trains, railless cars, electrically-driven agricultural machinery and implements, water pumping, and for industrial and domestic uses, even in the most inaccessible places; on the tops of mountains, villas are supplied with electrical energy for lighting, heating and cooking.

Electrical energy being available, it becomes possible to introduce some of the many electrical necessities for industrial and domestic uses.

But the introduction of electrical goods cannot be effected by sending English catalogues or long descriptive letters, or even by advertising locally; this will only bring answers from the speculative agents who swarm in that country. "Personal attention" is the only way. The Italian business man's motto is: "Chi vuole l'affare va a cercarla, chi non la vuole scrive"—Who wants the order calls for it, who does not want it writes—and he acts up to it. He will invariably call on you to settle some business, or ask you to call, but will not settle anything by letter or by deputy, hence the necessity of having a man of authority there who is invested with full power to act, and is practically proprietor of his Italian branch.

To know the Italian's character is also an important factor in securing orders. The Italian generally is honest, kind-hearted, with a great sense of honour and duty, and one not well acquainted with his nature might be misled by his voluble and demonstrative way of conversation. Naturally, he is quick, impulsive and decided, intelligent and quick to see a point of vantage, but generally he is diffident, hence the necessity of putting things before him clearly and speaking in a straightforward manner, as he will not accept any hints or sarcastic talk, and above all he is an individualist; he will break away from recognised rules and do things according to his own views—this has to be kept in check.

We should not depreciate them, they are not all "organ grinders or ice cream merchants." Italy can boast of having some of the largest and best organised electrical undertakings in the world, and her technical men are of the very highest standard, and both nationally and individually, they are ever keen on adopting new and improved social and business conditions.

"Scouting" is the first step to be taken by firms intending to start in Italy, and as no official reports are made of the doings of private companies and smaller firms, all information has to be gathered on the spot. Catalogues, pamphlets, and all literature should be made up in Italian (English catalogues are useless), the metric measurements given, and prices quoted in Italian currency for goods delivered Milan-Rome-Genoa railway station. These three are the best Italian centres for headquarters. All this work can be done in London, for the beginning at any rate.

When the time has come to start business there, this should be done in a way commensurate to the home standing and to the competitive way it is done in the country; first impressions are lasting, and the Italian being somewhat of an Oriental turn of mind, is greatly impressed by appearances. Hence firms should make themselves appear what they intend to be taken for.

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Another point I should like to mention, is our commercial policy in the various countries we intend to "invade." Generally, Britishers expect business people abroad to do things the way we do them; this is fatal to success. Why not adopt our Government's colonising policy and let people do as they are wont to do but under our supervision? It is a remarkable thing that our colonising and commercial policies are reversed to those of the Germans, hence their failure in the former and their success in the latter.

With regard to payments and the so much lamented long credits, payments are never cash on delivery (except by parcel post, in which case the Post Office collects and remits the cash). On receiving the goods the customer sends his "acceptance," which is a legal and properly stamped promissory note, generally made payable at three months, and if refusal of payment is made, legal prosecution can be begun without further ado, but refusals of payment are only made in extreme financial difficulties. Again, these acceptances are negotiable, so that one can pay one's debts with them also, and the passing of cash for differences is only made periodically. A few firms insist on six months' credit, but this is not usual; the credit of years' duration is quite exceptional and is made under conditions which would allow for such credit to be given in this country.

British goods are the best in quality, and their prices the highest. It would no doubt pay our manufacturers to have two qualities, standard and foreign, the latter being lighter and not so well finished, and with a difference of 25 to 33 per cent. in prices between them; then there would be a possibility of competing against local and even against future German competition.

Another point which helps business in Italy may be mentioned. Germans will send goods to be placed in showrooms, exhibitions, windows, &c., to any amount, and charge these at cost price payment being spread over a year. This is the best form of advertisement, besides causing practically a monopoly sale for such goods; they further make an agreement in return that all goods are to be ordered from them, so that in time they get these goods paid for, and new goods still on show, and so keep a great many "tied" businesses, with good and permanent results. The Italian lends himself to this. Generally speaking, Italian manufactures are not better than German ones and cost more.

As to general working expenses, wages, rates and taxes, these are less than in England; labour is good (six full days a week), but, as stated above, on account of its individualism, it has to be kept in check.

Goods arrive in Milan by rail "Petite Vitesse" in 25 to 30 days, at about £4 5s. a ton, and by "Grande Vitesse" in 12 to 15 days, at about £5 10s. a ton. With a good knowledge of the market, a few samples from the competitive manufacturers, a good stock on the spot and fairly good deliveries, there is no question but that Italy is a good field for the electrical trade, and is improving every day.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

War and the Neutrality of Science.

The sentiments expressed by the writer of your leading article are admirable, and it is hoped that they will be taken to heart by British swash-buckling scientists (if there be any).

In one respect, however, I think your leader-writer is in error. He speaks of "the bestial gospel of brute force preached by Treitschke, Nietzsche and Bernhardi." I should be glad if he would quote Nietzsche as an advocate of "brute force."

Nietzsche preached the gospel of the superman, not of the superbeast. He was a Pole, and had a great contempt for Prussian "Kultur," whereas he admired French culture. He preached the heroic in man, and if he were alive and sane at the present moment he would surely glorify the acts of the Belgians rather than those of the Prussians. It is a great mistake to associate him with those who have so misled the German Empire.

X.

Seizing the Enemy's Trade.

Is it not rather regrettable that there should be so much talk in influential newspapers about "Seizing the enemy's trade?" Does it not tend to discount somewhat our assertion, as a nation, that we have gone into this war with clean hands, and solely because we felt it our duty to vindicate the rights of a smaller and weaker nation, and to fulfil our pledges to her? Does it not also give colour to Germany's insinuation that it was trade jealousy and rivalry (in other words, the desire "to seize the enemy's trade") that prompted Britain to range herself against Germany? The ill-concealed spite and unholy glee shown in some of the letters and articles on this subject are surely most ill-timed and most unpatriotic. Moreover, their tone leads us to think that the writers regard our victory as already assured, and assumptions of this kind expressed in an arrogant and truculent manner are surely premature and in the worst possible taste. It is no time to boast of to-morrow when, from hour to hour, we know not what a day may bring forth.

If we do "capture the enemy's trade," we shall not retain it unless we give the same patient attention to small and seemingly unimportant details and to the requirements of clients that has always contributed so largely to the enemy's success.

It is worthy of note that some of the firms suspected of trading with the enemy have purchased immunity from attack by widely advertising the fact that they are genuinely British and only employ British labour, and henceforward they are, like Cæsar's wife, above suspicion. Many smaller firms, however, although quite as genuine, have been hard hit by the war, and cannot afford to protect themselves in this way. Is there any reason why they should be subjected to this kind of blackmail? How many engineering companies and firms can truthfully say that they have never had any dealings with Germany?

In uttering this protest I have no axe to grind. I wish to see my country come out of this war—as it went into it—with clean hands. True patriotism is something more than the waving of flags and the singing of patriotic songs. It means upholding one's country's reputation and ideals.

Britannicus.

[Our correspondent aims at lofty ideals, but war is war, and must be waged by every honourable means at our disposal, amongst which one of the most powerful and effective weapons is war on trade. Clearly and logically, "Britannicus" would have us refrain from capturing the enemy's merchant vessels, and from all similar acts not directly aimed at their armed forces; but that would merely prolong the agony. Let "Britannicus" study history, from which he will learn that, from time immemorial, war on trade has been regarded as a legitimate and inevitable accompaniment of military operations. Clean hands—yes; but not kid gloves.—EDS. ELEC. REV.]

Arbitrary Action of Public Authority.

Your correspondent in his first letter makes a sneering veiled attack on me, follows this up by insinuating I am not a gentleman and all the time shrinks behind his anonymity because he is frantically afraid that on another occasion he will not have a chance of obtaining an order from the public authority he is at the present time covering with abuse. I think my condemnation was none too harsh for such methods, and I am content to leave it to your readers to judge as to the gentleman.

Your "Advocate of Patriotism" evidently feels guilty when he styles himself a "wicked manufacturer." I certainly have never said or thought so—it is not the manufacturer, but his "general conditions of contract" insisted upon to the last full stop that I have always considered wicked.

I omitted to say whether I considered the authority acted correctly or not for two obvious reasons:—

(1) I had not the circumstances and details of the case upon which to form any opinion; and (2) had I had the advantage of this information it was not for me as an official of one public authority to publicly express an opinion on the action of another public authority, especially at the bidding of an anonymous writer.

F. W. Purse,
City Electrical Engineer.

Carlisle, *October 5th*, 1914.

[This correspondence is now closed.—EDS. ELEC. REV.]

The War and South African Trade.

A great opportunity now presents itself, owing to the present war with Germany and Austria, for British firms to recover the electrical trade on the gold mines of Johannesburg and in South Africa generally. During the last 10 years German firms have almost completely ousted British goods, as merchants have found themselves compelled to make arrangements with German import houses, in order to compete against the unfair competition of bounty-fed German competitors such as the A.E.G. (Allgemeine Elektricität's Gesellschaft) and Siemens. The largest electrical power station and distribution system south of the Equator was, with the exception of the boilers, supplied and erected by the A.E.G. for the Victoria Falls and Transvaal Power Co., Ltd. The incandescent lamp trade is almost entirely in the hands of German and Austrian manufacturers, as well as the smallest installation requirements.

Already a boycott by most of the mining groups and municipalities is being extended to German firms and goods, but the

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merchant is practically helpless, as most of his competitive lines are German or Austrian. British firms must use every endeavour to meet these new conditions, and place merchants in this country in a position to supply the large demands at competitive prices. This can be largely accomplished by giving them facilities for carrying larger stocks of up-to-date materials, and standing loyally by such firms as they appoint their agents, and not making competitors in their own specialities amongst rival firms.

Agencies to be a success must be *sole* agencies in every sense of the word. The writer knows of local firms who have spent considerable time and money in introducing specialities, and then found out afterwards that several opposition firms have secured the same goods, and are quoting in the market against them.

The crusade of a few years ago, under the cry of "Wake up, England," does not appear to have had any lasting effect. Principals should give their agents every facility for arriving at quotations, furnishing full particulars, drawings, and weights of their respective goods on the spot, and not have to be continually referring by letter or cable for fuller information and prices. The trade in South Africa is growing by leaps and bounds, and in order to keep our goods on the market, British firms must give more attention to the matters mentioned above.

The writer suggests that firms of standing here should be approached direct or through their London export merchants, and invitations made for them to represent their manufactures as sole agents, and in the event of satisfactory arrangements being concluded, the question of consignment stocks or full confidential information could then be finally settled.

In conclusion, the writer trusts that British manufacturers in electrical and kindred trades will take this matter up seriously, and grasp the opportunities now arising to recover lost ground, and build up a strong British electrical trade with the Union of South Africa and with Rhodesia.

Loyalist.

Johannesburg, *September 10th*, 1914.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

An Electric Steaming Oven.

We illustrate herewith an electric steaming oven specially constructed and designed for use on board ship, by Messrs. Crompton and Co., Ltd., of Salisbury House, London Wall, E.C.

The internal dimensions of the oven are approximately 24 in. × 18 in. × 24 in., fitted with a water evaporation boiler in the bottom of the oven.

The oven has five galvanised iron-wire baskets, capable of holding, roughly, from 56 to 80 or 90 lb. of potatoes, and the water is kept

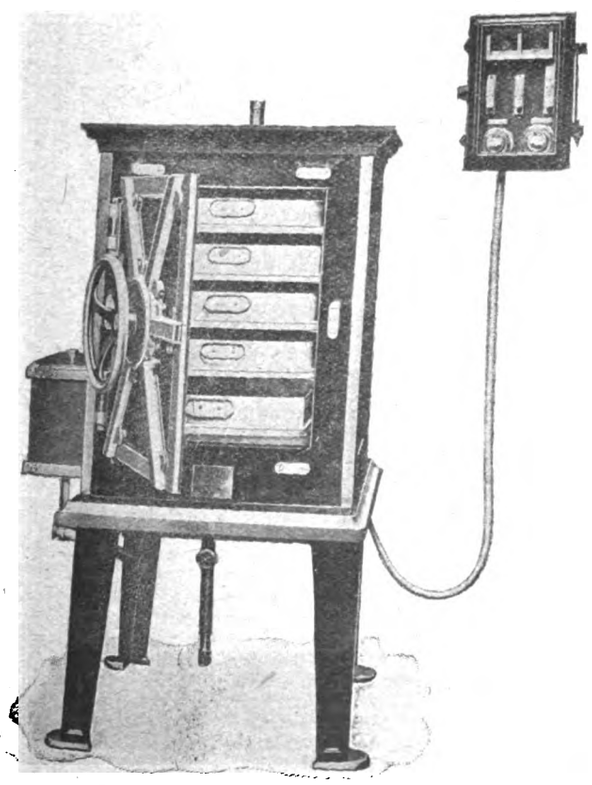

Fig. 1.—Crompton Steaming Oven

at a constant level by the small tank fixed at the side of the oven on brackets, which is fitted with a ball cock and is connected to the main water supply.

The heavy hinged iron door is packed with india-rubber packing, and made perfectly steam tight by locking bolts, operated by a volute screw and wheel handle.

The oven is loaded to approximately 5 kw., and is suitable for steaming either vegetables or puddings. The steamer is mounted on legs, to bring it to a convenient height, and to facilitate the inspection of the elements; the feet are webbed, with holes for bolting down to the deck of the ship.

A special switchboard is supplied, fitted with single-pole damper type fuses, luminous indicators, and two single-pole diamond pattern switches, mounted on a marble base, and enclosed in an ironclad water-tight box with glazed door, the water-tight switchboard being very necessary in the steamy atmosphere of the ship's galley.

It will be noticed that the switchboard is connected to the steamer by 4 to 5 ft. of flexible-metallic tubing and wiring.

Number Controller and Indicator.

Messrs. Austin Walters & Son, of 57, Lower Mosley Street, Manchester, have sent us particulars of a number controller and indicator which they are making.

The controller consists of a barrel with several rows of copper stud contacts corresponding to the number of lamps required for the formation of the numbers from 1 to 19. In rotating the drum by the indicating wheel on the same spindle, and pushing the locking device into the corresponding slot, the studs are brought into contact with flat springs wired in circuit with the lamps on the indicating board and forming the number indicated on the

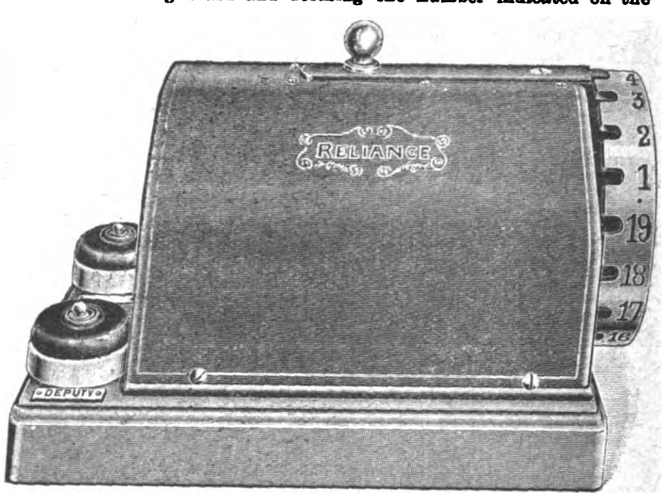

Fig. 2.—Electric Number Controller.

wheel. The locking device actuates a quick-break switch, which opens the circuit on unlocking the wheel; this prevents the possibility of arcing between the contacts when changing from one number to the other.

The indicating board consists of a number of lamps behind a perforated zinc plate. The makers find from experience that a lamp behind each hole is far better than one lamp illuminating two or three. In the latter case if the lamp gives out, the formation of the number is entirely lost. Three sizes are made: No. 1, from 1 to 9, No. 2, from 1 to 19, and No. 3, from 1 to 19 with "deputy" and "extra" in the same frame, this only entailing two extra wires.

LEGAL.

Prosecution Against Shotts Iron Co.

In the Hamilton Sheriff Court an action was raised at the instance of the Home Office against the Shotts Iron Co., Ltd., including Henry Love, as agent, and George Hutchison, as manager, of Rimmon Pit, at Shotts, belonging to the company. Respondents were charged with having committed a breach of the Coal Mines Act, 1911, in respect that they had failed between March 1st and April 24th, 1914, to have two single-core electric cables in the stone mine haulage road of the Rimmon Pit protected by a metallic cover, said cables not being either flexible cables for portable apparatus or signalling wires.

Proof in the case was avoided by the entering of a minute of admissions signed and agreed to by both parties. In the minute of admissions, both parties agreed that the cables in question were in use in an unarmoured condition before June 1st, 1911. Up to that time the cables complied with the requirements then in force relating to the construction of electrical apparatus in mines. For some time prior to June, 1911, and up to January, 1914, the cables had run along a ventilating road, which was not a haulage road. In January of this year, however, the cables were altered to run along the stone haulage road. It was also admitted that in respect of the cables no exemption from the requirements of Part III of the General Regulations under the Coal Mines Act had been obtained, and that unless they were covered by the exemption under 137 (*b*) of the General Regulations, the cables did not

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comply with the requirements of Sec. 129. The question really at issue was whether these two cables, having been removed from a ventilating to a mechanical haulage road, still fell within the exempting provisions.

Mr. J. C. Watson, Sheriff Court Advocate-Depute, maintained that the result of the respondents' contention that these cables in their existing condition, after removal, were exempted, was to transform an exception which had been given as a favour to the coalowners, in order to secure that the *status quo* should not be unnecessarily altered by the passing of the regulations, into a right of the coalowners to commit a breach of the regulations. To shift these unarmoured cables from a ventilating into a haulage road, and to continue to regard them as exempted from the regulations was a complete travesty of the whole purpose and meaning of the exception to the regulations. The exception only applied to cables and apparatus *in situ*.

Mr. J. C. Bishop, for the respondents, held that there was nothing in the regulations which prevented him from removing these cables from the part of the mine in which they happened to be in 1911 to any other part of the mine in which he might have found it suitable to use them. He took exception to the distinction which the Advocate Depute had drawn between a privilege and a right. It was in the scope of the right which the exempting provisions gave him that they commenced to differ. He held that these exempting provisions amounted to an absolute repeal for a brief time of the regulations relating to the construction of apparatus, and if it could be predicted of these cables that they were in use in June, 1911, then no requirements of construction could be quoted against him. Any unreasonable use of the apparatus could always be brought up under the sub-sections which gave the Mines Inspector the right to disallow it.

Sheriff Shennan indicated that as the point raised was one of interest in both mining and electrical circles, he would issue a written judgment upon it.

Sheriff Shennan issued a written opinion on Monday. He indicated, at the outset, that the question to be decided was not an easy one. At first he had been disposed to favour the contention put forward by the respondents, but after full consideration he had come to be of the opinion that he must convict. His Lordship thought that the true interpretation of Sec. 137 (*c*) lay between the opposing contentions of the prosecution and the respondents in the present case. His view was, in fact, that Sec. 137 gave exemption to cables and other apparatus only so long as they continued to be used for like purposes and under like conditions. What that exemption meant, he thought, was that the mine-owners might go on using their electrical plant in so far as it was effectively installed prior to June 1st, 1911, until the mines inspector asked them to alter it. He gladly recognised that the offence was purely a technical one, arising from what he held to be a mistaken interpretation of 137 (*c*). The fact that he himself had found the question one of difficulty made the mistake eminently pardonable. Possibly, the High Court might find it was not a mistake at all, but he could only go on his own opinion. He would impose a nominal penalty of £1 on the company, while he would dismiss the agent and manager with an admonition.

Alien Enemy Cases in Court.

On September 30th, in the City of London Court, before Judge Rentoul, K.C., Messrs. Plutte Scheele & Co., Ltd., 18 and 19, Queenhithe, claimed £5 3s. against the Imperial Lighting Co., electrical engineers, Pocock Road, for electric lamps supplied.

Mr. Jackson, defendants' solicitor, said they did not raise the moratorium, but plaintiffs were agents for Bender & Worth, Westphalia, Germany, and therefore could not recover, as the money, when paid, would be sent to Germany.

Mr. Rawlinson, plaintiffs' solicitor, said that the contract was entered into after the Proclamation. Plaintiffs were an English company, and the principal shareholder was a British subject. The name made no difference.

Judge Rentoul asked, as the defendants had had the plaintiffs' goods ought they to pay for them. Supposing the seller were the Kaiser—in his lucid moments—ought he not to be paid? Mr. Jackson said no, because payment was prohibited under the Proclamation. They could not pay an alien enemy, however much they wanted to do so.

Mr. Jackson: The money will be sent to Germany.

Judge Rentoul: Not a bit of it. Plaintiffs will keep it.

Mr. Rawlinson added that a branch of a German firm could carry on business here.

Mr. Jackson said the plaintiffs were not a branch. They were the agents of the German firm. There were £60,000,000 due by German firms to Englishmen, and the Germans were equally prohibited from paying the money. It was a great difficulty in the North of England, where many firms were on the verge of bankruptcy because Germany was not paying up.

Judge Rentoul said he had been ordering the retention of money due from the Court to Germans; but, as the order in the present case was given after the declaration of war, he must give judgment for the plaintiffs with the law costs; but the money, when paid, would remain in Court to await further order.

Another New British Magneto.—A new magneto for four-cylinder engines has been introduced by Messrs. Fellowes & Co., 99, Horseferry Road, Westminster.

WAR ITEMS.

Board of Trade Assistance.

Further additions to the series of pamphlets concerning German and Austro-Hungarian export trade issued by the Board of Trade Commercial Intelligence Department, deal with manufactures of iron or steel wire, heavy chemicals, tin wares (including tinfoil), and cast-iron goods (stoves, baths, &c.).

Further information in regard to commercial and financial conditions and openings for British trade in many countries has been received at the Commercial Intelligence Branch of the Board of Trade, where the detailed reports may be inspected. A brief outline is given below of the nature of the information received from each of the sources indicated.

Canada.—The Imperial Trade Correspondent at Toronto reports (September 9th) that financial conditions generally in Ontario are good. The chartered banks are in a strong position, and their managers state that legitimate borrowers will have no reason to complain of lack of credit facilities. There are signs, however, that the banks, as is, perhaps, natural under present disturbed conditions, will not grant loans for any great extension of factory operations, or for much new work of any nature. While the general financial situation is good there is an unmistakable spirit of economy on the part of the individual, the factory, the wholesale house, and public authorities. In the aggregate this means a reduced purchasing power for the time being at least, but at the same time it appears to be a good period for a close study of this market by those British houses desiring to do business now and in the future. British firms should in all cases quote strictly inclusive prices to Canadian buyers.

South Africa.—His Majesty's Trade Commissioner reports (August 25th) that there seems to be no doubt that British trade in South Africa will receive an enormous impetus as a result of the complications in Europe, although it may be acknowledged that the immediate prospects of trade are not of the best. There is considerable anxiety on the part of merchants with regard to stocks now on the water; but the effect of the moratorium in operation in the United Kingdom is that merchants fear that oversea manufacturers in all parts of the world will not be disposed to trade with the South African market so long as it is thought that payments for consignments are liable to be temporarily withheld in transit by the London banks.

The Trade Commissioner emphasises the importance of attention being paid to the following details of trade organisation by British manufacturers desirous of taking advantage of the extended possibilities of the South African market as a field for their enterprise:—

1. The need for local representation.
2. The enormous advantages that, as a rule, follow the visit of a principal to South Africa for the purpose of becoming intimately acquainted with local conditions of trade.
3. The necessity for meeting foreign competition by the supply of articles identical with those being exploited by our foreign competitors.
4. The adoption of an overhead charge in all cases where South African trade custom makes it necessary.
5. The study of packing, in order that handling, both on the part of the wholesaler and retailer, may be reduced to a minimum of labour with a maximum of convenience.
6. Sympathetic and generous treatment towards the local representative, and a strong endeavour to adjust the exporter's point of view to that of the South African merchant.

Ceylon.—The Collector of Customs has forwarded a statement showing the extent of the import and export trade of Ceylon done with Germany and Austria-Hungary respectively, together with a memorandum giving particulars of German and Austrian goods which find a ready sale in the colony. The collector of Customs mentions that there is no doubt that the success of the German trade in this colony has been due to the comparative cheapness of the goods when compared with similar articles of British make. In the whole of the East cheapness is the main consideration of the purchaser, provided his taste as regards colour, design, &c., is flattered.

Sierra Leone, Trinidad, Jamaica and British Guiana.—The governors of these colonies have forwarded detailed statements containing statistics of the imports of German and Austrian goods into their respective colonies, and showing the extent of the export trade from the colonies to Germany and Austria-Hungary. These statements, as well as certain German invoices forwarded by the Governor of Jamaica, may also be inspected at the Commercial Intelligence Branch.

Portuguese East Africa.—His Majesty's Consul-General at Lourenco Marques reports (September 15th) that German blue prints constitute the most important item of goods imported from Germany, measurements being 38, 32 and 28 in., selling at 7d., 6½d., and 5d. per yard, with 6 per cent. added to cover cost of insurance, freight, &c. German firms are in the habit of granting 90, 120 and even 150 days' credit. It is stated that manufacturers of railway material in the United States of America are anxious to obtain a footing in Portuguese East Africa.

France.—H.M. Consul at Lyons, who has made inquiries of the principal shopkeepers in his district with a view to ascertaining what classes of German goods sold in Lyons shops might be replaced by articles of British manufacture, says that the consensus of opinion is that the success of German manufacturers in France is largely due to the fact that their goods appeal to the masses, while English makers only consider the better class buyers, who are far less numerous. They should also make an inferior quality article, for which there is undoubtedly a demand, and should adopt the German plan of stating prices of goods arrived at Lyons, including Customs duty and postage.

Russia.—H.M. Consul-General at Moscow reports (September

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17th), that according to information received from a reliable source, the excitement which prevailed in Moscow when war was first declared has passed away, and the inhabitants have settled down to conduct their business in a normal fashion. As regards manufactures, it is asserted that the mills and factories in Moscow are working quite normally, and as long as they continue to get the necessary raw material, there is every prospect of their continuing to do so. Business concerns which do not depend upon the imports from abroad are as yet feeling very little of the consequences of the present conflict. There is no moratorium in Moscow, and business men maintain that there is no necessity for it. There is practically no dismissal of workpeople. A great deal of the success of German manufacturers in the Russian market has accrued not so much from the efficiency of the representatives they have had on the spot, but has been in a very great measure the result of their own systematic organisation and the way in which they have tried to meet the whims and fancies of their customers; not only that, but the most go-ahead firms have sent out their catalogues and circulars printed in the Russian language, giving Russian prices, weights and measures, and this always gives their offers a better chance to be considered than those submitted by firms in England and elsewhere, who supply their circulars and catalogues in a language unintelligible to the purchaser. The report received from H.M. Consul deals more particularly with the methods which have contributed to the success of German manufacturers of various classes of textile and other machinery and engineering and electrical appliances, and mentions among other articles which have been introduced extensively into Russia by the Germans, small engines and locomobiles, steam boilers and steam piping, heating and lighting apparatus, elevators and lifts, mining machinery, steam turbines and pumps, steam fittings, &c., steel goods, tool steel, wire ropes, electric lamps, woven and leather belting, &c.

Italy.—H.M. Consul at Brindisi reports (September 21st) that while large quantities of German and Austro-Hungarian goods are used in the Province of Apulia, they are not imported direct. Shopkeepers in the Province do not carry large stocks, but order their goods in the north of Italy and in Naples. Large credits are necessary, and owing to agricultural depression there is some difficulty in collecting accounts. Generally speaking, the demand is for cheap rather than lasting articles. The chief German imports include electrical machinery and ironmongery.

Portugal.—H.M. Legation at Lisbon has forwarded (September 11th) a report drawn up by the Secretary in Charge of Commercial Affairs, in which it is stated that in Portugal, even more than elsewhere, the partial resumption of commerce, and its gradual restoration to a normal current and a new course, may be influenced to the advantage of British interests. Austro-German trade with Portugal can, for practical purposes, be treated as German, the Austrian contributions being insignificant. German trade with Portugal has of late been developed, until it has challenged our previous pre-eminence in every region of Portuguese commerce, and has in some cases changed it into a German predominance. The report adds that high prices in Portugal, due to protection, caused a demand for cheap manufactures, and excessive production in Germany permitted a lowering of prices for surplus supplies; all the advantages of German business in Portugal have, however, been cancelled by the war conditions. The operations of the great German shipping lines are suspended until peace, and will be restricted probably for several years after. The Secretary in Charge of Commercial Affairs has furnished a detailed review of German imports into Portugal in relation to British, which indicates the lines on which British firms are most likely to find openings due to the suspension of German supplies, and also serves to show the extent of the demand. Articles which seem to offer opportunities to British trade are:—Electrical supplies, machinery, manufactured leather, porcelain, glass manufactures, copper, brass and bronze goods.

Australia.—H.M. Trade Commissioner at Melbourne reports (August 20th) that there need be no anxiety as to payments of reasonable obligations contracted by known importers in the Commonwealth being regularly met. The leading business men regard the present situation with equanimity. The Federal Government will support the banks if necessary by giving facilities for an extension of the currency. It is anticipated that there will be a considerable falling-off in imports, especially of luxuries, and the rise in prices will inevitably restrict trade. In the textile trade there is likely to be a falling-off in orders; as regards iron and steel and hardware, it is stated that in consequence of a 33⅓ per cent. increase in American freights on heavy metal manufactures, there is an opportunity for British manufacturers to extend their trade. No general statement can be made with regard to the placing of new orders for goods of any kind, but it is certain that the volume of the import trade will decrease. Apart from the dislocation due to the war, the outlook for the primary producers—the wool growers and wheat farmers—is not too bright, while the general export trade of the country is being seriously interfered with owing to war conditions. H.M. Trade Commissioner adds that if British manufacturers will systematically study the position, he is of opinion that they can secure a large amount of trade formerly done by Germany. In this connection it is suggested that new firms wishing to enter the Australian market should instruct their representatives to call at the Trade Commissioner's Office (Commerce House, Melbourne), which will be glad to assist with information and advice.

The officer in charge of H.M. Trade Commissioner's Office in Sydney reports (August 19th) that business is being executed much the same as usual, though there is a certain amount of anxiety and tension as to what is going to happen. A few wholesale houses, especially in soft goods, have cancelled orders given before war broke out, and the general feeling seems to be that for some time in the future the purchasing power of the public will be limited, and merchants are rather chary of carrying large stocks in consequence. In the future there must be expected a severe check on the activity of the industrial and commercial community in Sydney, and money is bound to be scarce.

The Imperial Trade Correspondent at Adelaide writes (August 15th) that British shippers of goods to Australia in British vessels, who have drawn against the documents, need have no fear about the draft being met, as the goods will represent even better value to the consignees now than they would under normal conditions. Imports are likely to continue, but on a restricted scale, as orders placed in future will be limited to absolute necessities. Exports for the time being have ceased, as the extra war risk charged by the insurance companies is practically prohibitive. The wool sales have been postponed.

New Zealand.—H.M. Trade Commissioner reports (August 19th) that although the war at first caused some panic in New Zealand and a large number of indents were cancelled, conditions have since improved. The financial position in the Dominion is strong; all the large importing firms are considered sound, and settlements are likely to be regularly maintained. Expenditure on the part of the public is likely to be considerably curtailed, and it is anticipated that retail firms and small dealers will feel the strain to a greater extent than the larger houses. The New Zealand Government has undertaken to carry on all public works on hand and to prevent unemployment as far as possible, and the people are being urged to make all efforts to re-establish trade within the Dominion and overseas. There is a strong prejudice against German imports, and British manufacturers making prompt overtures should be able to do good business.

The Sydney Turbine Contract.—The Australian papers just to hand contain the reports of the Sydney City Council's deliberations prior to the decision to purchase a steam turbo-generator from a British firm, at a cost of £15,500, *ex* works, and to pay the extra war risks thus occasioned. The *Sydney Daily Telegraph* of August 26th says:—"It was explained last night by aldermen that the Council had taken the best possible course in face of the present war, as the purchase would tend to prevent unemployment in England as well as here. 'Our subscription towards patriotism,' remarked one alderman, 'is the risk involved in getting the machine from England instead of from America.' It appeared from the debate at the Council meeting that the original turbo-generator was to have been supplied from Germany, but in view of the outbreak of the war it was obvious that the contract could not be proceeded with. The city electrical engineer (Mr. Forbes Mackay) then recommended that the offer of an Australian company to supply the machine from America be accepted, at a cost of £16,550. The General Purposes Committee of the Council recommended that his advice be followed, though Ald. English suggested that inquiries be made among British firms in regard to the matter. Subsequently the city engineer found that there was an opportunity of obtaining the plant from England in less time than had been thought possible previously. The matter came before a special meeting of the Electric Light Committee last night, with the result that it was recommended that the Council should accept the offer of Messrs. Willans & Robinson, of England, made through Messrs. Preece & Cardew. This the Council did on the motion of Ald. Milner Stephen, who moved it on behalf of the Electric Light Committee.

"The mover, in the course of his remarks, intimated that the decision to purchase more machinery was part of a system of extension of plant previously decided upon.

"Ald. Jones expressed pleasure that a previous decision of the Council to purchase material in England was being adhered to, though for some time it appeared to have been lost sight of.

"Ald. Griffin stated that the object of the Council was threefold, namely, to prevent unemployment locally, to purchase in England, and to get the machinery as soon as possible.

"It was decided to accept a report of the engineer stating that the 33,000-volt transformers to be supplied by Messrs. Siemens Bros. could be equally well made in the firm's English works, and that therefore he did not propose to cancel the contract."

The War and French Works.—Many electrical industrial and commercial business in France are necessarily closed at present owing to those who run them being in the fighting line or otherwise on service. Some of our esteemed French contemporaries are in the same predicament, and have had to suspend publication during the period of the war, proprietors, editors and staff all being engaged in some form of service or other in connection with the war. We learn that the works of Messrs. Vedovelli, Priestly, in Paris, are closed for this reason. Messrs. Laing, Wharton, Ltd., of Mildmay Avenue, London, N., are, however, manufacturing the firm's standard models and designs of "Vedopri" extra-high tension apparatus, isolation switches, fuses, &c., and will continue to do so until supplies can be again obtained from Paris.

Vancouver Engineer Recruits.—Mr. C. R. G. Conway, chief electrical engineer of the British Columbia Electric Railway Co., Ltd., and chairman of the local section of the Canadian Society of Civil Engineers at Vancouver, B.C., presided at a meeting of the Society early last month, at which it was decided to form an engineering corps of the Vancouver Volunteer Reserve which is now recruiting for home defence. Nearly 100 members volunteered at the meeting. It is the intention to invite electrical engineers and members of other societies into membership and to apply for recognition by the military authorities as soon as the corps is brought up to strength.

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Nationality and Naturalisation.

In the Electrical Review of September 25th, Mr. John E. Gray, in his letter commenting on my criticism of Mr. Campbell Swinton, casts some doubt upon my nationality. Mr. Gray is right in presuming that my surname is not English; as a matter of fact, it is of Scottish origin (like that of Mr. Campbell Swinton). My father and my grandparents on his side were all natives of Kelso (Berwickshire). My mother came of a Shropshire family, and I myself was born in the neighbouring county of Herefordshire. On these facts Mr. Gray will, I think, admit that I have the right to call myself a Britisher.

As regards my criticism of Mr. Campbell Swinton's statement about Mr. Alexander Siemens retaining considerable sympathy for the land of his birth, I may say that the construction I put upon Mr. Swinton's statement was, that Mr. Siemens would fail to remain loyal to Great Britain during the present war crisis. From the latter part of Mr. Gray's letter I now take it that this construction was not intended by Mr. Campbell Swinton, and if that is so, then I willingly extend to him (Mr. Campbell Swinton) my apologies for having taken a wrong impression of his remarks against Mr. Alexander Siemens.

G. E. Kebbs.

Liverpool, *October 5th*, 1914.

May I commend to your pro-German apologists the paper by General F. G. Stone in this month's *Nineteenth Century Magazine*, and draw the attention of those who appear to think that mere legal naturalisation can convert a born German into an Englishman, to the gallant general's conclusion: "Let no one for an instant deceive himself with the idea that any man, woman, or child, with German blood in their veins, has ever had a kindly thought for England and the English people at any time in the present century."

Even if we do not go quite as far as this, in my view, all Germans who are English only by naturalisation, must at present be considered as suspect. No doubt some of them are, probably, in fact, spies, and we should take no risks.

John E. Gray.

London, *October 3rd*, 1914.

It is not our intention to allow our space to be occupied with a correspondence on this subject, but as we have admitted Mr. Gray's quotation of the gallant General's expression of opinion, it is only fair that we should quote from Wednesday's *Times* the following letter replying to General Stone's conclusion. The writer precedes his comments with the quotation appearing in Mr. Gray's letter:—

"I am a German by birth—I have lived and worked in England for close on 50 years, and have been a naturalised British subject for the last 26 years. Will you allow me, as one who loves and admires and is deeply grateful to the country of his adoption, to utter a protest against the contention that every born German feels himself *eo ipso* an enemy of England? This to my mind is a monstrous self-deception, only made possible by an absolute want of personal experience. I know that there are many Germans in England at the present moment who, like myself, have not a shadow of a doubt about the justice of the English cause in this terrible war; who have watched for years with sorrow and dismay the growing megalomania of Germany, created by the all-powerful military caste and nurtured by commercial and even intellectual influences. At the present moment the unfortunate German nation appears to such as myself to be in a state of uncontrollable madness—comparable only to the fury of the French at the time of the great Revolution.

Paul David."

Oxford, *October 5th*.

Mr. Eck and the Union Electric.

"Though you have closed the correspondence initiated by Mr. Eck regarding the constitution of the Union Electric Co., Ltd., we would ask you at least to permit us to correct the impression left by Mr. Eck's diatribe against Mr. Evershed and this company. To describe Mr. Evershed's slip in a date (if there was one), as 'circulating false coin' is merely abusive, unless the alleged mistake substantially affected, to Mr. Eck's detriment, a correct impression of the matter at issue. Your correspondent does not suggest that it is not the truth that the majority of the directors of the Union Co. during its 14 years of existence were German, and his letter was therefore not directed to the point in dispute. In view of its offensive character, we much regret that you should have permitted it to appear in your columns.

"Evershed & Vignoles, Ltd,
"E. B. Vignoles, *Managing Director*.

"Chiswick, W., *October 5th*."

[This correspondence really *must* be considered closed.—Eds. E.R.]

To Capture German Trade.—We have received a letter from Mr. C. H. Luke, of High Holborn, W.C., which has also appeared in the daily Press, in which he expresses a number of views concerning steps that must be taken if we are going to capture German and Austrian trade. The reorganisation of the Board of Trade and the appointment of separate Ministers of Marine and Railways, of Commerce, and of Labour—points often urged in times of peace—are some of the measures advocated. He emphasises the necessity for prompt action and says that if something is not done now the whole matter is likely to be shelved and we shall continue to muddle along. We make the following quotations from his letter:—

"Every thoughtful Englishman must believe that on the action taken *now* will depend the future of the British Empire. Now is the time to take what is best from the German collective organisation in commerce, and graft it on to our individualism, thus forging an irresistible weapon for the nation.

"This can only be done, in my opinion, by the co-operation of three factors:—

"1. Live British firms, willing to drop antiquated methods, and seize the opportunity with both hands.

"2. By the adoption, under compulsion or otherwise, of a national policy on the part of our great joint stock banks, or if it is impossible to make the controllers of our banking institutions business men, by the formation of State-aided banks of commerce, whose main duty is not to avoid assisting their clients, but rather to meet half-way those requiring financial facilities for legitimate business enterprises.

"3. A thoroughly business policy on the part of the Government, which could quickly show itself in two most needed reforms, (*a*) the selection as ambassadors and ministers to foreign countries of men who have some business aptitude as well as diplomatic experience, and the appointment of commercial attachés, who shall in all cases be trained business men. (*b*) The appointment of trained business men as consul-generals and consuls in all important centres of trade, and the abandoning entirely of the policy of appointing foreigners as consuls and vice-consuls, in order to save a few thousand pounds per annum."

Radium for Manchester.—The Manchester Radium Committee, which recently raised £31,000 for supplies of radium to the Manchester Hospital, has secured considerable quantities of the metal which were intended for Germany. On the outbreak of war Sir William Milligan telegraphed to Pittsburg asking that supplies of radium, which he knew were on order for Germany, should be diverted to Manchester. As the completion of the order to Germany was impossible, his request was complied with, the result being that Manchester will secure full supplies six months earlier than was anticipated.—*Daily Telegraph*.

The Prince of Wales's Relief Fund.—We have pleasure in publishing the following letter:—

Buckingham Palace, *October 5th*, 1914.

"On August 6th I appealed to the nation to assist me in founding a National Fund to prevent and alleviate military and civil distress arising in consequence of the war. To-day, after the lapse of exactly two months, I am happy to say that the Fund has reached the splendid total of three million pounds. I wish to take this opportunity of thanking once more the many thousands of generous subscribers who have helped me to achieve this grand result.

"I have delegated the responsibility of administering the Fund to the Executive Committee which I have appointed, on the advice of the Prime Minister, and I count upon the Committee to see that assistance in emergency cases is adequate, and given with as little delay as circumstances permit. I trust that the portion of the Fund which is to be applied in relief of civil distress may, as far as possible, flow into productive channels such as assisting schemes for male and female employment, and, perhaps, into industrial training; for it is as repugnant to me, as it must be to the recipients, that assistance should be distributed only in the form of doles. What men most want is work, and what the young people need is training.

"The sum which has already been raised is magnificent, and I am confident that the generous British public will continue to do their utmost to alleviate the distress which war inevitably brings in its train.

"Edward."

Contract Difficulties in Australia.—The Chamber of Commerce at Sydney has been considering the position of Government contractors consequent upon the war. At a meeting held in August, according to a report in a Sydney newspaper, it was pointed out that many contracts had only been let within the last couple of months, and that contractors had no chance of getting their stocks. This applied more particularly to houses who dealt with German firms, and who tendered for the supply of goods where German-made goods were specified. Large contracts, embracing the supply of English, Dutch, and Italian-made goods, were also let, but, owing to the dislocation in the shipping world, it was unlikely that anything near the quantities of goods required would come to hand. It was also pointed out that some departments were giving unusually large orders for certain lines, and it was found impossible to meet such an extraordinary demand. It was suggested that some proposal should be made by which a percentage increase on the contract price should be allowed. On this point some contractors who had met the Tender Board and discussed the position with them said that the Government was ready to meet contractors in a reasonable spirit. No consideration should be shown to contractors who, while holding large stocks, deliberately advanced their prices, and so sought to enhance their profits in an illegitimate manner.

War Effects in Australia.—Extracts from the *Sydney Morning Herald*, of August 20th just to hand, says that at the annual meeting of the Perth Chamber of Commerce the new president (Mr. Garner) said that this war must necessarily give a great impetus to Australian manufacture, and it would give an opportunity to their friends in the old country to recover many branches of trade lost during the past few years to Germany. He found, as the result of inquiries in that State, that merchants dealing in soft goods, drugs, machinery and other commodities had on their books for goods sold over £2,000,000, and, even if the present trouble did not last as long as some of them expected, immense losses must be made by merchants. But, in addition to this, up to the very limit of their resources they must carry on every account in the State worthy of assistance.

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Australian Tramwaymen on Active Service.—The chairman of the Prahran and Malvern Tramway Trust has arranged to donate 5 per cent. of his salary to the Patriotic Fund, and the Trust has agreed to make an allowance to employés joining the Expeditionary Force equal to the difference between their pay as soldiers and the salaries received from the Trust. The men at work are contributing to the fund.

German Tramway Manager at Northampton.—A crowded meeting of ratepayers was held in the Northampton Town Hall last week, and passed a resolution of protest against the retention of Mr. J. Gottschalk, as manager of the Northampton municipal tramways. Mr. Gottschalk was born in Germany, but he has lived in England for over 30 years, and has held his present position for 12 years. He applied for naturalisation papers after the outbreak of the war.

The Council has decided to hold a special meeting next week to consider the question. We understand that the whole of the tramway workers, with the exception of three or four, have signed a memorial to the Tramways Committee asking that Mr. Gottschalk be retained. A special meeting of the Trades Council also pased a resolution to this effect, and regretting the unwarrantable attack made upon him. The organisers of the public meeting state that they will only be satisfied with Mr. Gottschalk's dismissal or a plebiscite of the town.

Scottish Steel Works Reopened.—It is stated that the works of the Scottish Iron and Steel Co., at Coatbridge, which were closed on account of German competition, are to be reopened consequent upon the receipt of a French Government order for a million and a half horse shoes.

Marylebone Electric Supply.—No fewer that 50 employés of the department have been called up for service or have enlisted, including eight from the generating station, 12 from the head office, 19 from the mains department, and 11 from the sales and publicity department.

Personal.—Lance-Corporal William Clement, of the Greenock electricity department, has been killed at the front. He was a commissionaire in the Corporation employment and a Reservist in the Black Watch. Another employé of the electricity works, J. McCann, is at the front with the Royal Scots.

A total of 250 men of the Edinburgh Tramways Co. are serving their King and country, and the names of two of them appear in a recent list of "missing." An engineman and fireman, named Kerry, is believed to have gone down with the *Cressy*.

Amongst the survivors from H.M.S. *Hogue* is Mr. Horace Lambert, of Bradford (formerly an employé of the Phœnix Dynamo Co., of Thornbury). Another employé at the Phœnix works—Lance-Corpl. J. Walker—has been reported as missing. He was connected with the Northumberland Fusiliers.

According to a Wood Green paper the following members of the Tottenham staff of the North Metropolitan Electric Power Supply Co. are now serving with the Colours:—

F. T. Hall, Royal Naval Squadron.
H. C. Hornblower, Chief P.O., R.N. Reserve.
C. Senior, 2nd Class P.O., R.N. Reserve.
H. Fisk, R.G.A.
R. Enticknap, R.G.A.
W. Spencer, R.F.A.
W. Hefford. 7th Middlesex.
W. Moss, Electrical Engineers.
A. Ogleby, K.R.R.

It is reported that two of the switchboard attendants formerly employed by the Tynemouth electricity department—Fred. W. Clarke and F. W. Osborne were lost in the cruiser *Cressy*. Both were married men.

It is feared that three wireless operators, who were among a large number of Marconi men to volunteer for duty in the Royal Naval Reserve were among those lost in the *Aboukir*, *Cressy* and *Hogue*, namely, Mr. G. E. Turner (*Hogue*); Mr. S. W. Rudderham (*Cressy*); and Mr. C. T. Massey (*Aboukir*)

Petty Officer Herbert Foulkes (34), of 49, Anderson Street, Salford, who was on board the *Cressy* when she was torpedoed, has been employed at the Salford electricity station. His name was not in the list of those saved.

The Stalybridge Joint Tramways and Electricity Board is granting half pay, with a minimum of 10s. per week, to the 37 employés who are serving with the Colours.

West Ham Electricity Department.—The West Ham Council has passed the following resolution with reference to the pay of men called to the Colours:—

"That the whole of the Council's employés, married or single, called up for service, or volunteering for service with the Forces, be granted by the Council full civil pay, less their service pay (calculated at 7s. per week), and in the case of married men in the Army, less also the actual amount of the separation allowance for the wife, as from the date of mobilisation or enlistment, the Council's payments to be continued so long as the employés are required to remain with the Forces, and are in receipt of Naval or Military pay; and that increments of salary under any scale becoming due to any officer or employé during his period of service with the Forces of the Crown be paid as they accrue."

Mr. W. Whitney, assistant mains engineer at West Ham, has joined the Royal Engineers (Naval Division).

Openings in France.—Monsieur Geo. Herdt, of 26, Rue de l'Echiquier, Paris, who already holds several agencies for general London firms, wants to represent other British firms who are anxious to cultivate the market there while German competition is non-existent. He writes to us referring to the opening that is now available for British and French firms to co-operate in respect to both import and export trade.

Municipal Employes and Reduced Remuneration.—At a meeting of the Manchester City Council which was held on Wednesday (this week), the following resolution was on the agenda in the name of Mr. Ross Clyne:—"That in view of the abnormal expense to which the city is put by reason of the war, the diminution of revenue caused thereby, and the greater financial burden on the crippled resources of the ratepayers, the Officials' (Conditions of Service) Special Committee immediately take into consideration the question of the remuneration of all Corporation employés, with a view to adopting an equitable reduction during the period of war." We are pleased to learn that the resolution was defeated.

The War and Contract Prices.—In the case of those firms which have intimated that they will not be able to carry out the terms of their contracts owing to the war, the Marylebone Electric Supply Committee has instructed the general manager to request them, when sending in their accounts, to submit invoices in exact accordance with the contract prices, and to submit for the consideration of the Committee separate claims for any extra costs in carrying out their contracts which they can attribute directly to the war.

The War Office Commandeers Magnetos.—We hear that the War Office has during the past week been commandeering all the ignition magnetos specially designed for use on eight-cylinder petrol motors that can be got. This type of magneto is only made in relatively small numbers, there being only one maker of motor-cars with eight-cylinder engines, the De Dion Bouton Co. The magnetos are understood to be required for use on aeroplanes, a large number of which, fitted with eight-cylinder engines, are now being prepared for war purposes.

German Iron and Steel Exports.—The *Financial Times* says that Mr. Bleckley, a director of the Pearson and Knowles Coal and Iron Co., speaking at the company's annual meeting last week, said that the war would result in the reduction of 50 per cent. in German exports of iron and steel. This would not mean capturing German trade, but resuming our old trades filched by German interlopers, not by fair competition and superior methods, but by the aid of export bounties and subsidised steamships which ruined much of our business.

A Tramway Family at the Front.—Mr. John Stevenson, of Nelson, and his three sons are serving the Army. Mr. Stevenson was a tramcar driver on Nelson tramways when the war broke out, and two of his sons were conductors on Burnley and Colne tramways.

Engineer Units—Royal Naval Division.—The following have received temporary Commissions as Lieutenants in the Royal Marines for duty with the Engineer Units of the Royal Naval Division:—R. G. Aston, L. H. Rugg, A.M.Inst.C.E., G. H. Spittle, A.M.I.E.E., A. J. D. Chivers, A.I.M.M., H. Dobell, A.M.I.E.E., R. Grierson, A.M.I.E.E., A.M.I.Mech.E., A. Williamson, A.M.Inst.C.E., T. C. Aveling, A.M.Inst.C.E., R. Stoltenhoff, Graduate I.Mech.E., G. W. Revell, A.M.Inst.C.E., G. E. Morgans, A.M.Inst.C.E. It will be remembered that these Units consist very largely of members of the Institutions of Civil, Electrical and Mechanical Engineers.

London Electrical Engineers to Recruit.—The London Electrical Engineers (Territorials), of 46, Regency Street, Westminster, have now received permission to recruit. An opportunity, therefore, occurs for members of the electrical profession to join a corps where their technical abilities will prove a valuable asset to their country. Application should be made personally or by letter to the Commanding Officer.

Spain.—Increases in the prices of electrical manufactured articles and raw materials to the extent of from 25 to 30 per cent. by Barcelona supplying firms have induced the Asociacion de Industriales Electricistas, of Catalonia, to call a public meeting to discuss the situation. Some 200 localities and towns of Catalonia and 14 lighting stations were represented; also all the Spanish electric lamp makers, the firm of Pirelli, and others. In the result, it was decided to appeal to the Government to fix a moderated tariff of prices, to compile a black list of firms charging exorbitantly, to form a National Buying Syndicate on a share basis, and to place orders in those countries abroad only where reasonable quotations are offered, and more particularly in the United States.

Relief Fund Contributions.—A war relief fund was organised by the employés of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., of Silvertown, four weeks ago, since when £100 has been voluntarily contributed. The intention is to send similar sums to the funds every four weeks as long as may be necessary. About 20 per cent. of the company's male employés of military age have joined the Colours.

French Carbons.—Respecting the shortage of carbons for arc lamps at present experienced, the Wells Electrical Co., of 73, Cheapside, E.C., ask us to state that their works in Paris are now making and delivering frequently, all types. They are the sole agents in Great Britain for the Cie. Française de Charbons pour l'Electricité, Paris.

Blackpool Employes' Allowances.—A special Committee, which has been dealing with the allowances to Blackpool Corporation employés, has decided to allow the wives of all employés serving with the Colours 12s. 6d. per week plus 2s. 6d. per child, and single men half wages as a minimum. Any cases of special distress are to be dealt with on their merits.

Inquiry Bureau Correction.—In our issue of last week we stated that the Employers' Parliamentary Council had decided to assist its members by the establishment of a temporary inquiry bureau. This was a mistake, as the organisation mentioned by the *Times* was the Employers' Parliamentary Association, which has no connection with the body known as the Employers' Parliamentary Council.

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REVIEWS.

Advertising and Progress. By E. S. Hole, and John Hart, first President of the Thirty Club. London: *The Review of Reviews.* Price 5s. net.

The authors of this work are men who are fully able to deal with the subject, having had considerable experience in advertising matters. Mr. John Hart has an intimate knowledge of the conditions obtaining in practically every market, and has been said to combine his great ability as an advertising agent with a wide and varied experience of financial and commercial matters. He was for some time in the advertisement department of *The Times*, and subsequently established an advertising service business in Paris. He is now the controller of the advertisement department of a popular weekly journal. Mr. Hole was associated for some years with the late Mr. W. T. Stead, and from "factotum" became advertising manager of the "Review of Reviews." He was largely responsible for the striking development of the business side of that journal.

In writing the work it is evident from a close perusal of its pages that the authors have been animated by a desire to secure a better understanding of the real and underlying principles of advertising and a more sympathetic note in the future utterances of those publicists who have apparently been too hasty in condemning the social significance of the genuine kernel of advertising. It is evidently intended that the book shall serve a purpose as a pioneer of a newer and more sympathetic handling by economists of advertising as a social force, and in a foreword it is hoped that more leisured as well as more able writers will develop the ideas therein into the more symmetrical form which the subject merits.

The first portion of the volume, which is written in defence of Advertising, deals with the subject comprehensively. In the opening chapter the author makes it clear that to his mind there is a factor in the science of Political Economy which is missing, and which he calls "the soul." Production, distribution and exchange are supposed to be the three essential points, but in the opinion of the author makes it clear that to his mind there is a mainspring of progress, the social dynamic, the proud assertion of commercial individuality by branded standardisation, the generation of the desire to possess, the facilitation of choice, the dissemination of knowledge of social resources; in a single word—Advertising."

The above sentence crystallises all that is wrong with the book. The language of the first portion of the work is strained and often absurdly flamboyant; a fault which seems ingrained in the majority of advertising men. There is a tendency to the "high-falutin'"; sentences that could be plainly and strongly expressed in ordinary every-day Anglo-Saxon lose much of their force when couched in Mr. Hole's picturesque, resplendent, glittering phrases. It is perhaps a minor point—at any rate it does not alter the fact that the author has got hold of the right ideas on his subject, but it is a little wearying continually to come across such sentences as "that ideal conception of a semi-mechanical and non-existent society which is a mere figment of the imagination of the professional economist." A certain idea is a conception of something non-existent; it is a mere figment, so is necessarily a conception and must also of necessity be born of the imagination. So here we have the usual advertising man's habit of saying the same thing several times over: "a conception of something non-existent which is a figment and which is an invention of the imagination."

Chapter 5, on "The Essential Economics," is, perhaps, the best in the first portion of the book. The statements are more clearly expressed and more tersely reasoned; the facts are presented in a more convincing form than in other chapters, although Chapter 9, dealing with the cost of selling, runs it very closely.

The second portion of the book, "Advertising—A Challenge," is the work of Mr. Hart, and is written in a much more concise and vigorous style. What the writer contends is that advertising is, in principle and in proper practice, the cheapest, the most honest and the most useful connection between supply and demand; that its value immeasurably exceeds its cost; that it tends directly to reduce the cost of selling, the cost of production, and the cost to the ultimate consumer, while at the same time it increases and standardises the quality or real value of the product. He contends that its cost does not fall on the consumer but, subject to the principles set forth in the early part of the book, on the non-advertiser and upon obsolete selling methods. According to Mr. Hart, when, by the survival of the fittest in the open fight of clean publicity the needs of man are supplied by the few "proved best" in every trade, then indeed will the consumer bear the cost of advertising, but it will be almost the only selling cost and but an infinitesimal fraction of the huge figures it is now battling to displace. In those days the dominating factor in the purity of advertising will be exactly the same as that which explains its defects to-day—the standard of the public education and intelligence, for that and advertising have steadily developed in mathematical ratio to each other.

The best chapter in this part of the book is undoubtedly Chapter 17, "Our Original Argument," which is devoted to discussing the question "Who Pays for Advertising?" The chapter on "The Creation of Goodwill" is also cleverly written and well-reasoned. The second portion of the book is distinctly better than the first, and it is evident that its writer is a man of practical experience and of keen business knowledge.

It must be admitted, although one has a certain reluctance to speak so plainly, that the predominant thought one has after reading the book is "Why ever was it written?" It does not seem likely to serve any useful purpose; it does not add to one's knowledge in any marked degree; and one has a feeling that in its pages a number of men of straw are erected for the purpose of being knocked down again. It is possible that here and there are men who might not agree in the main with the contentions of the writers, but surely they must be few and far between and not worth the trouble to which the writers of "Advertising and Progress" have evidently gone in order to convince them.

G. Basil Barham.

Modern Workshop Practice. By Ernest Pull. London: Crosby, Lockwood & Son. Price 5s. net.

Written for the use of students, this book is well suited to its purpose as regards the general treatment of the subject, but certain additions and modifications might be made with advantage in future editions. For instance, the illustrations from photos of various workshops all appear to refer to one works, and several of them have no direct bearing upon the matter dealt with where they are interleaved. Again, the works in question are engaged upon the building of large horizontal steam engines—a line of business fast becoming obsolete.

Illustrations from several more modern works would have been preferable, and they should have directly referred to the matter under consideration where inserted. We find, for example, an erecting shop shown in the midst of a chapter on milling, and a foundry illustrated in connection with forging tools and processes. In the first case a corner of a machine shop devoted to milling might have been shown, while in the second an illustration of a smithy is obviously needed.

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Under "Gears and Gear-Cutting" special machines for this purpose could well have been dealt with, and the grinding of internal cylindrical surfaces merits some reference in the chapter on "Precision Grinding." Although methods of holding work to be machined are given and illustrated, no reference is made to jigs—a serious omission when the extensive use of these devices in modern machine shops is considered.

Under "Notes on Belt Driving" the author begins by remarking that "The best belts are made from raw hide and should be of double thickness." This statement without any qualification gives the erroneous impression that all good belts are of this description, which is by no means the case; in fact, raw hide double belts are distinctly uncommon. These notes also condemn a greater ratio than 6 to 1 between pulleys, whereas a ratio of 10 to 1 is often advantageous, especially with individual motor drives. Again, the formula given for the horse-power of belts is based upon one horse-power per inch width per thousand feet per minute, but the table following gives powers fifty per cent. higher than this for narrow belts, also the powers do not increase in proportion to the width of the belts—an unusual feature in such tables, therefore one requiring some explanation. The chapter headed "Transmission of Power" can hardly be considered up-to-date in view of the absence of any reference to chain driving, ball and roller bearings, and friction clutches.

The author of this book has attempted to cover too wide a field in a small compass, and the subject matter might well have been limited to machine-shop practice, which could then have been more thoroughly dealt with. In fact, only a small portion of the book would have been excluded by this restriction. Revised on these lines this work should form a useful text-book for students, as the matter is put forward in a clear and concise manner.

Laboratory Manual: Direct and Alternating Current. By Clarence E. Clewell. London: Chapman & Hall, Ltd. Price 4s. 6d. net.

This book was compiled specially for the use of students at the Yale University, who, although not taking an electrical engineering course, attend for a certain amount of electrical instruction as a subsidiary part of their curriculum. It is designed to form a laboratory companion to Timbil's "Elements of Electricity," and contains references to the sections of this text-book in connection with each experiment, in lieu of any attempt to give the scientific principles underlying the practical work which it describes.

It will thus be seen that the purpose of the author was a very definite and limited one. While this purpose appears to have been well accomplished, and the result has probably been of value to the author's own students, we cannot think that the book is likely to prove of much general utility to readers in this country. Teachers who have a similar problem to face will probably prefer to work out their own scheme, and we do not see that they would be likely to find very much in the way of suggestions to help them in this book before us. We fancy that relatively few English students have adopted Timbil's "Elements of Electricity," as their text-book; those who have not can hardly be expected to make use of this manual with much profit, seeing that constant reference is made to the "Elements" for necessary explanation and illustration.

The manual contains instructions for carrying out 30 experiments; 20 of these are illustrative of continuous-current machinery and apparatus, while the last 10 are concerned with A. C. circuits, machines and apparatus.

Many of the "experiments" consist of suggestions for the study of some machine or piece of apparatus. Usually a short section on "Theory" heads the experiment, followed by a list of apparatus required, the order of carrying out the experiment, and finally a series of questions to bring out the conclusions which should be drawn from the measurements which have been made.

The experiments described and the suggestive questions which follow them have been well chosen and are clearly given; but, after all, it is not easy to illustrate the wide field of electrical engineering in thirty experiments. Any success which is attained in the effort to do so must depend so largely on the knowledge and experience acquired in other ways that it would be rash to recommend either this or any other equally restricted collection as being suitable for general adoption.

Elements of Electricity. By Lieut.-Col. Wirt Robinson. London: Chapman & Hall, Ltd. Price 10s. 6d. net.

This text-book on electricity has been prepared for the use of the cadets of the United States Military Academy. It follows the general lines adopted in such books, but the treatment is of an exceptionally high standard. The clearness of diction, conciseness of statement and general excellency of the diagrams are calculated to encourage the most backward student and at the same time provide an extraordinarily compact and exhaustive text for the more brilliant student.

The writer has not hesitated to use the calculus, and in his treatment of Alternating Currents he has used graphical methods to considerable advantage. The diagrams are, however, the outstanding feature of the work; every illustration has obviously been the subject of great care both in conception and execution, and the general effect of the bold outlines and lettering is most pleasing.

While the author devotes ample attention to theoretical matters, he also has a happy knack of conveying a very good general idea of such processes as electroplating, electrotyping, etc., in a very few words, so that although it is essentially a text-book of Electricity rather than of Electrotechnics, yet the student who reads this book carefully will have gained a wide knowledge of applied electricity, and that with a minimum expenditure of energy.

Specially worthy of mention are the chapters on Primary and Storage Cells, Ammeters and Voltmeters, and Electric Lighting. The shorter chapters on Thermo-Electrics and High Potential are also neat summaries of work, an extensive account of which is obviously beyond the scope of such a book as this. Lieut.-Col. Robinson has kept his book entirely free from the grosser type of Americanisms, and we can heartily recommend his book to students of electricity who want a clearly written and up-to-date book at a moderate price.—P.H.S.K.

Ebonite Supplies.—At a time when the supply of ebonite from the Continent, whence it has hitherto been imported in large quantities, is wholly interrupted, British users may be reminded that the Silvertown Co. have manufactured ebonite for 40 years, and their accumulated experience, together with the most up-to-date plant, enables them to meet all the requirements of consumers. The company are contractors to the British Government, and their ebonite was used by the National Physical Laboratory in conducting the exhaustive tests on which the Admiralty specification is based.

The following is a list of a few of the articles made of ebonite by the Silvertown Co.:—

Sheet, rod and tube, in various qualities and sizes, and special tubes for induction coils, as used for X-rays and wireless telegraphy, forks, channel sticks and perforated sheets, &c., for battery jars and accumulator boxes, telephone receiver cases, earpieces (interchangeable), handles and mouthpieces, switch handles and covers, coil covers, telegraph and tramway insulators, &c.

The company can quote for any type of moulding to sample or drawing, and make a speciality of covering metal fittings, such as spanners, with ebonite. They can, in fact, deal with any requirement in ebonite on receipt of full particulars.

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BUSINESS NOTES.

Consular Notes.—COREA.—According to the British Consul-General, a sum of about £1,200,000 is invested in electrical enterprises in Corea. Twelve new plants commenced work in 1913. The firm of Okura & Co. (representing German manufacture) have constructed a large plant near Shin-Anju in North Pyeng-An province, with a capital of £100,000 to supply light and power, to the town of Shin-Anju, and to a large mining district, including the Oriental Consolidated Mining Co.'s mines at Unsan. The supply of power was begun in November, 1913. Other concerns started in 1913 were the Chungju (Seishu) Electric Co., to supply light and power to the town of Chungju, the capital of North Chung Chong province, the Mokpo Electric Co. and the Kunsan Electric Co. The Suwon (Suigen) Electric Co. commenced work at the beginning of January last. The Suan mine, which the Seoul Mining Co. (an American corporation) works under lease from the Korean Syndicate, Ltd. (British), has been adding new machinery to its existing plant—partly British and partly American. To provide power for the mines a generating station is being built at Pyeng-yang, which was to start operations by the end of 1914. The Americans were successful in getting the orders for this machinery. Owing to the gradual extension of gold mining in Corea, there is an increasing demand for commodities used in the development of mining properties, such as iron and steel, machinery, pipes and piping, &c. As regards telegraphs and telephones, 437 miles of new telegraph lines were laid down during 1913, making the total mileage in Corea 4,142 miles. The telephone mileage at the end of the year was 2,195 miles of urban lines, and 2,597 miles extra-urban, a total of 4,792.

POLAND.—The British Consul at Warsaw, in a recently-issued report on Poland, comments on the preponderating share taken by Germany in the electrical trade, but adds that British makers can to a certain extent compete. Steam engines and boilers were mainly imported from Germany, Austria-Hungary and Switzerland. The Consul gives some figures to illustrate the progress made in the adoption of electricity. In Warsaw there were nearly 1,000 electric lamps in the streets. The total length of electric cables was 383,000 metres. Industrial establishments using electric power for motors numbered 4,800. During last year 4,086 new electrical installations were established, and 975 new electrical power plants were erected. A group of local engineers had decided to start a factory in Warsaw for turning out electrical fittings.

Book Notices.—The October number of the *Chamber of Commerce Journal* contains a great deal of useful information for manufacturers and exporters at the present juncture. Besides its usual features, the present issue gives interesting particulars as to the possibilities of competing, both at home and overseas, in various lines of goods hitherto supplied by Germany and Austria-Hungary. In this section of the *Journal* there are lengthy lists of demands from firms requiring to purchase goods in place of those formerly obtained from foreign sources, as well as offers of home manufacturers to make such goods in addition to their usual lines of manufacture.

We have received an advance copy of a lecture delivered by Mr. H. W. Jordan before the Secretaries' Association on "Private Companies, their Utility and the Exemptions they enjoy."

"Electric Cooking, Heating, Cleaning, &c." By "Housewife." (Edited by E. W. Lancaster, M.I.E.E.). London: Constable & Co., Ltd. Price 3s. 6d. net.

"National Physical Laboratory. Report for the year 1913-14." 1914. Teddington: W. Parrott.

"National Physical Laboratory. Collected Researches." Vol. XI. 1914. Harrison Sons. Price 20s.

"Science Abstracts." Vol. XVII, Part 9. Sections A and B. London: E. & F. Spon, Ltd. Price 1s. 6d. net each.

"Experiments." By P. E. Edelman. Minneapolis, U.S.A.: P. E. Edelman. Price $1.50.

Post Office Electrical Engineers' Journal. Vol. VII, Part 3. October, 1914. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

"*Proceedings* of the Physical Society of London." Vol. XXVI, Part 5. August 15th, 1914. London: *Electrician* Printing and Publishing Co. Price 4s. net.

Liquidation.—The Spiral Regulating Dynamo Co., Ltd.—This company is winding up voluntarily, with Mr. H. C. Bound, of 61 and 62, Lincoln's Inn Fields, as liquidator. A meeting of creditors is called for October 14th.

Fire.—By a fire at Ochil Hills Sanatorium, Kinrossshire, the roof of the electric and battery rooms was burned, while the machinery in the laundry was destroyed.

A Bankruptcy Offence.—Before the Recorder at the Central Criminal Court, on September 14th, the hearing was concluded of charges, under certain sections of the Bankruptcy Act, against H. Maisner, a general merchant, lately carrying on business at 45B, Jewin Street, London, E.C., of unlawfully and fraudulently removing part of his property within four months of the presentation of a bankruptcy petition against him and with attempting to account for part of his deficiency by fictitious losses and expenses. Mr. R. D. Muir, K.C., appeared as counsel for the prosecution, and Mr. Marshall Hall, K.C., defended. Mr. G. E. Corfield, Incorporated Accountant of Balfour House, Finsbury Pavement, E.C., was trustee in the bankruptcy. It was stated on behalf of the prosecution that in 1912 the defendant commenced trading at 45B, Jewin Street, with a capital of £700. From investigation of the books by the trustee since the debtor's bankruptcy, it was clear that at no time did the business pay, but notwithstanding this the debtor had lived extravagantly. Up to the end of June, 1913, the largest purchases in any one month did not exceed £900. In July, 1913, however, they rose to £2,800, and in August £3,272. On the other hand, his drawings during the seven months to July, 1913, for self and cash amounted to £472 only, but in August and September his drawings amounted to £2,700. The defendant became bankrupt in October, 1913. The bankrupt gave evidence denying the charges, but after a lengthy hearing, extending over three days, he was found guilty and sentenced to four months' imprisonment in the second division. We understand that the investigation of the whole matter was an exceedingly long and arduous one.

Patents and Alien Enemies.—Applications have been lodged at the Patent Office for the avoidance or suspension of the following patents or licences:—

No. and year of patent.	Name of grantee.	Short title.	Name and address of applicant.	Approximate date of hearing.
7,617/10	Podszus	Electric igniter for explosion motors	J. H. Meyer, 12, Lime Street, E.C.	Sept. 17th
9,845/11	K. & Th. Möller, G.m.b.H.	Filters for air	H. R. Witting & Partners, 125, High Holborn, London, W.C.	Oct. 5th
18,557/03	Callmann and Bormann	Liquid soldering composition	Bi-Metals, Ltd., 57, Lant Street, Southwark, Surrey	,, 7th
17,624/04	Leisel and Küpper	Material applicable for soldering, &c.	Bi-Metals, Ltd., 57, Lant Street, Southwark, Surrey	,, 7th
12,871/13	Buthardt	Timing gear in electric ignition devices	C. A. Vandervell & Co., Warple Way, Acton Vale, London, W.	,, 7th
20,929/12	"Vulkan" Maschinenfabrik Akt.-Ges.	Electric magnetic clutches	Glenfield & Kennedy, Ltd., Kilmarnock, Ayr, N.B.	,, 8th
23,150/12	Marks ("Vulkan" Maschinenfabrik Akt.-Ges.)	Switches for electro-magnetic clutches	Glenfield & Kennedy, Ltd., Kilmarnock, Ayr, N.B.	,, 8th
7,995/02	Jensen (Dr. G. Langbein & Co.)	Metallic deposits by electrolysis	G. Jones, 58, St. Oswald's Road, Small Heath Park, Birmingham	,, 13th
10,859/01	Goldschmidt	Welding metals	W. L. Turner, Purley Chase, Atherstone, Warwick, and H. A. Blackwell, The Albany, Old Hall St., Liverpool	,, 21st
24,489/02	Goldschmidt	Alumino-thermal process		

The application of Messrs. Witting was heard by the Ex-Comptroller on Monday last, when the applicants stated that they had hitherto obtained the apparatus from the German patentees; this was no longer possible, and it was necessary, to enable them to carry out existing contracts, that they should be allowed to undertake the manufacture of the article. Mr. Tennant, on behalf of the patentees, said that the offer of a royalty on the selling price made by Messrs. Witting was entirely acceptable. The application will be reported to the Board of Trade.

Trade Announcements.—The Sterling Telephone and Electric Co., Ltd., announce, owing to conditions having become more favourable, an advance of 5 per cent. in trade discounts dating from October 1st.

Messrs. W. J. Stokvis, Ltd., announce that their agency agreement with Messrs. E. C. Sparkes, of London, W., terminated on September 30th, and they desire all communications to be addressed in future to them direct at Oude Kraan 62, Arnhem, Holland.

Messrs. Mickelwright, Ltd., have moved to their new premises at Alperton, Wembley, Middlesex, built to cope with increasing business, and all communications should be addressed there in future instead of to Wells Works. Their telephone number is unaltered.

Owing to increased trade Messrs. Loxley & Co. have taken larger premises at 35, Kirkgate, Bradford, where larger stocks will be held. Telephone No. unaltered (4070 Bradford). Some of the firm's staff have left for the Front, but business is proceeding as usual.

Bankruptcy.—Trubie Moore, electrical engineer, of 75, Headingley Mount, Kirkstall, Leeds.—This public examination in bankruptcy took place at the Leeds Bankruptcy Court last week. It was stated that the debtor was now a garage manager, and a scheme of composition was being put forward subject to the annulment of the bankruptcy proceedings. The examination was closed.

Archibald Atkinson, of 16, Northgate, Baildon, carrying on business at 30, Great George Street, Leeds, and lately at 20, Chapeltown Road, Leeds, as an electrical and cycle engineer. The examination was closed in this case.

For Sale.—Salford Electricity Department have for disposal, by tender, 500 disused A.C. and D.C. meters. See our advertisement pages.

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Catalogues and Lists. — The Edison & Swan United Electric Light Co, Ltd., of Ponder's End, have prepared a large and effective showcard, in which the Union Jack is made good use of to tell the public to aid in keeping the flag flying by buying Royal Ediswan drawn wire lamps. We have received a copy of No. 1 of a 16-page periodical, entitled "Ediswan Electric Service," in which the progress of the company is to be recorded from time to time. Lamps, fans, lighting fittings, reading lamps and electric irons are the subject of neatly illustrated comment in the present issue.

Messrs. E. Brook, Ltd., Colne Road, Huddersfield.—October stock list (No. 5, eight pages) of single, two and three-phase motors available at the above address.

Messrs. Ozonair, Ltd., 96, Victoria Street, London, S.W.—Twenty-eight page pamphlet (No. 5) entitled "All about Ozonair," in which much information is given concerning the wide applications of Ozonair apparatus and processes. An imposing list of clients and copies of numerous testimonials are given. Copies will be forwarded to any central station or other engineer interested, on application.

Messrs. Browett, Lindley & Co, Ltd., Sandon Works, Patricroft, Manchester.—Catalogue devoted to Browett, Lindley vertical enclosed forced lubrication gas engines. General descriptive matter together with a full specification, also tabulated particulars of sizes, speeds, powers and weights are included. Views of the Sandon Works are given in the opening pages, and beneath the illustrations of the engines are given indications of some of electric lighting, gas, and other public authorities and companies to whom they have been supplied.

The New Destructor Co., Ltd., Welsbach House, Gray's Inn Road, King's Cross, London, W.C.—Fifty-page new catalogue, containing fully illustrated matter relating to the Horsfall destructor, its economy in working, and notes of the plants installed in Greenock, Liverpool, Poplar, Blackpool, Beckenham, Zurich, Hamburg, Colombo, and many other places where the public authorities have adopted the Horsfall type; portable, colliery, and hospital destructors, and clinker crushing and screening plant are also shown. No doubt this catalogue will be interesting to many borough engineers.

The Anglo-Swedish Electric Welding Co., Ltd., Wood Wharf, Greenwich, London, S.E.—Thirty-six-page illustrated catalogue, containing a full account of the Kjellberg process of electric arc welding and tabulated results of tests. The greater part of the list is devoted to illustrations of some of the work carried out under this process, such work including the repair of some thousands of boilers during the last 10 years.

Messrs. Austin Walters & Son, 57, Lower Mosley Street, Manchester.—Illustrated catalogue of electrical advertising signs, of various types, for bracket suspension and shop windows; also sign flashers, controllers, and time switches.

Pump Valves.—We are informed that a set of Dermatine pump valves fitted to a vacuum pump for a sugar refinery in London, in 1911, has been at work practically day and night ever since then, and when examined recently was so little worn that it was put back in the pump for further use.

Time Switches.—Messrs. Venner Time Switches, Ltd., received an order from Winchester recently for 105 time switches. They have also received the B. of T. approval for their type "RB" time switch.

LIGHTING and POWER NOTES.

Accrington.—New Gas-Electric Plant.—The borough electrical engineer has reported that the work under the gas making and by-product plant contract with the Power Gas Corporation, Ltd., involves the installation of two 1,000-H.P. gas producers, with cleaning and sulphate recovery plant, in duplication of the existing plant, and coupling up to the old plant to form a battery of 4,000 H.P. The contractors for engines, exhaust boiler and accessories are the National Gas Engine Co., for two engines of 1,000 H.P. each and one boiler. The exhaust boiler is being made by Messrs. Ruston, Proctor & Co., the cooling tower by Davonport Engineering Co., and the electrical generating plant by Messrs. Bruce Peebles & Co., consisting of one 750-KW. alternator and one 750-KW. dynamo.

Atherton.—Loan Sanction.—The L.G.B. has sanctioned the borrowing by the U.D.C. of £1,000 for sub-station equipment and £5,000 for mains, &c., in connection with the electricity undertaking.

Belfast.—Extension Scheme.—At the last meeting of the Tramways and Electricity Committee, it was resolved that the engineer be instructed to bring up at the next meeting a complete scheme in conformity with the recommendations of the two experts (Sir John Snell and Mr. W. J. Pratten), which indicated the need for immediate extension, and approved of the proposed site on Hamilton Road.

Bettws-y-Coed.—The U.D.C. has decided to reduce the price of electric light from 8d. to 6d. per unit for the next quarter, and to have the price brought up quarterly for revision.

Canada.—The British Columbia Association of Electrical Inspectors has decided not to allow the installation of nitrogen-filled lamps of over 1,500 watts except when approved fittings are provided. This practically excludes these lamps from British Columbia, as the National Electrical Code does not at present approve of sockets of any make of a capacity of over 1,500 watts. As this is likely to be the ruling throughout Canada, British manufacturers would probably profit by having their high capacity sockets approved by the Board of Fire Underwriters.

The City of Vancouver, B.C., may change its system of street lighting where this is done by arc lamps, in the immediate future, although it has not yet been decided whether luminous arcs or the new nitrogen-filled lamps will be used. The change will be made by the British Columbia Electric Railway Co. under the sanction and superintendence of the city electrician, Mr. C. H. Fletcher.

Caton.—Street Lighting.—The residents of Hornby Road have undertaken to bear the cost of public lighting by electricity in their district. An extension of the lighting in the centre of the parish and Town End, which was contemplated this winter, will not be proceeded with this year on account of the war.

Criccieth.—E.L. Scheme.—The Council has decided to proceed with the scheme for electric lighting, which was postponed in August last on account of the outbreak of hostilies on the Continent.

Darwen.—The Electricity Committee has approved a draft agreement with the Darwen Paper Mill Co., Ltd., for the supply of electricity for power and lighting at the Spring Vale Paper Mill.

Dewsbury.—Power Co. and T.C.—The Tramways and Electricity Committee has received a communication from the Yorkshire Electric Power Co., suggesting that the Committee should consider the future supply of electricity in Dewsbury, with a view to co-operation with the company. The Committee has declined to take the matter up.

The B. of G. has decided to engage the services of a non-resident electrical expert, to advise as to the E.L. system at present in use, its annual cost, and as to the advisability of obtaining a supply of electricity from outside sources.

Edinburgh.—The city electrical engineer has reported to the T.C. on work which might be undertaken with a view to providing employment during the winter.

Exeter.—L.G.B. Inquiry.—An inquiry was held last week into the application of the Corporation to borrow £4,000 for the extension of the electric light works.

Falkirk.—The electricity department announces an increase of ½d. per unit for private lighting, but the rate for public lighting and for large power users remains the same.

Finchley.—Workmen's Dwellings.—The Electricity Committee recommends as an experiment the following fixed charges for electric lighting and maintenance of the installation at the workmen's dwellings:—Houses rented at 5s. 9d. per week, 8d. per week: houses rented at 7s. 6d. per week, 9d. per week; houses rented at 8s. 6d. per week, 10d. per week; houses rented at 10s. 6d. per week, 1s. per week. The recommentation was adopted for six months. The supply of current would be checked by meters attached to each block of houses.

Horsham.—The U.D.C. has decided to grant electricity free to the local Rifle Club during the progress of the war, and to the Military Quarters of the Y.M.C.A., and a Horticultural Exhibition in aid of the National War Relief Fund.

Hove.—The Council, on the advice of Sir Alexander Kennedy, has decided to retain and work the electricity undertaking, lately taken over from the Hove E.L. Co.

Ingleton.—Year's Working.—The Electric Lighting Co. reported at its annual meeting (for the first time) a profit of £11 on the year's working. The development of Ingleton colliery should lead to an improvement in the company's position.

London.—Marylebone.—A comparison of the June quarter, 1914, with the previous year, shows that 3,393,314 units were sold, or 237,278 more than in the same period of 1913.

The revenue amounting to £33,561 was an increase of £944, and the total expenditure, £15,604, was less that £200 increase, generating expenses being nearly £200 less than in 1913, due to the efficiency of the new turbine plant.

At the present about 3 lb. coal per unit delivered to the mains is burnt, as compared with 3¾ lb. previously.

As regards the September quarter, it is, of course, anticipated that the war will have an adverse effect; some trade consumers are reducing their requirements, but, on the other hand, residential supply is in excess of that usually taken.

Mr. Seabrook, the general manager, points out that although there is still a large field in the borough for E.L., the bulk is occupied by gas consumers using hire, hire-purchase, &c., schemes. He considers that the electricity department could with equal success take up this class of business, but for the present efforts are concentrated on the heating and cooking load.

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St. Pancras.—New Cables.—In view of the possibility of distress, the Electricity and Public Lighting Committee recommends the Council to authorise the putting in hand of a scheme of cable renewal, at a cost of £4,650; if the scheme is approved, it will enable the work to be done in various sections as emergency arises, and the whole district south of Euston Road, west of St. Pancras and King's Cross, and also south of Platt and Delancey Streets, will then have been remodelled with modern cable, and the old cable removed.

The Electricity Committee also recommends that the L.C.C. be informed that the B.C. does not agree to the proposal made for reducing the outstanding period on its 42-year loan plant; the Finance Committee, while agreeing with this, suggests that representatives be appointed to interview the L.C.C. in the event of difficulties in connection with borrowing powers for extensions now in hand.

Llandudno.—The U.D.C. has reduced the charges for current for power to large consumers to 3½d. per unit for 10,000 units or over per annum, and to 4d. for a minimum of 7,000 units, less 5 per cent., for prompt payment of accounts in either case.

Lytham.—The clerk to the D.C. has been instructed to ask the St. Anne's Council when it is proposed to make a start with the work for providing the bulk supply of electricity to Lytham.

Maidstone.—Year's Working.—The report of Mr. Headley, the borough electrical engineer, on the year ended March last, shows a surplus of £712, which he estimates would have been over £1,500 had the same average price been paid for coal as in 1912-13. The units sold numbered 2,450,510, as compared with 2,031,686 in the previous year, and the power units represented 45 per cent. of the total, the load factor standing at 30·7 per cent. The prospects for the present year are considered bright, as the full benefit will be derived from the improved working of a new 800-kw. set installed in March, and from the larger power consumers connected up.

Manchester.—New Power Station.—At the annual meeting of the Trafford Park Estate Co., held in Manchester on October 1st, Mr. Marshall Stevens (chairman) said that when the last annual meeting took place negotiations were pending with the Manchester Corporation respecting the building of an electricity station in the Barton area of Trafford Park. The Corporation had now received Parliamentary sanction to purchase about 13 acres of land, and it was the Corporation's intention to make the purchase forthwith.

Port Glasgow.—The Greenock supply to the area is about to be commenced; one large engineering firm was to be connected up last week. Many applications have been received for electric services.

Rawtenstall. — Year's Working. — The borough auditor's report shows a profit of £2,480 on the working of the Council's electricity undertaking; of this, £846 has been placed to the renewals fund, £1,248 to capital account, and £386 to the estates department. On the tramways undertaking there was a loss of £878.

Salford.—New Plant.—Application is to be made for sanction to borrow £13,500 for an additional 5,000-kw. alternator. The Electricity Committee has entered into an agreement with the Bradford Dyers' Association for a supply of energy for stand-by purposes at their premises in Meadow Road, Broughton.

Sheffield.—A short midnight ceremony marked the transfer of the Kelham Island tramway power station to the Electricity Committee of the Corporation, which will now control some 35,000 kw. of generating plant, shortly to be increased to 45,000 kw. by new plant at Neepsend.

Under a three years' agreement the tramways supply will be charged at ·8d. per unit; 18½ million units were required last year for traction purposes.

Skelton and Brotton.—In connection with the E.L. scheme the U.D.C. has fixed the following provisional scale of charges for current, and submitted them to the Cleveland E.P. Co. for adoption:—Contract supply to give five lights per house, 7d. per week, and 1d. for each additional light; ordinary lighting, 4½d. per unit for the first 100, and 4½d. beyond, with meter rent and a minimum charge per quarter for current of 5s.; power and heating, 2d. per unit for the first 100, and 1½d. beyond; slot meter supply, 5½d. per unit and no meter rent.

Stainland.—Prov. Order.—The Council has decided to grant an interview to the Yorkshire E.P. Co. to discuss proposals with regard to the supply of electricity for lighting and power purposes.

Torpoint.—The electricity supply, provided by a local company, was switched on on September 30th; the resident engineer and manager of the works is Mr. H. Hill.

Turton (Lancs.).—Proposed Loan, &c.—On account of the cost involved in the provision of meters, the two-rate tariff for domestic power supplies has been abolished as from October 1st, and there has been substituted a flat rate of 1½d. per unit.

A L.G.B. inquiry was held at Bromley Cross, Turton, on Tuesday last into the Council's application for sanction to borrow £3,815 for the electricity undertaking.

"War" Lighting. — During the last week or two Londoners have had an opportunity of becoming accustomed to dimly lighted streets, the result of lamps being unlit or very largely obscured with a view to security against aerial attack.

Similar precautions are being adopted at numerous coast towns, particularly those open to naval attack.

Statistics show that the candle power of the Aberdeen street lamps has been reduced from about 650,000 to 80,000, the electric street lighting figuring at only 6,000 c.p. as against the usual 311,000 c.p. In Dundee similar steps are being taken, while this also applies to Sunderland and Lowestoft amongst others.

It is significant that attention has been called officially to the Admiralty notice bearing on the extinction of pier and promenade lighting, pointing out that the measures taken have been quite ineffective and that the general glare in some east coast towns is still visible as far as 25 miles from the coast, and that a considerable part of the object aimed at in extinguishing navigational lights has been neutralised by the failure of coast towns to reduce their general lighting.

Warrington.—Loan Sanction.—The T.C. has received permission to borrow £2,000 for new cables. The Gas Committee is to obtain tenders for duplicating the electric plant at the retort houses.

West Bromwich.—Proposed Loan.—The T.C. is recommended to seek a loan of £5,547 to cover the cost of certain extensions to generating plant and cables, necessitated by the supply of energy to Messrs. Hackett & Sons.

Wimbledon. — Loan Sanction. — The L.G.B. has sanctioned the borrowing of £8,500 for E.H.T. cables and conduits. The electrical engineer is to report to the Council on the desirability of the adoption of electrically-propelled vehicles.

Wirral.—Hospital Lighting.—The L.G.B. has sanctioned the borrowing of £700 by the Wirral Joint Hospital Board, for the electric lighting installation of the buildings.

TRAMWAY and RAILWAY NOTES.

Australia.—It is officially considered that the war will not appreciably retard the carrying out of the Melbourne suburban railway electrification scheme; only some £6,000 of material is of German origin, and it can be obtained elsewhere. In connection with the Sydney railway station lighting and signalling projects, a portion of the work has already been carried out, but owing to the difficulties in obtaining supplies of apparatus from Europe, the completion of the scheme is uncertain.

In order to develop the Melbourne tramway system in the western suburbs, it is proposed to form a tramway trust representing Essendon, Footscray, Williamstown, Werribee and Braybrook municipalities, with the object of constructing an electric tramway to serve each district on a route between Essendon and Williamstown beach. The scheme is estimated to cost £139,184.

Colne.—Track Renewal.—The Tramway Committee, on September 30th, decided to postpone the relaying of the tramway track in Burnley Road owing to the increased prices of material.

Coventry.—The T.C. has decided that the Tramways Committee's recommendation relative to the construction of double lines of tramways, mentioned in our last week's issue, be deferred.

Dover. — The Council has decided to have plans prepared with a view to relaying the tramway track in Folkestone Road.

East Ham.—The T.C. has appointed a deputation to attend the conference with the West Ham Assessment Committee with the object of securing a settlement of the outstanding difficulties in regard to the assessment of the tramways undertaking.

Edinburgh.—The Tramway Committee is considering the question of providing tramways to Queensferry, in view of the traffic to that district; two alternative routes are to be considered by a Sub-Committee.

Halifax.—Proposed Tramway Extensions.—The Tramways Committee has decided on the promotion of a tramways Bill in the next session of Parliament, and the Tramways Special Sub-Committee is authorised to negotiate and complete all necessary agreements with outside authorities likely to be affected by the powers to be sought under the Bill. The Bill, it is understood, will contain provisions for an extension of the tramways to Elland and Stainland, and power to run motor-buses to Ripponden and Cragg Vale, whilst there may possibly be some mention of an extension of the tramways from Brighouse to Rastrick.

(*Continued on page 500.*)

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MR. ROBT. W. PAUL'S ELECTRICAL INSTRUMENT WORKS AT NEW SOUTHGATE.

In these days of limited companies, we seldom meet with examples of industrial concerns of the patriarchal order, so to speak—establishments which have been built up by the

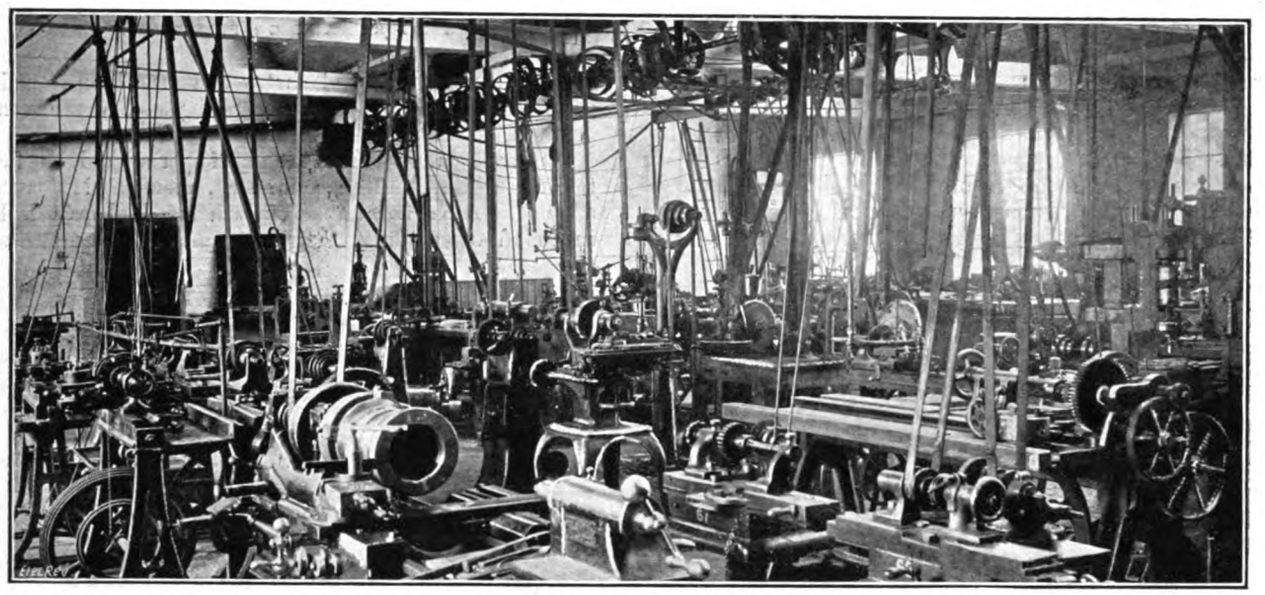
Exterior of Works.

unaided efforts and indomitable perseverance of individuals—such as used to form the backbone of British industry. Many of the businesses which were thus founded have developed into huge joint-stock undertakings with limited liability, and have lost that individuality which characterised them in the days when they were being laboriously erected upon the foundation of personal effort and self-denial—they have become "corporations with no soul to be saved and no body to be kicked." The instrument factory of Mr. Robert W. Paul, on the other hand, is a striking exception to the general run; it is not only his works, but also his own work, and retains throughout the impress of his personality, which gives it the atmosphere of a living organism rather than of a complex machine.

The foundation of the business was laid by Mr. Paul in Hatton Garden, London, in 1891; the works at New Southgate were built in 1902-3, and were designed especially for the manufacture of electrical instruments. The buildings are of brick, and have a total floor space of about 20,000 sq. ft. The main building is partly in two stories, containing on the ground floor drawing and other offices, storerooms for materials and finished apparatus, and a room for the inspection of the latter before dispatch; the upper floor is divided into rooms set apart respectively for winding galvanometer and resistance coils, and for testing and adjusting manufactured apparatus. In this building also is a suction producer-gas plant and engine, which drives the machine shop shafting as well as two dynamos for charging the storage batteries; the latter include a battery giving 100 volts for general light and power purposes, and a few large cells for giving heavy currents at low voltages. With the aid of motor-generators and alternators, alternating current supply for testing purposes is obtained.

The machine shop, in one story with a saw-toothed roof, also forms part of the main building, and is equipped with a variety of machine tools for the heavier manufacturing operations, including lathes and drills, turret lathes, milling, grinding and gear-cutting machines, engraving machines, &c. In this shop are benches fitted with lathes which can be swung up and back against the wall when not required; by pivoting these on their own counter-shafts, this operation is made possible without removing the belts or altering their tension.

The remaining buildings are devoted to lighter work, such as the construction of delicate parts, assembly, testing and calibration of instruments, enamelling, lacquering and nickel-plating. In order to ensure the soundness of the wooden cases of instruments, Mr. Paul found it necessary to manufacture these in the works, and put down a cabinet-making shop equipped with wood-working tools, together with provision for keeping the timber in store for long periods.



Main Machine Shop.

Part of Machine Shop, Showing Bench Lathes on the Right.

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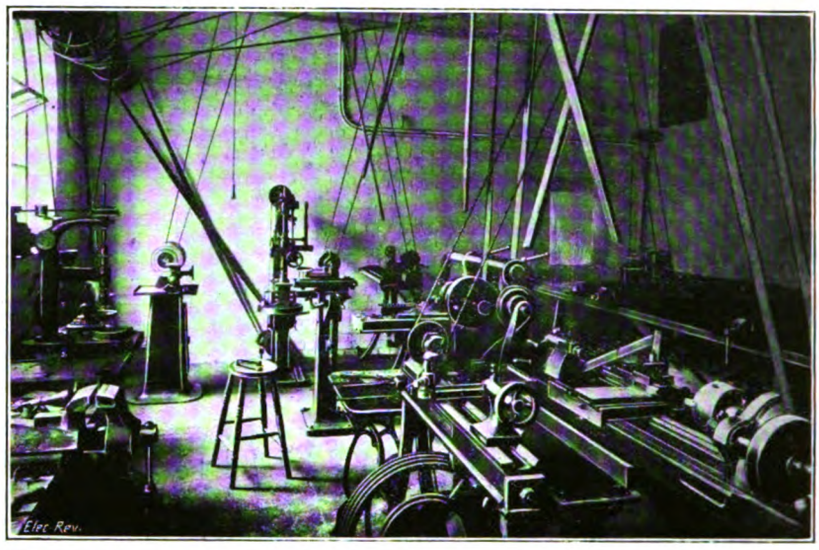
A special feature of the manufacturing operations is that of frequent and severe inspection, which affords a guarantee that all defects shall be eliminated before any finished apparatus leaves the premises. Accurate calibration is a *sine qua non*, and to make sure of this, the working standards are checked at the National Physical Laboratory at regular intervals.

The firm has consistently specialised in the manufacture of electrical standard and portable testing apparatus, its products being known in every civilised country. We understand, for example, that the output of the largest German meter works is standardised against Paul instruments. The demands for new apparatus for electrical measurement, consequent on the development of new fields of electrical work or of new and improved methods, necessitate the maintenance of an experimental or development department which is constantly occupied in this direction. At present a considerable amount of work is being done in the design of new instruments for the measurement of alternating current, at supply, telephonic and radio-telegraphic frequencies, and in this work the firm has been honoured by the collaboration of many leading British scientific men. On the other hand, a large number of standard types have been developed and are made for stock in relatively large quantities.

Although certain apparatus cannot be stocked in great quantity, this does not hold good in the case of the components of apparatus such as the well-known "Unipivot" movements and similar parts; these are made wholly to stock in large batches, and from them it is easy to build up instruments as required without loss of time. In such cases advantage is taken of the opportunity of ageing the magnets and springs after the completion of the apparatus, so as to secure invariability of the readings. For this purpose Mr. Paul has devised a simple pattern of glazed storage cabinet, consisting mainly of standard front and back with dust-tight doors; these parts can be combined with ends and shelves of any desired width to suit requirements, and the system has been found to possess qualities of elasticity and adaptability which have proved their value.

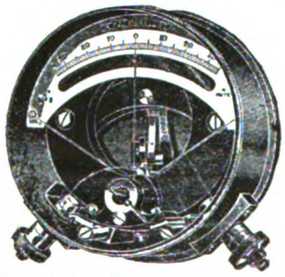


Special Workshop for Training Apprentices.

To avoid undue multiplicity of parts, and to facilitate the utilisation of those in stock, a simple plan has been adopted. A pair of samples of each standard part is kept in the drawing office, hanging on hooks in a multileaved show-frame so as to be readily accessible when required; one of the pair is provided with a red label, and is never allowed to leave the office; the other has a green label, and can be sent into the stores or works, or, in the case of items which are purchased ready made, it can be sent away

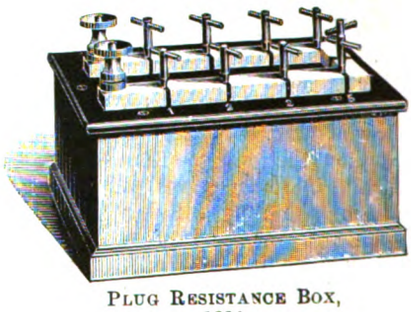
Ayrton-Mather Static Voltmeter, 1914.

Cyclometer Dial Bridge, 1914.



Portable Unipivot, as used in G.P.O., 1914.

Post Office Galvanometer, 1891.



Plug Resistance Box, 1891.

Some Examples of Paul Instruments, as made in 1891 and 1914.

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to the makers to obtain quotations. Illustrated indexes of these parts are kept in the drawing offices and stores. The small parts are stored in boxes of standard sizes, which fit the spaces provided on the shelves, and each box bears a letter and number corresponding to the records on the labels, as well as a number indicating the minimum quantity

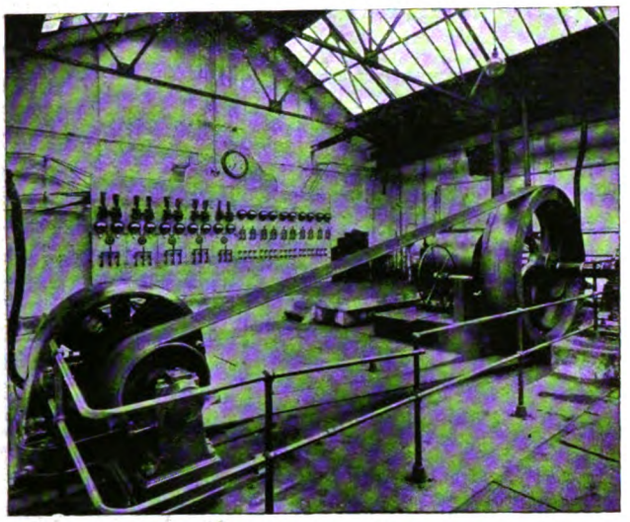

Fig. 1.—G.E.C. Dynamo and Main Switchboard in the Arrol-Johnston Works (see p. 498).

below which the stock must not be reduced. The drawings also bear references to the index numbers corresponding to the parts to be embodied.

The method adopted for shop drawings is worthy of notice, being at the same time cheap, efficient and convenient. In a corner of the drawing-office a small dark room has been constructed, and provided with water supply, &c., for bromide paper development. A camera is fixed in the side of this room, together with a right-angle prism which is mounted over the centre of a horizontal table outside the dark room. All drawings are made in pencil on white paper of a standard size; when finished, they are pinned on the table above mentioned, illuminated with Cooper Hewitt lamps and photographed direct on sensitive paper, which is at once developed and fixed whilst still wet on a three-ply board measuring 16 in. × 12 in. for use in the workshop. The drawing appears in white lines on a dark background, and the image having been rectified by the prism, the photograph is an exact positive copy of the original. These mounted negatives have been found most satisfactory in service, and are easily and compactly filed in racks when not in use. No tracings are ever made, so that copying errors are completely eliminated; and no drawings are ever inked in, so that alterations can easily be effected.

Another interesting detail of the works management is the system of shop orders which has been developed; this is so devised as to reduce the amount of clerical work to the minimum, and to relieve the foremen of the burden imposed upon them by some systems.

The foreman's order is a folder specifying the work pertaining to his department, and is his authority for issuing job tickets to the men. These tickets, which have a distinctive colour for piece-work or day-work, give brief particulars of the job, with reference to a drawing and accompanying operation sheet.

The times of starting on and leaving off the job are entered by the foreman on this ticket, and, on completion of the job, the labour cost is totalled by a clerk. On issuing a ticket, the foreman allots it a letter, and enters a corresponding letter on his folder; on completion of the whole order the time-clerk collects the tickets, places them in the folder, and summarises them on the back of it. The folder is filed under the order number, and forms a complete and easily accessible record of the work done.

The cost per piece is entered in a loose-leaf book, and the relation between present and previous costs of any article is thus shown at a glance.

A priced material list, prepared before executing the work, is revised from time to time, and dispenses with the need of an elaborate system of booking out material to individual jobs.

This system, of which we have given only a brief and inadequate sketch, has been adopted by other manufacturers who have observed its working in Mr. Paul's factory.

The calibrating of instruments and the printing of their scales are naturally operations of considerable importance in these works, and ingenious devices have been adopted to reduce the time occupied and to improve the results attained. To this end, the moving-coil instruments, generally speaking, are treated as microammeters, and are inserted in a circuit to which an E.M.F. of precisely 0·1 volt is applied; to maintain the correct conditions, an amount of resistance is cut out of the total exactly equal to the resistance of the instrument that is inserted. A dial rheostat is included in the circuit, so adjusted that successive points on the dial give currents of 5, 10, 15, &c., millionths of an ampere. The instrument to be calibrated is mounted centrally under a special device carrying a small reading microscope, with which the position of the pointer is accurately observed; the microscope is mounted on a radial arm, and is brought into such a position that the image of the pointer coincides with a cross-wire in the field of view, when a stylus at the end of the radial arm is depressed, making a pinhole in a large paper chart. This operation is repeated for each position of the dial rheostat throughout the range of the instrument. The chart is then taken to a second apparatus, in the scale-making room, where the calibration is transferred from the chart to a blank scale by similar means, a little printing device taking the place of the microscope.

The printer is self-inking, and automatically makes the fifth and tenth division lines of different lengths, the intermediate divisions being made equal in width by a neat adaptation of the diagonal scale principle. The same apparatus are applicable to both flat and sector-shaped scales, and the quality of the scales obtained is excellent.

The products of the works are so varied that it is impossible here to enumerate them; many of them have been

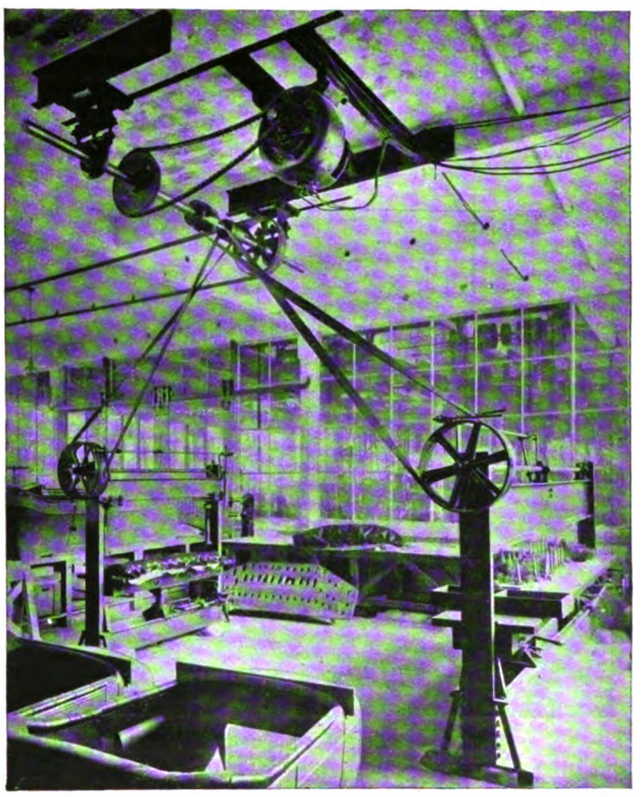

Fig. 2.—Buttoning Machines and Presses (see p. 498).

described in our pages, and the bulky catalogue which is approaching completion contains not only detailed descriptions of the apparatus, but also a great deal of valuable information as to their uses.

The "Unipivot" movement, which forms the essential feature of a variety of ammeters, voltmeters, galvanometers, thermo-indicators, &c., is probably the best known of Mr. Paul's inventions, but he is constantly engaged upon

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improvements in existing apparatus, such as resistance boxes, testing sets, high-frequency ammeters, &c., and in evolving

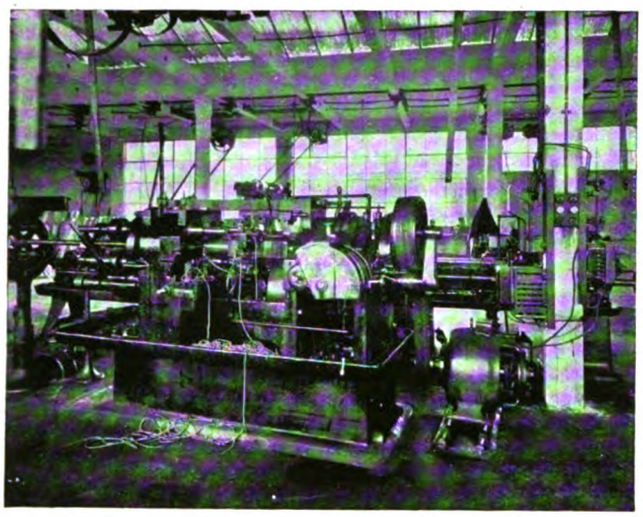

Fig. 3.—Electrically-driven Automatic Machine (Arrol-Johnston Works).

from the experimental form to the commercial instrument new types of measuring apparatus, such as the Campbell inductance standards, the Irwin hot-wire oscillograph, the Hill & Griffith calcometer, &c. One of his latest feats is the construction of an ohmmeter and generator in one case, which, with the aid of three scales and a sliding adjustment, has a total range of measurement from 0·00005 ohm to 100 megohms. Recently the development of pyrometric apparatus in conjunction with the Unipivot indicator has claimed his attention, and a variety of patterns has been standardised.

For some years Mr. Paul has maintained a branch in the United States, where skilled men trained in his own works are employed in testing instruments on arrival, and making special calibrations, &c., to suit customers' requirements.

Recent additions to the works include a mess room, a rifle range, and a model workshop. The latter has been equipped in order to carry out a scheme of workshop instruction for apprentices, which has engaged Mr. Paul's attention for a long time; in a letter published in our

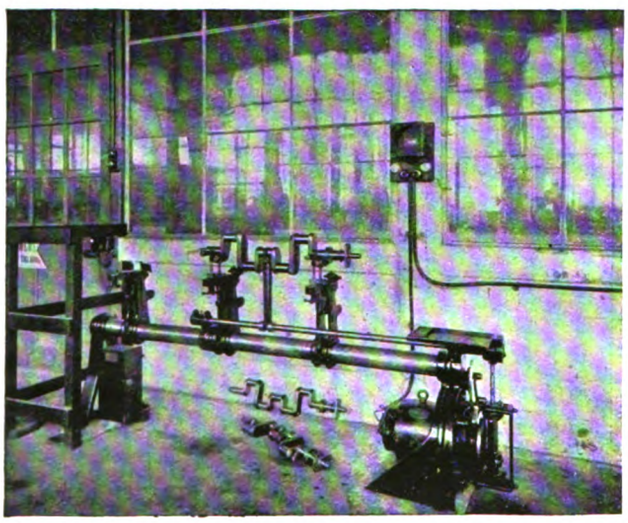

Fig. 4.—Crankshaft Testing Machine.

"Correspondence" columns in June last, he pointed out that the systems of instruction in vogue at the technical colleges were totally unsuited to the requirements of instrument makers, who were unable to derive from lectures on electric lighting, power and traction, &c., information that bore upon their daily occupations. Failing any other cure for the complaint, he has characteristically tackled the question himself, and has secured the collaboration of the Middlesex Education Authority, which will provide instruction in drawing, mathematics and physics, and electricity, including elementary laboratory practice. Practical instruction will be given at Mr. Paul's expense in his special workshop, which has been equipped with an excellent outfit of machine tools and other apparatus for the purpose, at considerable outlay.

The whole of the instruction will be given during the firm's working time, thus imposing no additional burden on the apprentices, and it will be given free of cost. It is hoped that by this means the prevailing scarcity of skilled

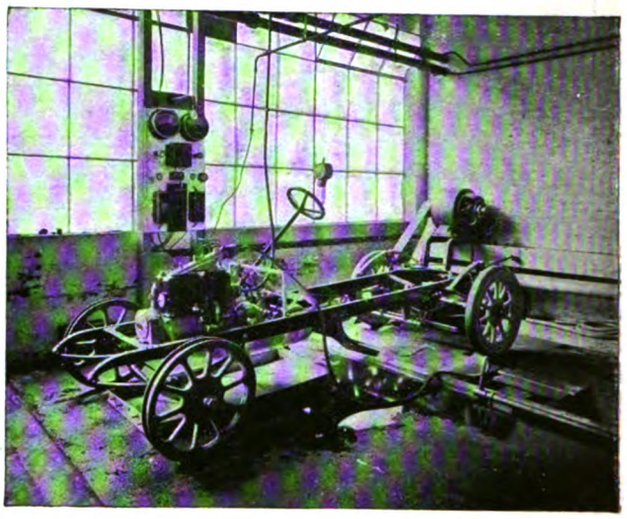

Fig. 5.—Motor-Car Engine Testing Bed.

and intelligent instrument makers will be relieved, with advantage to all parties. The experiment will be watched with interest, as the difficulty is common to all firms engaged in the same line of business, and has hampered the progress of the industry in this country. We trust that it will bear good fruit, and that the results will be reflected in the continued and increased prosperity of the undertaking described above.

THE ARROL-JOHNSTON MOTOR-CAR WORKS.

The new works of Messrs. Arrol-Johnston, Ltd., near Dumfries, have been laid out on the most up-to-date lines, on an estate of no less than 100 acres, and are designed to produce cars of a high quality at a low price in very large quantities. The buildings have been arranged round three sides of a square, with a middle bay, the plan resembling the letter E, and as the window area is exceptionally generous,

Fig. 6.—View in the Automatic Machine Shop.

comprising almost the whole of the side walls, the workshops are particularly well provided with light, in most cases coming from both sides.

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The nature of the manufacture rendered it essential to take advantage of every possible economy in methods of production; automatic plant has been installed wherever practicable, and, of course, the works are electrically driven throughout. The contract for the electrification was placed with the General Electric Co., Ltd., and the electric lighting installation was put in by Messrs. Claud Hamilton, Ltd.

The power house contains generating plant aggregating 625 KW.; suction gas engines were chosen as the prime movers, and the two 140-KW. and three 115-KW. Witton dynamos, generating direct current at 220 volts, are driven by low-speed horizontal gas engines through belts. One of the illustrations on page 497 shows one of the generating sets and the main switchboard, which comprises five generator and five feeder panels. For lighting the works when the larger plant is shut down, a 15-KW. gas-electric set has been installed in a small engine house adjoining the larger one.

The constructional processes have been so arranged that castings and raw material are taken in on the top floor of the works, and gradually descend as they are machined and assembled, until the finished product reaches the ground floor.

In the automatic machine shop the larger machines are individually driven, while the smaller ones are arranged in groups driven through Coventry chains by 20-H.P. Witton motors running at 1,100 R.P.M. An example of the individually-driven machines is shown in fig. 3, illustrating a four-spindle Gridley automatic machine driven by a 10-H.P. Witton motor. The motor-starter and Salford switch controlling this and other similar machines will be seen on the right-hand side of the illustration. An idea of the extent of the automatic machine shop will be gathered from the fact that there are no fewer than 20 20-H.P. groups of automatic machines. Fig. 6 shows part of this shop.

Where minor processes are carried on, it has been made a practice to group the necessary tools together and drive them from a 20-H.P. Witton motor fixed on the ceiling. In the body department the wood-working tools are also grouped.

An interesting feature of the plant is a bank of machines for fixing the buttons on the cushions and upholstering, splitting the leather, and similar work. These machines are shown in fig. 2, page 497.

In the polishing shops a 25-H.P. Witton motor drives a long bank of polishing machines, the air from each of which is drawn off by means of a hood connected to a fan driven by a 5-H.P. motor.

In the paint shops electric motors are used for driving air compressors and vacuum machines. The paint for the wheels is atomised and sprayed by compressed air, the operation being conducted in a hood from which the air is continuously exhausted, removing the paint fumes from the atmosphere of the room. At the moment only a 2-H.P. motor is installed, but a larger plant driven by a 20-H.P. motor will shortly be erected for spraying car bodies.

Every part of an Arrol-Johnston car is thoroughly inspected before it is assembled, and an example of the thoroughness with which this inspection is conducted is offered by a crankshaft testing machine which is shown in fig. 4. This machine is driven by a ½-H.P. Witton motor, and the crankshaft is caused to rotate. If the crankshaft be out of balance it oscillates in position, and automatically scribes itself at certain points which indicate where the metal needs to be taken off, and at the same time the operator is given an idea, by means of a pointer showing the extent of the oscillations, what amount of metal needs to be removed to secure perfect balancing.

The car-testing department contains a number of testing beds, as well as engine running-in plants. Before testing, each engine is given a prolonged run, being driven direct by a Witton motor. When on the testing bed, the rear wheels of the car rest on rollers coupled by a belt to a dynamo, which is thus driven by the engine, and the energy generated by the dynamo is absorbed in a resistance situated outside the shop. The switchboard for measuring and controlling the power generated by the dynamo is seen behind the car. By this means precise information is gained as to the performance of the engine, and assurance is obtained that it is running perfectly.

The foregoing description gives but a feeble idea of the extent of the works. No mention has been made of the tool-room with its two 20-H.P. motors, the erecting shop with its 5-H.P. motor, the foundry with one 15-H.P. and two 5-H.P. motors, the smithy, the copper shop and the numerous other situations in which electric motors are installed for various purposes.

The whole of the building is lighted by Osram lamps, there being 550 lighting points and 150 plugs for power and light.

The works have a special interest for our readers, as being the home of the Arrol-Johnston Edison electric cars.

Mr. T. C. Pullinger is the managing director of Arrol-Johnston, Ltd., and Mr. Robert Bailie the company's electrician, under whose charge the electrical installation was carried out.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

The Kaministiquia power plant at Kakabeka Falls, which supplies the "twin cities" Fort William and Port Arthur, is to be increased in size from 22,000 H.P. to 35,000 H.P.; a good deal of the work has already been carried out, and it is expected that it will all be completed in a few weeks' time.

On October 1st the plant of the Peterborough (Ontario) Light & Power Plant becomes the property of the City, the sum of $100,000 having been paid over for this.

Whatever may be the financial standing of the Saskatchewan Government telephone system, there is no doubt about its growth as, in 1908, the long-distance pole line mileage was only 497, and now it is practically 3,400, some 300 towns and villages having been connected up. The recent oil boom in Calgary, Alberta, is said to be largely responsible for the connection of over 600 new telephones.

Another Diesel engine electric plant is to be installed in Western Canada at Duncan, B.C.; this contract has already been let.

In Quebec Province the Provincial Government recently contemplated putting down a power plant on the Lacline Canal but, apparently owing to the war, this work will not be undertaken at present.

In Montreal, Quebec, the question of renewing the Montreal Tramways Co.'s franchise has been under discussion again recently, but although plans for subways and motor 'buses have been discussed, no decision has yet been made.

With the supply of power at 110,000 volts to Windsor, from Niagara Falls, a distance of over 200 miles, which was commenced quite recently, the Hydro Electric Power Commission of Ontario is now operating a line which is believed to be exceeded in length by only one other in the world.

Readers of these notes will remember that last year there were several serious breakdowns of the high-tension transmission lines of this Commission during the summer, but it is satisfactory to record that no mishaps of any moment have occurred this year, although the transmission system has had to withstand the effects of a number of electrical storms of great severity. If a record such as this can be kept up for a number of years there will be less talk of auxiliary steam plants as a necessary "adjunct" of hydro-electric systems.

It is reported that this Commission, having looked into several plans for obtaining more power from the Niagara river, now proposes to build a large generating plant at Queenstown (Ontario), utilising the waste water which will flow through the new Welland Canal, instead of locating this plant near the whirlpool, and using the water of the Niagara river itelf; a greater fall of water is said to be obtainable at the former point.

The question of constructing what are now known as "hydro-radial" electric lines is still to the fore, and several meetings have been held within the past few weeks by the municipalities already served, and to be served, with hydro-electric power supplied by the H.E.P.C., to discuss the matter.

The first line proposed to be constructed will be about 105 miles long, and will run from Toronto through Port Perry, Markham and Newmarket; the cost is estimated at $4,300,000, operating revenue at $776,000, and operating expenses at $469,000, leaving a profit of $307,000. The net revenue for the first year is placed at about $20,000. Besides getting the advantage of the railway facilities afforded by this line, the towns through which it will pass will also get cheap electric power, for whereas 200 H.P. supplied to a certain town without the railway would cost $45 per H.P.-year, with the railway passing through it the same town can be supplied for about $27—a saving of $18, or over £3 10s. 0d. per H.P.-year.

Trade conditions here are beginning to settle down a bit and the Governments, both Dominion and Provincial, are using their influence to keep everything as normal as possible.

As in the Old Country, the Department of Trade and Commerce is urging on Canadian business men the necessity of trying to capture all possible German trade. Rifle corps are springing up like mushrooms; schools and colleges, law societies, boards of trade, architects' and engineers' clubs, and even churches are all making efforts to get men into training, and electrical engineers are not the least enthusiastic, as may well be imagined.

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TRAMWAY and RAILWAY NOTES.

(*Continued from page* 494.)

Huddersfield.—Tramway Extension.—The extension to Marsden was opened to the public last Saturday, having been inspected on behalf of the B. of T. on Thursday. The fare from Huddersfield to Marsden is to be 5d., as compared with the 7d. charged by the railway company.

Leeds.—Tramway Relief Work.—With a view to relieving the labour situation, the tramways department is proceeding with the Gniseley tramway extension, and a start is to be made with the overhead work for the railless traction routes to Otley and Burley; the tramway from York Road to Halton, and the new tramway offices are to be commenced, and it is intended to apply for power to borrow £32,000 for the building of the latter.

London.—The interchange facilities between the Bakerloo and Metropolitan Railways at Baker Street Station will become greatly improved on the 15th inst., from which date moving stairways, loading direct from the platforms of the latter line to the Bakerloo station beneath, will supersede the existing means of connection. Passengers transferring from one railway to the other will be saved something like two minutes in making the change.

Manchester.—Relief Work.—The tramways department is to undertake the relaying of certain tramway track in order to provide employment for about 100 unemployed. The electricity department will also find work for 35 on cable laying.

Rotherham—Sheffield.—The through running arrangement between the tramway systems of these towns has been discontinued, owing to Sheffield insisting on ½d. fares being put into operation in Tinsley on the section within the city, where the line belongs to Rotherham. The Rotherham Corporation has decided against this proposal, and the Tramways Committee is recommending that in addition to various powers to be sought in Parliament for 'bus and railless traction routes, compulsory through-running powers to Sheffield should be asked for.

Stainland (Yorks.).—The U.D.C. has decided to ask the Huddersfield Corporation to continue the tramway system from Outlane to Stainland. The Council and Halifax are also in communication in connection with a similar prospective extension of Halifax lines.

York.—The B. of T. has confirmed the York Corporation Light Railways (Extensions) Order, 1914, granted by the Light Railway Commissioners.

TELEGRAPH and TELEPHONE NOTES.

An Underground Telephone.—The *Times* quotes a report, attributed to an Austrian lieutenant, who, when about 30 km. from Lublin, gave orders to his men to lie down and rest. All at once (he says) I saw that a corporal, who had lain down to sleep about 400 paces from me, sprang up, and by all kinds of gestures tried to communicate something to me, and finally made a sign to me with his finger to go to him. Naturally, I understood nothing of what he meant, and thought at first that the man had lost his reason through the great fatigue. When I reached him he whispered to me that while he was on the ground he had heard calling without being able to see anyone. He had only understood the word "Hallo!" Thereupon I lay down on the ground and heard quite clearly "Hallo! hallo! . . . hallo, Lublin!" and, in between, Russian curses. I stood slowly up, and saw a few yards in front of me a heap of beetroots covered with some earth, such as could be seen regularly at distances of about 100 metres. This heap before me was close up against a large shrub, and when I examined the thing a little closer, I observed a small wooden door in a hole next to the shrub, which, beyond question, was the entrance to a subterranean excavated passage. I had the heap surrounded, and then kicked the door in. Three peasants sat there in a space of about 2 metres square, with a field telephone. They were two under-officers of a field telephone detachment and an officer of the General Staff, who was charged with the duty of informing his chief in Lublin of all the movements of our troops. We had only discovered the telephone office through an accident, for the door and the hole in the ground were so well concealed by the bush, that apparently we should have marched past them without the slightest suspicion.

Cable Tariffs.—The prohibition of the use of codes continues to evoke complaints from traders. One firm states that the extra cost incurred by it during August was over £750, and points out that so heavy a handicap is a positive menace to business. Another writer urges that the real test of a cable message is not the language in which it is framed, but the character of the sender. It is suggested that the cable companies, receiving the messages in plain language, should themselves put them into code, making a small charge for the labour entailed. The *Times* of Saturday last adopts the view which we also put forward on the previous day, that the danger has been exaggerated, and is not removed by the mere prohibition of the use of codes. As letters can be sent to Berlin and arrive there within 24 hours, the delay of cable messages for that period would remove the risk of transmission of useful information by way of the cables.

It is generally held that the ten-letter concession is altogether inadequate, and that the use of codes, under suitable conditions, should be resumed, at any rate within the British Empire and to the United States. Numerous suggestions are put forward in the *Times* by correspondents with a view to obtaining relief without endangering the national interests.

Cutting Telephone Wires.—Two men charged with cutting military telephone wires at Groombridge have been handed over to the military authorities to be tried by court-martial, the alleged offence being a military one, as Kent and Sussex were proclaimed a district under the Defence of the Realm regulations.

Motor Vehicles for Telegraph Service.—The Construction Branch of the General Post Office has recently put in service a 20 H.P. petrol motor-wagon, specially designed for the transport of telegraph and telephone poles and other material. The vehicle is provided with a crane of the sheer-leg type, and an engine-operated winding drum at the left side of the driver's seat. With these adjuncts, the vehicle is capable of lifting a 56-ft. pole, measuring 4 ft. 6 in. in circumference at the base, and 2 ft. 6 in. at the top, into a vertical position, and lowering it into the ground, in the short space of 1 min. 45 sec. The Post Office authorities are also at present experimenting with the use of motor vehicles in connection with the testing of the main telegraph cables in this country. A special motor-van has been acquired for this purpose, and this, after having been fitted with the necessary testing apparatus, is now travelling all over the country in connection with the cable-testing work.

New Wireless Receiver.—It is reported from Rome that a new receiver has been invented by Prof. Argentieri, which requires no masts, and consists of a very small apparatus. No details are available.

Telegraphic Delays.—Reports have been published alleging grave mismanagement at the Central Telegraph Office, resulting in serious delays to urgent Government messages.

The Poulsen Wireless System.—The *Financial Times*, on October 3rd, published a circular sent by the Board to the shareholders of the Universal Radio-Syndicate, Ltd., relating to a previous communication circulated by Mr. Viggo Gandil, one of the directors, from which it appears that a dispute has arisen between them with regard to the option held by the Syndicate over the Poulsen system. The option was due to expire on August 31st, unless the company that was to be formed to purchase the patent rights was registered before September 1st; in view of the abnormal state of affairs the Board was unable to proceed with the arrangement, and suggested to Mr. C. Hage (the holder of the rights) that the option agreement should be suspended until the conclusion of the war.

The circular states that Messrs. Norton Rose Barrington & Co., Mr. Hage's solicitors, on September 1st notified the Post Office that owing to the lapse of the option Mr. Hage had become entitled to possession of the Syndicate's Atlantic stations, and caused the Admiralty to withhold a substantial sum which it had promised to pay to the Syndicate on September 4th.

Wireless in the Pacific.—Marconi's Wireless Telegraph Co. announce the opening of their high-power wireless stations at San Francisco and Honolulu, affording direct communication between these two places. The rate from Great Britain is 2s. 3d. per word, representing a reduction of 9d. per word, as compared with the existing rate *via* the cables.

The Marconi Co. also announce that their Atlantic deferred night and week-end letter services to Canada and the United States have not at any time been suspended, and the conditions being again practically normal they are able to give effective and speedy service to all clients.

Wireless Spy?—On Thursday last week, at West London Police Court, Morgan Adolf Watsdorf, 19, a clerk, living at 129, Coningham Road, Shepherd's Bush, was charged on a warrant with establishing and working at that address a wireless telegraph installation without a licence. The accused lived with his grandfather, who was a registered German alien. In 1912 the authorities learned of the installation, and ordered it to be dismantled. On August 5th this year it was discovered that the apparatus had been re-established and the masts and wires of the aerial were in position. The aerial was removed on August 15th by Post Office workmen, but on August 17th the premises were again visited, when a complete wireless installation was discovered, connected with the electric power main of the Hammersmith Borough Council. N. P. Hinton, assistant engineer in the Engineers' Department of the General Post Office, described the apparatus. Under ideal conditions messages could be transmitted 100 miles by day and 150 miles by night, and could be received from all the English, French, and German long-range stations. The accused was remanded.

Wireless Telephony.—Mr. Marconi has recently carried out a series of important experiments with his new system of wireless telephony, which were completely successful. The system will shortly be adopted in the Italian Navy.

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CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—November 25th. Victorian Railways. 25 battery signal machines for operating signals. Contract 27,479. Contractors' Room, Railway Offices, Spencer Street.

December 2nd. Victorian Railways. 1,376 steel disk wheels complete, including retaining rings for electric cars; steel disk wheel centres and steel tires for electric motor-cars; 1,376 steel disk wheels for electric motor-cars. Three separate contracts. Particulars from Contractors' Room, Railway Offices, Spencer Street.

Adelaide.—November 11th. Portable desiccating plant, petrol motor driven, for Postmaster-General. See "Official Notices" October 2nd.

Perth.—November 18th. 249 accumulators and power board, for Postmaster-General. See "Official Notices" October 2nd.

Brisbane.—November 4th. Paper-insulated lead-covered cable; insulators; ironwork, &c.; cast-iron pipes; iron or steel poles and fittings; galvanised-iron wire; and covered wire, for Postmaster-General. See "Official Notices" October 2nd.

November 18th. Instruments and parts. See "Official Notices" to-day.

December 15th. Switchboard, common battery, automatic or semi-automatic, for the Postmaster-General. See "Official Notices" September 25th.

Sydney.—Municipal Council. Motor generators and switchgear suitable for electric vehicle battery charging. Specification, 10s. 6d., from City Electrical Engineer,

Belfast.—October 13th. Electric light installation in the operating theatre and wards, for the Board of Guardians. Particulars from Mr. R. H. Wilson, Clerk, Union Offices.

Birkenhead.—October 15th. Electrical sundries (Form 12), and metallic and carbon filament lamps and fittings (Form 14), for the Mersey Railway Co. Mr. J. Shaw, General Manager, Central Station, Birkenhead.

Blackpool.—Corporation. 24 cast-iron distribution pillars, H.T. and L.T. cables, earthenware conduit. See "Official Notices" to-day.

Birmingham.—October 26th. Electric light installation, Western Road House and Dudley Road Infirmary, for the B. of G. Messrs. Edwards & Shaw, engineers, 105, Colmore Row, Birmingham (returnable deposit of £5).

Brighton.—Electrical fittings, &c., for three months, for the B. of G. Mr. H. Burfield, Clerk.

Colwyn Bay.—October 20th. Turbo-alternators and condensing plant; boilers, stokers, pumps, &c.; switchgear; cooling tower; crane; power station cabling and wiring; cables; rotaries and transformers, for the U.D.C. See "Official Notices" Sept. 25th.

Heywood.—October 17th. Corporation. Converting plant, A.C. and D.C. switchgear and cables, battery booster, E.H.T. overhead line, E.H.T. switchgear for sub-station. See "Official Notices" September 25th.

Leicester.—October 17th. Corporation. Steel plate, girders, steel troughing, &c., for the Tramways and Electricity Committee. Specifications from the Borough Engineer.

Littleborough.—October 12th. U.D.C. (1) Removal of transformer kiosk and gear and connection of mains to new sub-station; provision of additional cables, road work, &c. (2) Transformers, equipment and switchgear, for new sub-station. See "Official Notices" September 25th.

London.—October 28th. L.C.C. Installations, 160 wiring points, 200 lights, at Victoria School, Hammersmith; 126 wiring points, 170 lights, at Woolmore Street School, Poplar. See "Official Notices" to-day.

Manchester.—Two electrically-driven hydro-extractors are to be purchased by the Baths and Wash-houses Committee.

New Zealand.—December 5th. The Gisborne Borough Council invites tenders for direct-current meters. Particulars from the Electrical Engineer's Office, Gisborne.—*New Zealand Shipping and Commerce.*

Pontypridd.—October 20th. U.D.C. 1,800 yards of ·4 concentric paper-insulated and lead-covered cable, for Electric Light and Tramways Department. See "Official Notices" to-day.

Porth.—October 17th. E.L. installation, electricity and destructor works, Appletree, Porth, for the Rhondda U.D.C. Robert Hammond & Son, Engineers, 64, Victoria Street, Westminster, S.W. (Returnable deposit of £1 1s.)

Spain.—October 14th. The Spanish Post and Telegraph authorities in Madrid are inviting tenders for the concession for the construction and working during a period of 20 years of a telephone exchange in the town of Merida (province of Badajoz).

October 15th. Tenders are being invited by the municipal authorities of Herrera de Pisuerga (province of Palencia) for the electric lighting of the town during a period of 10 years.

Swansea.—October 6th. Electric light wiring and fittings, new police station, for the T.C. Borough Electrical Engineer (returnable deposit of £2).

Tunbridge Wells.—November 7th. Corporation. 12 months' supply H. and L.T. cables. See "Official Notices" to-day.

Warrington.—October 13th. Sub-station ironclad switchgear, for Tramways Committee. See 'Official Notices" October 2nd.

CLOSED.

Aylesbury.—Messrs. Johnson & Phillips, Ltd., have received contracts for the lighting and power switchboard at Aylesbury, together with the supply, erection and connecting-up of underground cables, boxes and pillars, meters and fuses; also the conversion of existing gas standards and lanterns for electric light.

Blackpool.—The Education Committee has accepted the tender of Mr. J. W. Fielding for electric bells for the Waterloo new infant school.

Bolton.—The Tramways Committee has decided to purchase 250 tons of steel rails from Messrs. W. Scott, Ltd., on the terms of the existing contract, and to order from Messrs. Hadfields, Ltd., the points and crossings required during 1915 at the contract price now being paid.

The Electricity Committee has accepted the following tenders in connection with the equipment of the new power station at Back-o'-th'-Bank:—

T. Ryder & Sons.—Screw-cutting lathe.
Tangyes, Ltd.—Screwing machine.
Wm. Muir & Co., Ltd.—Rotary drilling machine.
Chloride Electrical Storage Co., Ltd.—Maintenance of storage battery.

Burnley.—The Guardians have accepted the tender of Messrs. F. Thornton & Co. for the supply of electrical requirements for the ensuing half-year.

Bury.—The T.C. has accepted the following tenders:—

B.I. & Helsby Cables, Ltd.—Copper trolley wire, line ears, and straight line hangers.
F. Smith & Co.—Strain wire.
J. Russell & Sons, Ltd.—Poles.
F. R. Cass. Small bases.
Thermit, Ltd.—Welding of rail joints.
Tramway Supplies, Ltd.—Insulated bolts and Brooklyn strain insulators.
Estler Bros., Ltd.—Section insulators.
W. Scott, Ltd.—Steel girder tramway rails.
Bayliss, Jones & Bayliss.—Tie bars.
Leeds Steel Works.—Cross anchors.
E. Allen & Co.—Clips.

Dewsbury.—The B. of G. has accepted the tender of Messrs. E Brook, Ltd., for the repair of the electric cables at the new infirmary, the cottage homes, and other parts of the institution.

Dundee.—The offer of Mr. T. C. Keay, Dundee, for electric power installation at the Sanatorium, amounting to £1,215, is recommended for acceptance.

Eccles.—The T.C. has accepted the tender of Messrs. E. Bennis & Co., Ltd., at £425, for a coal conveyor and elevator at the electricity works.

Grimsby.—The Public Lighting Committee recommends the Council to enter into a contract with the Tudor Accumulator Co., Ltd., for the maintenance of two batteries at the electricity works for a further period of ten years, at an annual charge of £106.

Hull.—The Tramways Committee of the T.C. has accepted the tender of the Brightside Foundry and Engineering Co., Ltd., for heating and ventilating extensions to the Liverpool Street workshops, at £6,873.

Leyton.—The electrical engineer (Mr. F. Harman Lewis) reports that, owing to the increased loads, it is necessary during the winter to replace most of the existing line switches with larger ones, at a cost of from £90 to £100, and instructions have been given for the work to be carried out. Owing to the war, the engineer has been obliged to enter into a contract with Messrs. W. T. Henley's Telegraph Works, Ltd., to supply a mile of twin 3/18 service-line cable at a cost of £87 14s. 4d. The price last paid by the Council under a contract for German-made cable was £42 12s. 9d. per mile. The engineer has also ordered a supply of 20,000 pairs of carbons from the Oliver Arc Lamp, Ltd., at £4 15s. per 1,000 pairs. The engineer is going into the question of the advisability of installing additional plant to be available for the winter of 1915-16.

Maidenhead.—The T.C. has accepted the tender of the Crynant Colliery Co. for 500 tons of coal for the electric light works, at £1 1s. 4d. per ton.

Maidstone.—The T.C. has accepted the tender of Messrs. Martin & Newman for boiler-house extensions at the electricity works, at £1,093.

Manchester.—The Electricity Committee has accepted the tender of the Liverpool Electric Cable Co., Ltd., for a supply of cable.

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London.—The Metropolitan Asylums Board has accepted the tender of the Cedes Electric Traction Co., Ltd., at £575, for the supply of a 30-cwt. electric vehicle; also the tender of Messrs. Toy & Winalow, at £57, for repairing the electric light and fire installation at the Mead station.

St. Pancras.—The Electricity Committee reports the receipt of the following tenders for either an electro-oil or an electric lift for the use of vehicles connected with the works of the refuse destructor, and for the electricity department in case of necessity:

Medway's Safety Lift Co.	£1,350	(for electric lift)
Medway's Safety Lift Co. (recommended)	1,169	
Howard Martineau	1,500	
Waygood-Otis, Ltd.	2,225	(for electric lift)
Do. do.	1,895	Do. do.
W. Wadsworth Sons	1,960	
A. & P. Stevens	2,200	
S. H. Heywood & Co.	2,509	
Spencer & Co.	2,687	

The chief electrical engineer reports that, after full consideration of the plans and tenders and the assurance of the Medway Safety Lift Co. that their design was for plant of a sufficiently substantial nature, and bearing in mind the large quantity of dust about the works, also the difference in the cost, he advised that their offer for an electro-oil lift be accepted, with the addition of £200 for a spare motor-driven oil pump.

In connection with the contract of the British Niclausse Boiler Co., the company state the steel supporting work for the boiler chimneys was not included in their contract, and they informed the chief electrical engineer that, having regard to the low figure of their quotation, they were not prepared to go on with the contract unless its exclusion were agreed to. The Committee, after full consideration and under the circumstances, recommends the exclusion of this work.

Northampton.—The Town Council has accepted the tender of Messrs. J. W. Gray & Son, at £55, for the supply and fixing of lightning conductors at the Girls' Secondary School.

Salford.—The following tenders have been accepted by the Electricity Committee:—

Johnson & Phillips, Ltd.—86 3,000-c.p. "Metroflam" flame arc lamps; one year's supply of flame arc carbons (about 15,000 pairs), £6 17s. 6d. per 1,000 pairs.
Willans & Robinson, Ltd.—5,000-kw. alternator, £10,410.
Isaac Storey & Co.—Boiler feed water heater, £78.
Lea Recorder Co.—"Lea" recorder, £98.
A. Wright & Co.—"Wright Precision" recorder, £60 10s.

Todmorden.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for the supply to the electricity works of a voltage regulator for £84.

Warrington.—The tender of the B.I. and Helsby Cables, Ltd., has been accepted by the Town Council for a supply of lead pipes, at £23 14s. per ton, as has also the tender of the Albion Clay Co. for supplies of earthenware conduits.

West Bromwich.—The T.C. has been recommended to accept the following tenders:—

Brush Electrical Engineering Co.—500-k.v.a. static transformer.
Phœnix Dynamo Co.—100-k.v.a. motor alternator.
Braithwaite & Kirk—Steelwork and extensions to boiler house.
Babcock & Wilcox, Ltd.—Pipework.

Woolwich.—After considering 14 alternative offers, the Electricity Committee has been successful in obtaining plant to be delivered at a date sufficiently early to meet urgent requirements, and has accepted the tenders of the British Thomson-Houston Co. for the supply of the necessary turbo-alternator and exciter, and Messrs. Cole, Marchant & Morley for a surface condenser and turbine-driven pumps, at a total cost of £9,155.

Worksop.—The U.D.C. has accepted the tender of the General Electric Co., Ltd., for street lanterns, at £1 16s. 6d. each.

York.—The Corporation Tramways Committee recommends the acceptance of the tender of the Edison Accumulators, Ltd., for the supply of four omnibuses, at £1,172 each.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, October 9th. At 8 p.m. At Holborn Restaurant. Smoking concert.

North of England Institute of Mining and Mechanical Engineers.—Saturday, October 10th. At 2 p.m. At Wood Memorial Hall, Newcastle-on-Tyne. Papers on "The Utilisation of Exhaust Steam for Collieries, Ironworks, &c., and the Cost of Electric Current Generated," by Mr. W. C. Mountain. "A Portable Electrical Gas-detecting Device for Use with Miners' Lamps," by Mr G. J. Ralph. A fire-damp indicator or methanometer will be exhibited and demonstrated by Mr. A. Williams.

Institution of Mechanical Engineers (Graduates' Association).—Monday, October 12th. At 8 p.m. Paper on "The Reclamation of Waste Products in Industrial Undertakings," by Mr. G. H. Ayres.

Association of Engineers in Charge.—Wednesday, October 14th. At 8 p.m. At St. Bride's Institute. Presidential Address on "The British Empire—and our Work in it," by Mr. F. Bailey.

Nottingham Society of Engineers.—Wednesday, October 14th. At 8 p.m. At Welbeck Hotel, Milton Street. Annual meeting.

Greenock Electrical Society.—Thursday, October 15th. At 7.45 p.m. At 21, West Stewart Street. Paper on "Alternating Current," by Mr. J. H. Parker.

Institution of Mechanical Engineers.—Friday, October 16th. At 8 p.m. At Storey's Gate, S.W. General Meeting.

NOTES.

Fire Prevention.—The British Fire Prevention Committee has issued a special "Warning" sheet for use in emergency hospitals, which can be had gratis on application to the Committee, 8, Waterloo Place, S.W.

Employment Improving.—The Board of Trade announces (says the *Times*) that in the trades compulsorily insured against unemployment—namely, building, works of construction, engineering, shipbuilding, vehicle making, &c.—the percentage of unemployment at October 2nd was 5·1, as compared with 5·4 a week ago, and 6·3 a month ago. These figures relate to the whole of the United Kingdom, and include all unemployed workmen in the insured trades.

Electrical Loan for China.—The *Times* correspondent at Peking states that the Anglo-Franco-Chinese Corporation is reported to have signed an agreement with the Chinese Government for a loan of £10,000,000 for the construction of tramways and water and electric light services in Peking, "the prior rights of this business having been cancelled."

American Activity.—The September Report of the Society for Electrical Development to its members leads off with this interesting quotation:—

"Europe has stopped producing. It is consuming, destroying. Yet Europe must live. It must buy from us. It must take of its age-old hoarded billions and purchase from us. With a fat harvest at our back, with a swarm of American ships soon to traverse the sea, with bursting rich South America delivered to us and obliged to give us its billions of trade, with the Panama Canal opened almost providentially for the purpose, we are on the brink of intoxicating prosperity."

The intoxication stage almost appears to have been prematurely entered upon.

The report, otherwise, indicates the activity and enterprise of the Society, which is busily issuing pamphlets, window transfers, picture stamps, post-cards, &c., publishing articles on doing it electrically (in journals "the names of which we are, for obvious reasons, not at liberty to mention"), and in other ways pushing business. It is suggested that, in wrapping up small parcels, the use of a tough gummed paper tape often shows a saving in cost and time over string, and, of course, the Society provides such tape, with the slogan "Do it Electrically" on the face. Window displays are devised each month in special lines, and lectures are given before local societies; and a special motion picture film is being shown in 45 cities.

Steps are already being taken to establish United States banks in South America to facilitate the capture of trade in that quarter, and the Society for Electrical Development intends to obtain all possible information for its members as to the local markets, sending a special representative for members, if desired. Branch banks will be established first in Rio Janeiro, Buenos Ayres and Valparaiso.

Copper.—Messrs. H. R. Merton & Co.'s statistical tables contain matter of especial interest at the present time, the position of copper forming some indication of the activities of the electrical industries under the present disturbed conditions. The comparatively low price, combined with smaller supplies, reflects the natural initial set-back consequent on a period of rather uncertain shipments and financial stringency, but the general aspect of the figures is most encouraging, showing how a situation of unprecedented difficulty has been met and dealt with. At the end of August, 1914, stocks in England and Wales stood at 17,572 tons, and French stocks at Havre were estimated at 5,536 (this latter figure, however, being that for the end of July, since when no returns have been received). Dutch stocks were 2 900 tons, and German were estimated at 3,973 tons (July figures). Total European stocks, including 4,000 tons afloat from Australia, were 34,806, an increase of 694 tons over the figure for the end of July. Supplies during the month of August amounted in all to 26,623 tons, against 43,310 tons during July. In April, 1910, the figure was 27,332, and in February, 1909, it was 24,653, under normal conditions. The figures showing the sources of supply are of unusual interest. From North America during August arrived 16,720 tons. The average from this source, taken over the 12 months preceding July, 1914, was 34,800 tons per month. From Spain and Portugal the supply was 1,816 tons, quite normal. From other European countries, not specifically mentioned, 3,412 tons were obtained, a quantity which exceeds that recorded for three of the preceding 12 months. Chile shipments were 2,175 tons, rather low; and Australian 2,500, against an average of 3,400 tons. Total deliveries, at 25,429 tons, are, of course, low.

For the end of September, stocks in England and Wales were 18,610 tons, the figure for France being given, as before, from the July figure. The Rotterdam stock had dropped heavily to 950 tons. German figures are, of course, estimated.

Supplies increased to 31,454 tons. From North America 19,244 tons were contributed, a figure not much exceeded in October, 1912 (21,414). Spain and Portugal sent 1,204 tons, and other European countries 5,661 tons, quite a normal figure. Chile shipments, at 2,845 tons, were very little below the average. Australian shipments are given at the same figure as for end of August. This country is, however, rapidly resuming normal output, the quantity afloat at the end of September being 5,050 tons.

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Ultra-Violet Rays.—In the issue of *Science* for September 25th, Messrs. F. H. Verhoeff and Louis Bell give a preliminary account of their prolonged researches on the subject of "the alleged dangers to the eye from ultra-violet radiation." The following are extracts from the article:—

"The vital question is not whether a light source gives ultra-violet radiations, but whether it gives them of such kind, and in sufficient quantity, as to make any injury to the eye possible under practical conditions.

"During more than two years past the writers have spent a large amount of their time in an investigation from a quantitative standpoint of the effects of radiation on the various media of the eye from the corneal epithelium back to the retina, and have investigated with considerable care the maladies reputed by one writer or another to be due to the specific effects of radiation. Broadly, we have found that no artificial source of light used for illuminating purposes contains enough ultra-violet radiation to involve the slightest danger to the eye from its effects under any readily conceivable conditions of use, and that such pathological action as can be obtained experimentally from the ultra-violet is confined to a strictly limited region of the spectrum, and obeys perfectly definite quantitative laws in its action. Incidentally, we have found most extraordinary resisting power of the eye as respects radiations outside this particular range.

"Most of the experiments were made upon the eyes of rabbits and monkeys. A number of crucial experiments were also made upon our own eyes.

"The liminal exposure capable of producing photophthalmia to the extent of conjunctivitis accompanied by stippling of the cornea, is in terms of energy 2×10^6 erg seconds per sq. cm. of abiotic radiation of the character derived, for example, from the quartz lamp or the magnetite arc. About two and a half times this exposure, *i.e.*, 5×10^6 erg seconds per sq. cm., is required to produce loss of corneal epithelium.

"Abiotic action for living tissues is confined to wave-lengths shorter than 305 $\mu\mu$, at which length abiotic effects are evanescent, while for shorter wave-lengths they increase with considerable rapidity.

"For the quartz arc and the magnetite arc the abiotic activity of the rays absorbed by the cornea is 18 times greater than those which are transmitted by it. To affect the media back of the cornea requires, therefore, at least 18 times the liminal exposure heretofore mentioned.

"Even with exposures as great as 150 times the liminal for photophthalmia the lens substance is affected to a depth of less than 20 μ, and this superficial effect undergoes in the rabbit complete repair.

"The lens protects completely the retina of the normal eye even from the small proportion of feebly abiotic rays which can penetrate the cornea and vitreous.

"Experiments on rabbits, monkeys and the human subject prove that the retina may be flooded for an hour or more with light of extreme intensity (not less than 50,000 lux), without any sign of permanent injury. The resulting scotoma disappears within a few hours. Only when the concentration of light involves enough heat energy to produce definite thermic lesions is the retina likely to be injured.

"To injure the cornea, iris, or lens, by the thermic effects of radiation, requires a concentration of energy obtainable only under extreme experimental conditions.

"Actual experiments made on the human eye show conclusively that no concentration of radiation on the retina from any artificial illuminant is sufficient to produce injury thereto under any practical conditions.

"The abiotic energy in the solar spectrum is a meagre remnant between wave-lengths 295 $\mu\mu$ and 305 $\mu\mu$, aggregating hardly a quarter of 1 per cent. of the total. At high altitudes and in clear air it is sufficient to produce slight abiotic effects such as are noted in snow blindness and solar erythema, the former only occurring with long exposures under very favourable circumstances, and the latter being in ordinary cases complicated by an erythema due to heat alone.

"Erythropsia is not in any way connected with the exposure of the eye to ultra-violet radiations, but is merely a special case of colour fatigue, temporary and without pathological significance.

"Commercial illuminants we find to be entirely free of danger under the ordinary conditions of their use. The abiotic radiations, furnished by even the most powerful of them, are too small in amount to produce danger of photophthalmia under ordinary working conditions, even when accidentally used without their globes. The glass enclosing globes used with all practical commercial illuminants are amply sufficient to reduce any abiotic radiations very far below the danger point.

"Under ordinary conditions no glasses of any kind are required as protection against abiotic radiations. The chief usefulness of protective glasses lies not so much in their absorption of any specific radiations as in their reducing the total amount of light to a point where it ceases to be psychologically disagreeable, or to be inconveniently dazzling. Glasses which cut off both ends of the spectrum and transmit chiefly only rays of relatively high luminosity, give the maximum visibility with the minimum reception of energy. For protection against abiotic action in experimentation, or in the snow fields, ordinary coloured glasses are quite sufficient."

Appointments Vacant.—Test-room assistant (for war period), for Leith Corporation (35s.); sub-station attendant (£2), for Sunderland (temporary); three switchboard attendants (temporary) for Edinburgh Corporation (30s.) Particulars are given in our advertisement pages.

Trade Returns in War Time.—The September Figures.—Foreign Trade.—The following are the electrical and machinery figures given in the official returns for September:—

Imports.	*Month of September.* £	*Inc. or dec.* £	*Nine months, 1914.* £	*Inc. or dec.* £
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	47,770	−94,228	1,029,212	−101,711
Machinery	221,698	−300,579	5,307,273	−137,338
Exports.				
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	180,078	−107,231	2,384,390	−1,379,999
Machinery ...	1,624,050	−1,423,511	26,106,566	−1,382,998

Business Openings Abroad.—A company in Vancouver wishes to secure the agency of a United Kingdom manufacturer of tungsten lamps, electrical goods, and novelties and vacuum flasks.

A Quebec firm wishes to secure the representation of United Kingdom manufacturers of galvanised telegraph and telephone wire and porcelain insulators.

A Palermo firm wishes to get into communication with United Kingdom manufacturers of electrical material, including metal-filament lamps.

Names and addresses in all the above cases can be obtained at the Commercial Intelligence Branch of the Board of Trade in London.

Pocket Lamps Wanted.—H.M. Consul at Amsterdam (Mr. J. J. Broderick) reports that a firm at Enkhuizen, Netherlands, which has hitherto imported electric pocket lamps from Germany, desires to get into touch with United Kingdom manufacturers of these goods. The name and address may be obtained from the Board of Trade Commercial Intelligence Department in London.

Boiling the North Sea.—The Naval correspondent of the *Times*, evidently running short of serious matter, on Wednesday discussed some of the propositions put forward by more or less ingenious inventors, for effective defence against submarines. The following is too good to be abbreviated:—

"The idea of submarines being automatically destroyed by an electrical blockade is cleverly worked out by one writer, with plans showing how it might be adopted all the way from the North Frisian Islands to Borkum, or farther south, on a line opposite the German coast. The plan suggested is to place a series of good conducting poles, supported by buoys, at suitable intervals from one another, slightly below the surface, the poles being sufficiently long to reach the depth in which submarines move. Strong currents of electricity would pass continuously from pole to pole, and would, it is assumed, be of sufficient power to destroy any metal-built vessel passing through the current, either by firing her petrol or exploding her torpedoes. Sea water being a fair conductor of electricity, says the writer, the current would pass from one pole to another, and by the use of resistance indicators any defect in the apparatus would be revealed, and could be quickly repaired. The current would be supplied from the east coast by cable, and to prevent interference with the system it would be necessary to guard it by an adequate patrol. It is also suggested that if desirable an experiment could be made on a smaller scale for the electrical defence of one of our own harbours, and of course the current would have to be shut off when British submarines were passing in or out."

The dense mass of ignorance of electrical phenomena displayed by this writer need not prevent us from trying to form a mental picture of his apparatus, so "cleverly worked out." The possibilities are immense.

Further on in the same article, we read:—

"From America the suggestion is made that a special kind of torpedo or mine should be devised which would travel up and down in the water, rising and sinking automatically. Such weapons are to be provided with powerful magnetic attractors, so that, should a submarine pass over them, they would rise, and if they made contact, would detonate and destroy the hull of the vessel. Failing to reach the submarine, they would fall again, but remain in an active condition. Chemicals generating gas are to be used to impart the up and down motion, and other features of these novel mines, or lively torpedoes, as the writer calls them, are supplied."

Apart from these freak ideas, however, it is pointed out that it may be possible to gain information as to the movements of submarines by means of telephonic receivers, as used for submarine signalling.

Embezzling Car Fares.—At Liverpool Police Court, on October 1st, a Corporation tramcar conductor, John Edward Hocking, pleaded guilty to three charges of embezzling fares, and was fined in two of the cases, the total amount of the penalty being £4 13s. It was stated that the prisoner collected used tickets thrown down in the cars by passengers, and, when opportunity arose, issued them a second time, making the new punch-hole as near to the old one as possible. An official of the tramways department, travelling as a passenger, noticed that his ticket had two punch-holes, and the prisoner was put under observation.

Inquiries.—Makers of manganesite sheet packing, and of fireproof insulated wire (not merely asbestos covered) for internal controller connections, are asked for.

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Educational Notes.—University College, London.—The Goldsmid Entrance Scholarship, tenable in the Faculty of Engineering, of the value of £90, has been awarded to Mr. John Sinclair Fraser, of Dulwich College.

In Advance of the Times.—We are of all men most sympathetic with the Press Bureau in the overwhelming and unprecedented difficulties under which it labours in the performance of its very important duties, and we are also inclined to be sympathetically disposed towards the *Daily Telegraph* in respect to its efforts to publish information earlier than its contemporaries. It will be gathered, therefore, that it is with no feelings of ill-will if we indulge in a very merry laugh at the expense of both of them. On September 22nd it was announced in the *London Gazette* that the following articles would be treated as conditional contraband during the continuance of the war:—"Copper, unwrought; lead, pig, sheet, or pipe; glycerine; ferrochrome; hæmatite iron ore; magnetic iron ore; rubber; hides and skins, raw or rough tanned (but not including dressed leather)."

A Reuter dispatch from Washington, dated "Thursday," appeared in the *Daily Telegraph* of October 3rd:—

"Mr. Page, the United States Ambassador in London, has cabled to the State Department that Great Britain intends to treat as conditional contraband of war the following commodities, viz., copper, unwrought lead (pig, sheet, or pipe), glycerine, ferrochrome, hæmatite iron ore and magnetic iron ore, rubber, hides and skins, raw or rough, and tanned (not dressed) leather."—*Reuter.*

The Press Bureau, always willing to be accommodating where the public interests require prompt publicity of safe matter, would not stand in our contemporary's light, so the paragraph duly appeared with the following now stereotyped footnote:—

"The Press Bureau has no objection to the publication of above, for which, however, it accepts no responsibility."

We do not know which to be most amused at—our contemporary's "scoop," the jumbling of the punctuation which makes the lead unwrought instead of the copper, or the Press Bureau's consent and its caution in washing its hands of all responsibility. Sir Stanley Buckmaster, whose department seems to us to have been very inconsiderately treated by some writers who fail to understand its difficulties, should himself be afforded some relief in contemplating the unconscious humour of his staff.

Half-Watt Street Lamps at Chicago.—According to the *Electrical Review and Western Electrician*, the Chicago (U.S.A.) municipal authorities have for some time past been experimenting with 300-watt nitrogen-filled tungsten lamps with a view to replacing the standard flame arc lamps used for street lighting by them. In the beginning of September 728 of these lamps were in use, and the results obtained have been so satisfactory that it is intended to keep on adding such lamps, so that before long over 15,000 will be in use in Chicago, as well as 2,700 75-watt 100-C.P. lamps of similar type for residence district lighting.

The arc lamps which are to be replaced are 450-watt flame type arcs, numbering some 10,000, which were adopted as a standard rather more than two years ago. The trial 300-watt tungsten lamps are of the Westinghouse Mazda type, and cost about $4 each, with a 1,000 hours' life guarantee.

In place of the arc mechanism, there is a compensator giving 20 amperes to the lamp from the 10-ampere line circuit, and an extra tap on the compensator enables it to be used on 6·6-ampere circuits, the lamp current being 20 amperes in this case. The outer globe is an Alba glass diffusing globe, and some lamps have an inner special refracting globe made of two cup-shaped prismatic glass globes sealed together with the prisms on the inner surfaces to protect them from dust, the outer surfaces being smooth; this refractor is intended to give a greater lateral distribution of light. It is intended to install some of the new units with clear glass outer globes, to determine the effect of the refractor under the most favourable conditions. Ample ventilation of the fixture is given through openings screened to keep insects out. The lamps can be lowered for cleaning, and are spaced from 160 to 250 ft. apart.

The flame arcs to be displaced give a maximum of 1,150 C.P. in a direction near 30° below the horizontal on laboratory test. The city engineers point out, however, that data obtained show the two lamps to be on a competitive basis, as in actual service the deposit on the arc inner globe greatly reduces the light transmitted. The transmission efficiency of a new clear inner globe is 92 per cent., but after several months' service this falls to 47 per cent. of the light generated.

The electrodes last 100 hours, and the brushing out of the inner globe, condensation chamber, &c., raises the transmission efficiency to 54 per cent.; washing the globe brings it up to 75 per cent.; removal of the ingrained deposit by hydrofluoric acid raises the figure to 92 per cent. of the original.

In ordinary service in Chicago the transmission efficiency is about 55 per cent.

The new tungsten lamps give an average maximum of 600 C.P.; this figure slightly increases to commence with and then gradually decreases, so that, on the whole, it gives nearly equal illumination with the flame arc. When in addition electrode and lamp renewal costs, trimming, cleaning and energy costs for the arcs are considered the Chicago city engineers arrive at the conclusion that the cost of maintenance of the two types will be about equal for equal illumination if the tungsten lamps last 1,000 hours; even if their life is less than this, the manufacturers' guarantee is in favour of the new lamps, and it is also pointed out that the initial investment is only about half that for the flame arcs.

The 75-watt 100-C.P. lamps are mounted inverted in totally enclosed diffusing globes on remodelled gas lamp-posts.

Institution and Lecture Notes.—Institution of Electrical Engineers (Western Section).—At a Committee meeting held on September 24th, it was unanimously decided that no meetings of this section of the Institution should be held at present, as, owing to the war and the resultant unsettled state, the attendance at the meetings was likely to be small.

Institution of Electrical Engineers.—The first meeting of the new session in London will be held on October 29th, when Sir John Snell will deliver his presidential address.

Greenock Electrical Society.—On Thursday last week, Mr. T. H. Whysall delivered a lecture on "Cottonopolis and its Electricity Supply," outlining the history of the Manchester electricity undertaking from 1893, when the supply was commenced, up to the present day, when over 100,000,000 units are sold annually. The undertaking is the largest in the country, employing about 1,100 persons, and operating over an area of 30 square miles. At the power stations 200,000 tons of coal are consumed per annum, while the total capital expenditure is close on 3¼ million pounds. Showing how the older generating sets had to be removed to make way for more modern machinery, he mentioned that on a recent visit to a Port-Glasgow shipyard he recognised two of the original Manchester sets installed to supply electricity in the yard. These engines would shortly be removed again to give place to the supply from Greenock.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—We stated last week that Mr. Pearson had been placed in charge of the Lancaster Corporation electricity works. This should have been Mr. J. B. Patterson.

Mr. W. E. Appleton, of the Birkenhead Corporation electricity and tramway department, has been appointed as mains assistant at the Nuneaton Corporation electricity department.

Mr. L. Randle was presented with a dressing-case from the officials and staff of the Devonport Corporation electricity works on his resignation. The chief engineer (Mr. F. W. Spark) made the presentation, and Mr. Conville responded.

Mr. T. B. Briggs, of the Blackburn electricity department, has been appointed senior engineer-in-charge at Newport (Mon.) electricity works.

General.—The employés of the Commercial Cable Co., at Waterville (Co. Cork), have presented an address to Col. A. R. Cole-Hamilton, who was Chief Censor for the War Department at Waterville, and has now been appointed to the East Lancashire Regiment for service at the front.

Mr. George Kidd, newly appointed general manager of the British Columbia Electric Railway Co., Ltd., at Vancouver, B.C., is a comparatively young man, and he entered its service in January, 1908, from which date until March, 1911, he held the position of secretary of the London office. This he relinquished in order to go to Vancouver to take up the position of comptroller and assistant to the general manager. This position he held until May, 1914, when on account of the then general manager's departure for England he was appointed acting general manager. Upon Mr. Sperling's appointment to a position on the London board of the company, already mentioned here, Mr. Kidd succeeded him as general manager. His appointment has met with general favour among the members of the staff.

Mr. T. J. Grainger, who was manager of the late Sunbeam Lamp Co., Ltd., has now joined Cryselco, Ltd., of Bedford, as sales manager for the Newcastle District, with offices at 21, Moseley Street, Newcastle-on-Tyne, where he will be pleased to see his old friends, or hear from them by post. Telephone: Central 3474, or telegram: "Cryselco, Newcastle-on-Tyne."

Mr. Walter T. Keetley has left the A.E.G. Electric Co. and taken up the post of manager to the North Staffs. Electrical Supplies Co., Glebe Street, Stoke-on-Trent. He invites supply houses to forward their complete lists.

Mr. John Henry Schnauber, mechanical and electrical engineer, of 220, Keighley Road, Bradford, announces in the *London Gazette* that on September 9th, 1914, he renounced the surname of Schnauber and adopted the name of John Henry Shaw.

Mr. G. Williamson, of the staff of Messrs. Crompton & Co., Ltd., at the Arc Works, Chelmsford, is leaving to take up an important appointment with the firm at Sydney, Australia.

The conclusion of the address delivered by Mr. Chas. Bright on "A Nation's Awakening," appears in the *Tonbridge Free Press* for October 2nd.

Mr. H. E. Moul has resigned from the board of the Union Electric Co., Ltd.

Obituary.—Mr. E. Home.—We regret to record that the death occurred suddenly on September 25th, at the age of 48, of Mr. Elijah Home, a partner in the firm of Home & Rowland, electrical engineers, of Charlton, London, S.E.

Mr. C. J. Hall.—The death took place at Headingley, Leeds, on Friday, of Mr. Chas. J. Hall, M.I.E.E.

Mr. G. Woolley.—The death took place on Sunday of Mr. Geo. Woolley, director of the Ludlow E.L. Co., Ltd., and a former member of the Town Council.

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NEW COMPANIES REGISTERED.

Thos. H. Windibank & Co., Ltd. (137,849).—This company was registered on October 2nd, with a capital of £1,000 in £1 shares, to carry on the business of electrical and illuminating engineers, manufacturers of electrical machinery and appliances, illuminated facias, signs, flashers and arc lamps, contractors of installations for lighting, power, wiring, bells, alarms, telephones, telegraphs and other purposes, heating and ventilating engineers, makers of kinematograph cameras, projectors and apparatus, manufacturers of petrol, steam and gas engines, motor cars and mechanically-propelled vehicles, &c. The subscribers (with one share each) are:—J. M. Dransfield, 35, Lynette Avenue, Clapham, S.W., hardware traveller: Hy. Windibank, 29, Pemdevon Road, West Croydon, electrical engineer. Private company. Thos. H. Windibank is the managing director. Registered office, 177, London Road, West Croydon.

North British Electric Welding (Eastern), Ltd. (9,244).—This company was registered in Edinburgh on September 25th, with a capital of £4,000 in £1 shares, to carry on the business indicated by the title. The subscribers (with one share each) are:—D. Small, 45, Hope Street, Glasgow, consulting engineer: J. Inglis, 21, Stanley Road, Leith, shipbuilder. Private company. The number of directors is not to be less than two or more than nine: the first are J. Inglis, D Small, H. M. MacNeal, E. A. Qualk, and L. S. Taylor; qualification, 100 shares. Solicitor, T. J. Addly, 21, Duke Street, Edinburgh.

Custodis, Ltd. (137,827).—This company was registered on October 1st, with a capital of £6,000 in £1 shares (3,000 "A" and 5,000 "B"), to carry on the business of chimney constructors, builders, contractors, merchants, dealers in stone, sand, lime, bricks, timber, iron, steel and other building and construction materials, brick, tile and terra cotta makers, sewage contractors, electric and mechanical engineers, &c. The subscribers (with one share each) are:—H. Hoeveler, 45, Christchurch Road, Streatham Hill, S.W., director; W. Harrison, 1, Raymond Buildings, Gray's Inn, W.C., solicitor. Private company. The number of directors is not to be less than two or more than five; the first are H. Hoeveler and W. Harrison; qualification, £5: remuneration as fixed by the company. Registered office, 119, Victoria Street, Westminster, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Highfield & Co., Ltd.—Deb. dated September 4th, 1914, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: G. Highfield, 87, Rainbow Hill, Worcester.

United River Plate Telephone Co, Ltd. (23,654).—Capital, £2,000,000 in £5 shares (324,000 ord., 40,000 pref. and 36,000 unissued). Return dated May 21st, 1914. All the pref. and ord. shares taken up; £5 per share called up on 348,000 shares: £1,740,000 paid; £80,000 considered as paid on 16,000 shares. Mortgages and charges: £300,000.

South American Light and Power Co., Ltd. (74,446).—Capital, £200,000 in £1 shares. Return dated July 21st, 1914. 172,400 shares taken up. £122,407 paid. £49,993 considered as paid. Mortgages and charges: £150,000.

W. Sisson & Co., Ltd. (82,295).—Capital, £25,000 in £1 shares (5,000 pref., 13,000 ord., and 7,000 defd.). Return dated September 8th, 1914. 3,975 pref., 11,801 ord., and 7,000 defd. shares taken up. £1 per share called up on 3,975 pref. and 6,851 ord. £10,336 paid. £12,450 considered as paid on the remainder. Mortgages and charges: £3,391 0s. 8d. Bank overdraft at date.

Turner, Atherton & Co., Ltd. (66,901).—Capital, £175,000 in £1 shares (87,500 pref). Return dated September 10th, 1914. 61,812 ord. and 73 811 pref. shares taken up. £1 per share called up on 7,259 ord. and 19,228 pref. shares. £26,487 paid. £109,166 considered as paid on the remainder. Mortgages and charges: Nil.

W. H. Allen, Son & Co., Ltd.—Capital, £200,000 in £1 shares. Return dated September 19th, 1914. 152,500 shares taken up. £1 per share called up on 2,500 shares. £2,500 paid. £150,000 considered as paid on the remainder. Mortgages and charges: £50,000.

Brotherton Tubes and Conduits, Ltd. — Particulars of £6,650 debentures, created September 24th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Mexican Companies.

We are indebted to the *Financial Times* for the following particulars of the financial results, &c., of the two principal electric light and power and tramway companies operating in Mexico during the year ended at December, 1913.

Mexico Light and Power Co., Ltd. — Net revenue 6,194,650 pesos, an increase of 541,617 pesos. Including $1,184,405 brought forward, there is a total credit of $3,977,117. Out of this sum have been paid the current expenses and fixed charges, amounting to $2,289,574, and dividends aggregating 7 per cent. per annum on the preference shares, and 4 per cent. on the ordinary share capital, leaving a credit on profit and loss account of $724,142, of which $405,619 has been transferred to the reserve account (increasing same to $705,619), and the balance, $318,523, has been carried forward. The total sum to the credit of the reserve account, as increased to $705,619, has been applied in writing down the value of certain investments and accounts, and providing for the extraordinary expenditures during the year, including the expenses of protecting its properties on account of the disturbed conditions in Mexico. Since January 1st, 1914, the board has considered it advisable, owing to the continued state of political unrest in Mexico, and the consequent heavy fall in exchange, to defer for the present the payment of further dividends on the share capital. The policy adopted for the protection of the properties during the disturbances of 1912 has remained unchanged, and although considerable extraordinary expenditure has been incurred in connection therewith, the company has been able to continue operation and has not sustained any serious damage to its properties. The recent news on the Mexican situation shows a tendency to an improvement in the present state of affairs. The statistics show a considerable increase in the sale of power over previous years, but not so great as it should have been if the condition of the Republic had been normal. The operating expenses show a further reduction from 24·68 per cent. to 23·24 per cent. The extension of the system of canals and tunnels to divert several rivers into the Nexaca watershed was completed before the rainy season of 1913, and with this vast storage the directors are relieved of any anxiety regarding the supply of power.

Mexico Tramways Co.—Net revenue 3,164,756 pesos, an increase of 145,806 pesos. Including $1,462,928 brought forward, there is a total credit on profit and loss account for the year of $4,195,136. After meeting current expenses and fixed charges, and 7 per cent. dividends on the share capital, $1,382,967 has been carried forward. The ratio of operating expenses to earnings was 46·48 per cent., as compared with 47 per cent. in 1912. Of the $2,547,756 to the credit of reserve account December 31st, 1912, $711,152 has been applied to writing down the value of certain investments and accounts and providing for the extraordinary expenditure incurred for the protection of the property on account of the disturbed conditions in Mexico, and in writing off the expenses in connection with the issue of 35,126 additional shares. There now remains to credit of reserve account $1,836,604. Since January 1st, 1914, the board has considered it advisable, owing to the continued state of political unrest in Mexico and the consequent heavy fall in exchange, to defer for the present the payment of further dividends on the share capital. Although considerable extraordinary expenditure has been incurred for protection of the property, the company has been able to continue operation with no serious damage to its plants, &c. The Mexican situation shows a tendency to improve. The property has been maintained in good condition, and for this purpose 741,611 pesos have been expended during the year. In October, 1913, the board authorised the creation of £1,200,000 6 per cent. three-year secured notes, conferring on the holders the right of converting the same into ordinary shares at par. When the financial situation is favourable the board propose to issue the notes and apply the proceeds towards paying off the outstanding temporary loans. In order to provide for the right of conversion given by the notes, the share capital was increased in November, 1913, by the creation of an additional 100,000 shares of $100 each. These shares remain in the treasury.

Dick, Kerr & Co., Ltd.

The directors report that the profits earned during the 12 months' trading to June 30th, 1914, amount to £44,762, plus £10,325 brought forward, making a total of £55,086. Out of this sum the debenture interest and trustees' fees have been paid, and there has been reserved the sum required to provide for the premium payable on the redemption of the present debenture stock. These items absorb £11,261, leaving £43,825 available for appropriation as under:—Dividend of 6 per cent. per annum on the preference share capital (the half-yearly dividends to December 31st, 1913, and June 30th, 1914, have already been paid) £18,300, carrying forward £25,525. The directors do not recommend the payment of dividend on the ordinary shares. The sum carried forward may be required to meet possible contingencies resulting from the state of war. A material reduction in value of investments and assets generally is also to be anticipated, but the directors propose to utilise the reserve of £150,000 for adjustment of values when the permanent depreciation can be assessed. The preference shareholders are being asked to sanction an issue of additional debenture stock. The necessity for more working capital has been clearly indicated by the later balance-sheets, but is now intensified by the indications of increased business to be expected from the diminution of German competition at home and abroad.

The annual meeting is called for Thursday, October 15th.

A separate general meeting of preference shareholders will follow the annual meeting, at which a resolution will be submitted sanctioning the creation and issue of debentures, debenture stock, and other securities, so that the total amount shall not exceed an amount which, together with the amount of the 4½ per cent. first mortgage debenture stock for the time being outstanding shall make up a total of £650,000. In a circular accompanying the notice calling the meeting it is stated that the company's cash resources have been gradually depleted to the extent of nearly £70,000 by the redemption of existing debentures, and, at the same time, the demand for additional working capital increases with the expansion of the manufacturing department of the business. If the creation of these additional securities is sanctioned, it is the intention of the directors only to issue upon favourable opportunity offering, and to the extent necessary to meet the permanent additional requirements.

Cuba Submarine Telegraph Co., Ltd.—Interim dividend declared for the six months ended June 30th last at the rate of 5 per cent. per annum on the ordinary shares.

Babcock & Wilcox, Ltd.—Interim dividend of 5 per cent. on the ordinary shares.

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Amalgamated Wireless (Australasia), Ltd.

The *Sydney Morning Herald* publishes the first report of this company, which nominally covers the 12 months ended June 30th. As the amalgamation of the Australasian Wireless Co., Ltd., with the Australian branch of Marconi's Wireless Telegraph Co., Ltd., was effected on November 30th, 1912, the actual working of the present company really extends over a period of 19 months. The report states that trading for the first seven months was considerably handicapped by the expense of running two organisations, but this has been avoided by the amalgamation of the business and staffs of both companies. Since then a change for the better has been noticed, and there has been a gradual accumulation of profits. The company now controls under subsidy agreements for fixed terms 75 passenger and cargo vessels. The New Zealand Navigation Act is expected to affect favourably the trading profits of the company. The net profit up to June 30th was £8,616, out of which the directors propose a dividend of 4 per cent., absorbing £5,600, adding £3,000 to patents reserve account, and carrying £16 forward.

Northern General Transport Co., Ltd.—The following notice has been issued to the shareholders :—

In the circular letters dated December 12th, 1913 sent by this company to the Chairman of the Gateshead and District Tramways Co., the Tynemouth and District Electric Traction Co., Ltd., and the Jarrow and District Electric Traction Co., Ltd., offering to exchange shares in those companies for holdings in this company, it was stated that:—"Dividends on the preference shares will be paid in March and September, and the directors hope to be in a position to pay an interim dividend each year on the ordinary share capital of the Transport Co." The business of the Transport Co. has progressed in a satisfactory manner, and in ordinary circumstances the payment of an interim dividend on the ordinary shares would have been justified. In view, however, of the position brought about by the war, the directors feel that it will be wise to withhold on this occasion the payment of an interim dividend on the ordinary shares. The dividend on the preference shares for the half-year ended June 30th last will be paid on the 30th inst. Unless any untoward event occurs the directors anticipate paying a dividend on the ordinary shares in March next, which will be satisfactory to the shareholders.

Official Notices re Companies.—Unless cause is shown to the contrary the following companies will, at the expiration of three months, be struck off the Register :—

Automatic Glass Blowing Patents Syndicate.
Automatic Weldless Chain Co.
Auxiliary Power Co.
Bishop's Stortford and Stansted Electric Lighting Co.
British Electric Light Wiring Co.
British Ever-Ready Electrical Co.
Burkel Tram Rail Syndicate.
Cauricedale Anti-Friction Metal Syndicate.
Concentric Condensers.
Cumberland Power Syndicate.
Economic Furnaces.
Penmacho, Corwen and Bettws-y-Coed Light Railway Co.
Positive Rotary Pumps.
Technical Advertising.
Traction and Power Agency.
Wolfram (Tungsten) Syndicate.

Rangoon Electric Tramway and Supply Co., Ltd.—An extraordinary meeting of the first mortgage debenture-holders of the above company was held on Wednesday, at the offices, 3, Great Winchester Street, E.C., Mr. Frank Tobin in the chair, when a resolution was passed appointing Sir Arthur Norman Hill a trustee in the place of Sir John Gray Hill, deceased. Subsequently a meeting of 5 per cent. mortgage debenture-stockholders was held, under the presidency of Mr. J. W. Dawson, at which a similar resolution was agreed to.

Kalgoorlie Electric Power and Lighting Co., Ltd.—The directors have declared a dividend at the rate of 4 per cent. per annum on the preference shares for the half-year to September 30th, payable October 16th.

South-Western Electrification.—The *Financial News* states that in connection with their electrification projects, the directors of the London and South-Western Railway are offering £1,000,000 5 per cent. preference 10-year bonds at 99¼.

Direct United States Cable Co., Ltd.—An interim dividend of 2s. per share, less income-tax, is announced for the 31st inst., making with the interim dividend already paid a total distribution of 4 per cent. for the half-year ended September 30th.

Calcutta Tramways Co., Ltd.—Interim dividend at the rate of 6 per cent. per annum (3s. per share) on the ordinary shares for the past half-year.

United River Plate Telephone Co., Ltd.—Interim dividend of 3 per cent., payable November 2nd.

STOCKS AND SHARES.

Tuesday Evening.

Business has again been better in the Stock Exchange during the past week than has been the case since the Stock Exchange closed. In all departments the revival of interest is to be noticed, and in the street market almost animated dealings take place, during the morning session, in Home Railways and certain other favourite stocks. Interest seems to evaporate soon after lunch time, and markets go home to tea; but day by day the business broadens, and the obvious tendency of the investor is to put money now into domestic stocks rather than into those of the foreign countries which have proved so disastrous for British capital during the past few years.

The Electric Supply section is quiet and steady. In a few shares—Chelseas, for instance, London Preference, South Londons and Metropolitans—a little business is doing; but, otherwise, the market remains restricted. To give an idea of how prices stand at the present time, we have assembled the following quotations of the leading London share issues; and it will be seen that, in the comprehensive catalogue, the falls are comparatively slight. Sellers, however, have some difficulty in realising, and the scarcity of buyers is still noticeable :—

Share.	Price July 30th.	Present price.	Fall.
Brompton and Kensington Ord. ..	9⅛	8⅞	¼
Do. do. Pref. ..	9⅜	8⅝	—
Charing Cross Ord.	5½	5	½
Do. Pref.	4⅞	4½	⅜
Chelsea	4⅞	4⅝	¼
City of London Ord.	16	15	1
Do. Pref.	13⅛	12⅝ *xd*	½
County of London Ord.	12	11⅝	⅜
Do. Pref.	12	11⅝	⅜
Kensington and Knightsbridge ..	7⅞	7½	⅜
London Electric Ord.	1 7/16	1⅜	1/16
Do. Pref.	5 7/16	4⅝	1/16
Metropolitan Ord.	8⅜	8⅛	¼
Do. Pref.	4 7/16	4⅜	1/16
St. James's Ord.	9⅜	9	⅜
Do. Pref.	6⅝	6⅜	¼
South London	8 3/16	8	1/16
Westminster Ord.	8⅝	8¼ *xd*	⅜
Do. Pref.	5⅛	4⅞	¼

Possibly the would-be investor is somewhat deterred from electric supply shares by the quaint appearance of the London streets after dark, where the obscuring of the lights is being carried on in a manner as mystifying and elaborate. We hear, incidentally, that this programme was first ordered by the War Office, but later on the Admiralty took up the work, and insisted that some of it should be done over again, in a different manner. The drastic regulations issued on Tuesday with reference to street and domestic lighting have given rise to the supposition that the authorities must be looking for aerial night attacks on an extensive scale.

The Home Railway market shows pronounced improvement. As already indicated, the investor is evidently turning his attention to domestic securities as likely to offer one of the best fields for appreciation. The Steam stocks have gone ahead sharply. Metropolitans have hardened a little to 31½, and Districts to 19, the latter being the same as on July 30th, while Metropolitans are a point better. Underground Electric Income bonds continue firm.

Marconis rose last Saturday to 36s. 3d., and at 35s. are still five shillings higher than they were a fortnight ago. The rise is due to the repurchases by bears and to the understanding that the company's British business, while at present under Government management, is doing so well as to warrant advance in the quotation of the shares. Americans at 9s. 6d. and Canadian Marconis at 5s. 3d. are also harder.

The Telegraph and Telephone market obtains a fair amount of attention, but prices are not quite so firm as they were a fortnight back. The following are the chief changes that have occurred during the past two weeks :—

Stock or share.	Present price.	Fall.
Anglo-American Telegraph 6 per cent. Preferred ..	101	5
Do do. Deferred	21⅜	⅛
Eastern Extension Telegraph Ordinary	11⅜	⅛
Eastern Telegraph Ordinary	128½	6
Do. 8½ per cent. Preference	75½	1½
Do. 4 per cent. Debenture	94	3
Globe Telegraph and Trust Ordinary	10½	⅛
Do. 6 per cent. Preference	12	⅛
Great Northern Telegraph	29	⅜
Western Telegraph Ordinary	12⅜	⅛
Automatic Telephone 6 per cent. Preference	1	1/16

Further shrinkage has occurred in the price of Brazilian Traction shares, and the present price of 47½ is 10½ lower than when the House closed. The other foreign traction securities are mainly steady. Some of the bears complain that they cannot buy back the bonds of Mexican companies of which they are short, and this despite the far-from-favourable conditions still ruling in Mexico City. General Carranza has resigned, but has been re-elected.

The Mexico Tramways Company has just published a report in which all the figures are decidedly good, with the vital exception of the exchange, and the special disbursements of a protective nature incurred by reason of the revolution. In the event, there is a million-and-a-quarter dollars for the directors to play with, but this is not sufficient to maintain the 7 per cent. dividend without assistance from the carry-forward. The Mexican Light and Power Company publishes a story on much the same lines. Here again, the fall in the exchange has made serious inroads upon the profits, in addition to which there is a special outlay for protective works, as in the case of the Tramways Company. The 4 per cent. dividend on the Common stock is maintained, at the expense of reduction in the carry forward.

Manufacturing and Miscellaneous issues are quiet, the feature being an improvement in Edison & Swan shares to 4s. 3d., more than double the quotation prevailing two months ago. General Westinghouse Preference are 9¼. British Westinghouse Preference improved to 33s. 9d. Calcutta Trams are steady at 7¼. The Anglo-Argentine group is practically unmoved. Dealers are still short of the company's 4½ per cent. Debenture, but are sellers of the 4 per cent. and the 5 per cent. issues. London General Omnibus shares hardened a trifle. The Rubber share market keeps up well, prices being maintained, of course, by the consideration that, both during the continuance of the war and afterwards, mechanical traction will be more and more required. Armament shares are amongst the firmest in the Industrial department, Armstrongs, Birmingham Small Arms and Vickers all exhibiting strength.

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LARGE INDUCTION MOTORS: SOME FEATURES OF MECHANICAL DESIGN.

By G. G. MOORES, B.Sc. Eng.

(*Continued from page* 453.)

Stator Frames.

The design of a large stator frame for a particular machine is usually based upon previous experience rather than on calculations as to strength. One reason for this is that the stresses occurring during construction can hardly be determined with any degree of accuracy, and these are, as a rule, much greater than the stresses to which the frame is subject during actual service.

Then there is also the question of initial strains caused during the casting of the frame. By careful proportioning of the parts these strains can be reduced to a minimum, but it is hardly possible that they are ever obviated altogether. Further, the frame has generally to be made of ample strength in order to be rigid, and the proportions necessary for sufficient rigidity can only be determined by experience.

The general problem is to make the frame of ample strength and rigidity, with due regard to economy of material. Other points to be considered are arrangements for ventilation, simplicity of construction and machining, low cost of pattern and adjustability of the same for variations in width of frame, and the general appearance of the whole machine. These considerations have led to the evolution of the "box" type of frame, which appears to be an example of the survival of the fittest. The section of this type is based upon the section shown in fig. 9, which may be modified and developed to suit various conditions. For instance, the solid cylinder, which forms the inner circumference, may be replaced by a series of bars placed parallel to the axis of the frame. These bars, which may be some such section as fig. 10, serve to carry the punchings, and the space between them allows for ventilation when holes are provided in the outer circumference of the frame. This modification will give a section something like fig. 11. It will be seen that the frame now consists essentially of two circular beams of channel section tied together at intervals. If it is desired to increase the width of the frame, this can now easily be done by adding one or more beams of T or I section between the two channel beams, as shown in fig. 12.

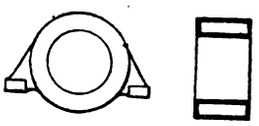

Fig. 9.

Fig. 10.

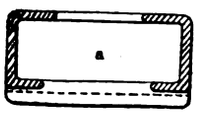

Fig. 11.

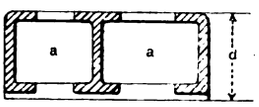

Fig. 12.

Webs are sometimes placed at intervals across the section parallel to the axis of the frame in the space *a* (figs. 11 and 12), but these merely impede the ventilation and add to the weight of the casting without adding materially to the strength or rigidity, and it is doubtful whether they are at all necessary except in the largest sizes—say, frames of 14 ft. diameter and upwards.

Although box-type frames are the most common, they are excelled as regards suitability for ventilation by the skeleton frame which consists merely of two end flanges connected together at intervals by cross ribs, the space between the ribs being entirely open. A good example of this type of frame is illustrated by fig. 13, which represents a 600-B.H.P., 500-R.P.M. colliery fan motor, by Messrs. Vickers, Ltd.

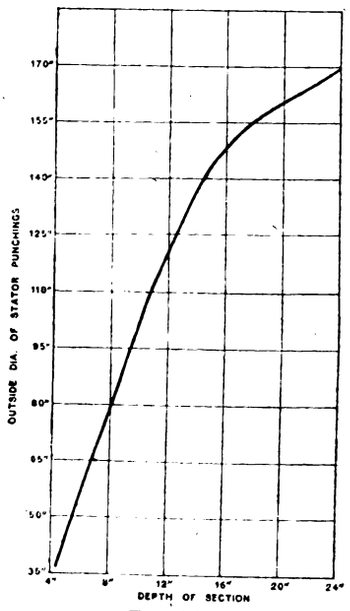

Fig. 14.

The proportions of a frame of the box type are, as already stated, largely dependent on experience. For preliminary designs the curve, fig. 14, may be accepted as approximating to average modern practice for cast-iron frames, the thickness of metal varying from $\frac{3}{4}$ in. at 3 ft. diameter to $1\frac{1}{4}$ in. at 14 ft. diameter. The "depth of section" referred to is indicated by the dimension *d*, fig. 12.

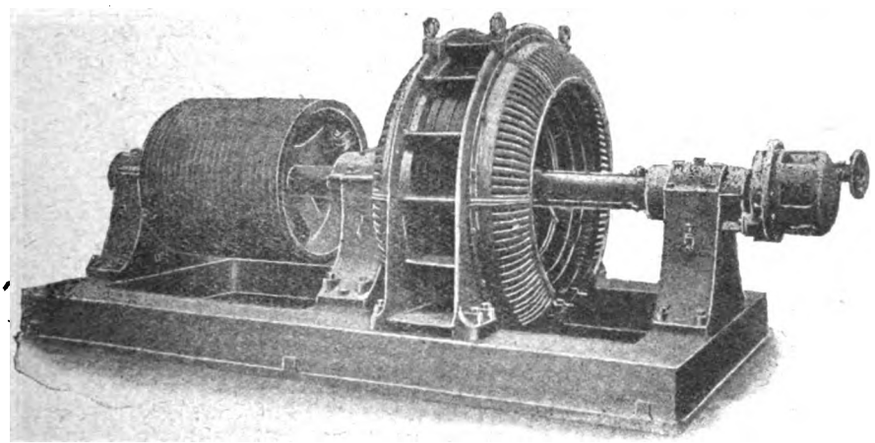

Fig. 13.—Vickers 600-H.P. Motor.

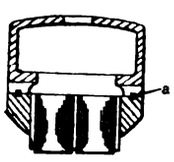

Fig. 15.

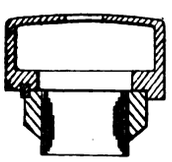

Fig. 16.

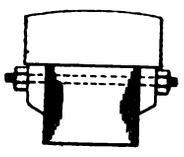

Fig. 17.

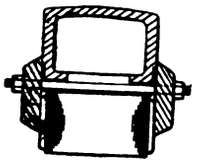

Fig. 18.

Stator Cores.—Of the methods of securing the stator core punchings in the frame, there are two which practically hold the field. One is to hold the punchings in place with key rings, and the other is to secure them with bolts. A typical keyed-in core is shown in fig. 15. The key rings *a* are in this case made in segments, and are inserted by placing them in the keyway of the endplate between the

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bars of the stator frame, and then driving them round into the bars (which are widened at the ends), and securing them by caulking or some similar method.

Another method of fixing keys is illustrated by fig. 16. In this case one end plate rests against a flange in the frame; the key ring is made in one piece, and is sprung into position while the core is under the press. This method, it will be seen, necessitates the use of a wider frame than the previous one, and it is probably not so good in other ways, although quite commonly used.

Figs. 17 and 18 are two examples of cores secured by bolts. The former indicates the method usually adopted in this country, whilst the latter represents some recent American practice. In the latter example the endplates are cast in short segments, each pair of segments carrying two or three of the bolts.

Some of the methods here illustrated of constructing stator cores require modification when the core has to be "split," that is, built so that the upper half of the stator can be easily removed from the lower half. The end plates shown in figs. 15 and 16, for instance, are obviously not suitable for making in halves without some modification which will make them self-supporting when the frame is split. The bolted cores are, however, quite suitable for splitting, the punchings being supported by dovetail keys, and, in the case of fig. 18, also by friction between the end plates.

In splitting a core it is usual to make the division through one of the slots, not through a row of teeth, for the reason that ventilating plates and tooth supports could not be made satisfactory at the point where a row of teeth is divided. It is on this account also that when large punchings are made in segments, instead of complete circles, the division between the segments is usually made through a slot.

Fig. 19 shows a good example of a split stator by the British Thomson-Houston Co. It will be noticed that the winding is specially distributed so as to avoid the necessity for removing coils when the frame is divided; all that is necessary in this case is to disconnect three joints at each point where the frame is split. The joints consist of a plug screwing into a socket in such a manner as to make an efficient electrical connection whilst being adaptable for easy

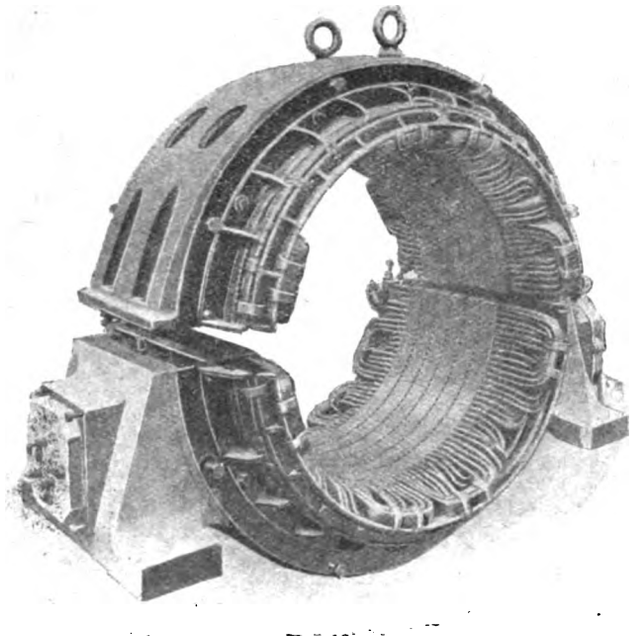

Fig. 19.—Split Stator of B.T.H. 150-h.p. Motor.

disconnection. The method of neatly and firmly securing the end connections on this machine is also worthy of note.

End Brackets.—The purpose of end shields or brackets on a motor may be the protection of the windings, the enclosing of the machine for ventilation or other purposes, or the support of the bearings. The points affecting the design of these are the scheme of ventilation of the machine (see fig. 4) and general appearance of the machine as a whole, the space occupied by the windings and connections and the voltage of the machine, the possibility of easily removing the end brackets when the motor is in service so that the windings may be readily inspected, the accessibility of the air-gap which requires occasional checking, and the strength of the end brackets. In cases where end brackets support the bearings, the strength depends on the particular

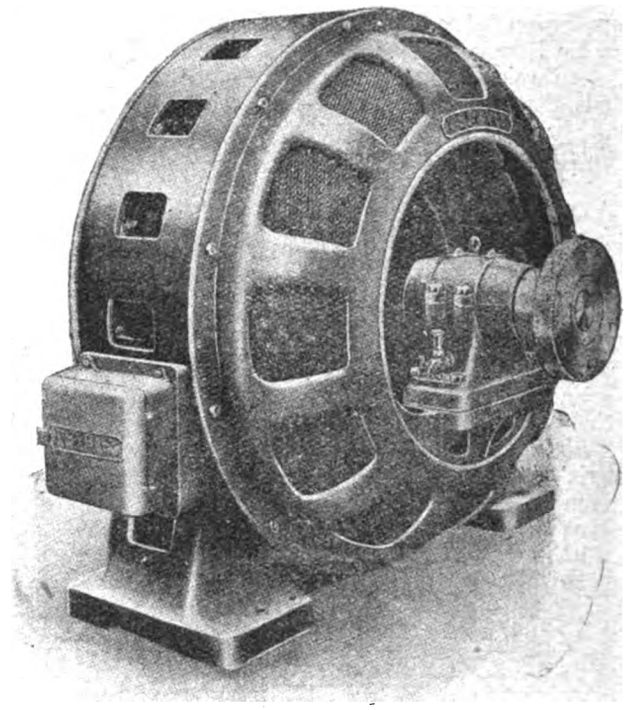

Fig. 20.—Bruce Peebles Motor, with Adjustable Bearing.

design adopted, and practice varies so much that a general discussion of the subject is hardly feasible. Protecting shields of the type shown in the Vickers motor, fig. 13, are, however, in fairly general use, and Table I, giving the suitable thickness of cast-iron for end shields of this type, may be found useful.

TABLE I.

Diameter of end shield...	3 ft.	4 ft.	5 ft.	6 to 12 ft.	14 ft.
Thickness of metal ...	$\frac{5}{16}$ in.	$\frac{3}{8}$ in.	$\frac{7}{16}$ in.	$\frac{1}{2}$ in.	$\frac{5}{8}$ in.

When the bearing housing is cast in one piece with the end bracket, some difficulty has to be overcome in making the bearings adjustable so that the rotor may be accurately centred in the stator. A more convenient method sometimes adopted for large machines is to fix the pillow block on to a horizontal seat cast on the end bracket, as shown in the illustration, fig. 20, of a large motor for direct coupling by Messrs. Bruce Peebles & Co. The bearings in this case can be readily adjusted with liners in the ordinary way.

(To be continued.)

Electric Ploughing.—Some experiments made at Gazzo Veronese, Italy, with electric ploughs resulted in the following estimates of comparative costs: With animals, \$5·30 to \$5·75 per acre; steam, \$4·30; electric power, \$3. The ground was ploughed to a depth of 15 in., and the above costs were obtained on the basis of 200 days' work a year and energy at 3 cents per KW.-hour. In the same district for 100 days' work a year, with electricity at 4 cents per KW.-hour, the costs were: steam, \$5·07, and electricity, \$3·36 per acre. Other plants in the same district are said to have reduced the cost of electric ploughing to \$2·83 per acre.

Estimates made at Reggio Emilia on 741 acres electrically ploughed showed capital invested, including 8 km. of line, at 8,280; operating expenses, including depreciation on plant, at \$4,324.

Ploughing with steam was figured at \$4,360; using gas engines, at \$4,368; and using oil engines, at \$4,285.

Fuel in this district costs, for coal, \$12 per metric ton; wood per quintal, \$·8; petrol, per .5 gallons, \$1·80; kerosene, per quintal, \$7.—*Journal of Electricity, &c.*

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TRADE STATISTICS OF ITALY.

The following statement, showing the imports of electrical and similar goods into Italy during the year 1912, is extracted from the recently issued trade statistics. The figures for 1911 are added for purposes of comparison, and notes of any increases or decreases are given.

Copper, brass or bronze wire more than ½ mm. diameter.—	1911. Lire.	1912. Lire.	Inc. or Dec. Lire.
From France	1,455,000	1,114,000	− 341,000
,, Germany	1,280,000	1,176,000	− 104,000
,, Great Britain ...	5,000	31,000	+ 26,000
,, United States ...	—	65,000	+ 65,000
,, Other countries ...	173,000	72,000	− 101,000
Total	2,913,000	2,458,000	— 455,000
Copper, brass or bronze wire of ½ mm. diameter or less.—			
From Germany	422,000	511,000	+ 89,000
,, France	34,000	161,000	+ 127,000
,, Other countries ...	10,000	10,000	—
Total	466,000	682,000	+ 216,000
Boilers.—			
From France	330,000	41,000	− 289,000
,, Germany	487,000	434,000	− 53,000
,, Great Britain ...	1,803,000	1,865,000	+ 62,000
,, Switzerland	65,000	55,000	− 10,000
,, Other countries ...	255,000	276,000	+ 21,000
Total	2,940,000	2,671,000	− 269,000
Steam engines, stationary, without boilers.			
From Belgium	15,000	—	− 15,000
,, Germany	504,000	623,000	+ 119,000
,, Great Britain ...	1,033,000	1,184,000	+ 151,000
,, Switzerland	22,000	16,000	− 6,000
,, United States ...	365,000	357,000	− 8,000
,, Sweden	—	87,000	+ 87,000
,, Other countries ...	275,000	163,000	− 112,000
Total	2,214,000	2,430,000	+ 216,000
Steam engines, semi-stationary (with boilers), hot-air motors, compressed air, gas, petrol, etc.—			
From France	145,000	133,000	− 12,000
,, Germany	1,781,000	2,250,000	+ 469,000
,, Great Britain ...	1,608,000	1,924,000	+ 316,000
,, Switzerland	474,000	496,000	+ 22,000
,, United States ...	291,000	192,000	− 99,000
,, Other countries ...	516,000	287,000	− 229,000
Total	4,815,000	5,282,000	+ 467,000
Hydraulic machines and water or wind motors.—			
From France	83,000	107,000	+ 24,000
,, Germany	1,228,000	954,000	− 274,000
,, Great Britain ...	555,000	91,000	− 464,000
,, Switzerland	168,000	148,000	− 20,000
,, United States ...	96,000	85,000	− 11,000
,, Other countries ...	72,000	227,000	+ 155,000
Total	2,202,000	1,612,000	− 590,000
Dynamo-electric machines weighing more than 1,000 kg.—			
From Austria-Hungary ...	174,000	590,000	+ 416,000
,, France	749,000	163,000	− 586,000
,, Germany	4,860,000	4,453,000	− 407,000
,, Great Britain ...	438,000	471,000	+ 33,000
,, Switzerland	353,000	159,000	− 194,000
,, United States ...	88,000	60,000	− 28,000
,, Belgium	303,000	133,000	− 170,000
,, Other countries ...	3,000	79,000	+ 76,000
Total	6,968,000	6,108,000	− 860,000
Dynamo-electric machines weighing 1,000 kg. or less.—			
From Austria-Hungary ...	264,000	786,000	+ 522,000
,, France	208,000	123,000	− 85,000
,, Germany	4,365,000	3,353,000	− 1,012,000
,, Great Britain ...	294,000	311,000	+ 17,000
,, Switzerland	306,000	198,000	− 108,000
,, United States ...	195,000	125,000	− 70,000
,, Other countries ...	287,000	95,000	− 192,000
Total	5,919,000	4,991,000	− 928,000

Accumulators & metal parts.—	1911. Lire.	1912. Lire.	Inc. or Dec. Lire.
From Germany	28,000	64,000	+ 36,000
,, Great Britain ...	3,000	1,000	− 2,000
,, France	20,000	77,000	+ 57,000
,, Other countries ...	3,000	2,000	− 1,000
Total	54,000	144,000	+ 90,000
Electric transformers.—			
From Austria-Hungary ...	979,000	557,000	− 422,000
,, France	20,000	21,000	+ 1,000
,, Germany	2,302,000	2,862,000	+ 560,000
,, Great Britain ...	27,000	12,000	− 15,000
,, Switzerland	382,000	266,000	− 116,000
,, United States ...	13,000	72,000	+ 59,000
,, Other countries ...	3,000	2,000	− 1,000
Total	3,726,000	3,792,000	+ 66,000
Parts of dynamo-electric machines and of transformers.—			
From France	118,000	132,000	+ 14,000
,, Germany	1,127,000	1,158,000	+ 31,000
,, Great Britain ...	64,000	138,000	+ 74,000
,, United States ...	100,000	115,000	+ 15,000
,, Switzerland	52,000	222,000	+ 170,000
,, Other countries ...	184,000	110,000	− 74,000
Total	1,645,000	1,875,000	+ 230,000
Electrical apparatus.—			
From Germany	3,203,000	3,827,000	+ 624,000
,, Great Britain ...	344,000	187,000	− 157,000
,, Switzerland	193,000	269,000	+ 76,000
,, United States ...	235,000	145,000	− 90,000
,, Other countries ...	491,000	222,000	− 269,000
Total	4,466,000	4,650,000	+ 184,000
Arc Lamps.—			
From Germany	437,000	279,000	— 158,000
,, Austria-Hungary ...	18,000	11,000	— 7,000
,, Great Britain ...	1,000	4,000	+ 3,000
,, France	16,000	15,000	— 1,000
,, United States ...	3,000	5,000	+ 2,000
,, Other countries ...	4,000	3,000	— 1,000
Total	479,000	317,000	— 162,000
Electric lamps, incandescent.—			
From Austria-Hungary ...	831,000	2,340,000	+ 1,509,000
,, Sweden	49,000	40,000	— 9,000
,, France	215,000	266,000	+ 51,000
,, Germany	2,222,000	5,105,000	+ 2,883,000
,, Great Britain ...	12,000	10,000	— 2,000
,, Switzerland	159,000	163,000	+ 4,000
,, Other countries ...	335,000	685,000	+ 350,000
Total	3,823,000	8,609,000	+ 4,786,000
Carbons of all kinds for electro-technical purposes.—			
From Austria-Hungary ...	212,000	221,000	+ 9,000
,, Germany	467,000	580,000	+ 113,000
,, France	12,000	81,000	+ 69,000
,, Switzerland	4,000	11,000	+ 7,000
,, United States ...	70,000	54,000	— 16,000
,, Other countries ...	2,000	2,000	—
Total	767,000	949,000	+ 182,000

The classes of electrical and allied goods, in which Italy is making most progress as an exporter, are shown in the following comparative figures of her exports (special trade) in 1911 and 1912 :—

Dynamo electric machines, weighing 1,000 kg. or less.—			
To Argentine	570,000	666,000	+ 96,000
,, France	218,000	265,000	+ 47,000
,, Brazil	133,000	202,000	+ 69,000
,, Austria-Hungary ...	44,000	108,000	+ 64,000
,, Other countries	301,000	624,000	+ 323,000
Total	1,266,000	1,865,000	+ 599,000
Copper, brass or bronze wire more than ½mm. diameter.—			
To India and Ceylon ...	189,000	292,000	+ 103,000
,, Tripoli	2,000	99,000	+ 97,000
,, Egypt	5,000	20,000	+ 15,000
,, Other countries	4,000	27,000	+ 23,000
Total	200,000	438,000	+ 238,000

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	1911. Lire.	1912. Lire.	Inc. or Dec. Lire.
Boilers (including multitubular).—			
To Argentine Republic ...	188,000	183,000	— 5,000
,, Tunis	10,000	112,000	+ 102,000
,, Tripoli	5,000	50,000	+ 45,000
,, Brazil	82,000	59,000	— 23,000
,, Chili	165,000	122,000	— 43,000
,, Other countries	324,000	160,000	— 164,000
Total	774,000	686,000	— 88,000
Steam engines, stationary, without boilers.—			
To Argentine Republic ...	487,000	730,000	+ 243,000
,, Spain	Not	152,000	—
,, Tunis	stated	113,000	—
,, Russia	separately	33,000	—
,, Portugal		29,000	—
,, Other countries	367,000	199,000	—
Total	854,000	1,256,000	+ 402,000
Steam engines, semi-stationary, with boilers.—			
To Argentine Republic ...	89,000	346,000	+ 257,000
,, Tripoli	—	397,000	+ 397,000
,, Roumania	81,000	372,000	+ 291,000
,, Egypt	115,000	213,000	+ 98,000
,, France	4,000	119,000	+ 115,000
,, Russia	87,000	111,000	+ 24,000
,, Other countries	410,000	518,000	+ 108,000
Total	786,000	2,076,000	— 1,290,000

N.B.—25 lire = £1.

APPLICATION OF ELECTRICAL DRIVING TO EXISTING ROLLING MILLS.

By L. ROTHERA, B.Sc., of London.

(*Abstract of Paper read before the* Institution of Mechanical Engineers, *April 24th*, 1914.)

The question of the application of electrical driving to existing rolling mills is of the greatest importance to a country such as this, where steel, iron, and other metal works have been in existence for a considerable number of years, and where the question is, not the best method of putting up new works, but the best method of making an old works so economical that it can compete successfully with those in other countries, which have only within a later period entered this field, and have, consequently, been able to make use of the latest advancements of science.

There are a number of conditions, any one of which may prove the deciding factor in the employment of electricity. The most important are economy of running, improved drive, considerations of space, and greater use of existing plant.

Dealing first with the economy of running, that is, cost of power per ton rolled, the first main factor is the cost of electrical energy. This cost may vary within extremely wide limits, in some cases being as low as 0.1d. per B.O.T. unit, and in other cases rising up to 0.7d. or even more. The figure first mentioned has been, and is being, obtained by the employment of blast-furnace or coke-oven gas to drive gas-engines for generating electric power.

The charges made by supply companies vary within wide limits; the lowest figure for power in a steel works which has come to the author's knowledge is about 0.33d. per unit, and the highest is in the neighbourhood of one penny per unit. With the lower cost there is little, if any, advantage in putting down a central station in the works themselves to be driven by steam. When waste heat is available for raising steam, or exhaust steam can be employed, the conditions are quite altered, and the cost of generation is so low that any works would be well advised to install their own generating plant.

The fact that motors have been put down, even in cases where power has to be purchased at the highest price mentioned above, goes far to prove that the electrical drive has been judged the most satisfactory one to employ.

The second factor on which the economy largely depends is the lay-out of the works. In the case of a works which has extended very largely, and in which the boiler plant has remained centralised, the quantity of coal used per year in making up for pipe-line losses and wastage is a very heavy factor in the year's coal bill. As against this wasteful condition must be taken the economical method of electric power transmission, which is carried out by small cables which can be put up anywhere quite out of the way, and in which no loss takes place when the machines, to which they convey power, are not running, and only a small fraction of loss when the machines are running.

Under anything like reasonable conditions of electric power cost the auxiliary plant in a mill is also much better driven by means of electric motors.

A third factor is the class of work done. The steam-engine, whilst efficient on steady continuous load, becomes very inefficient on a widely fluctuating load. In the case of an electric-motor drive, the efficiency over a very wide range, say from half-load up to 100 per cent. overload, varies only to the extent of 2 or 3 per cent., whilst the steam consumption of an engine may vary as much as 7 to 9 per cent. The greater the fluctuations in the load, the more advantageous the electrical drive appears. As the load on a rolling mill is, in most cases, a very variable one, the economy of the efficient electrical drive is apparent. In the case of a sheet mill the average power-demand represents approximately one-third of the normal power of the motor, whilst the peak load represents practically 50 per cent. overload on the motor. This mill is driven by a 600 H.P. motor when working under normal conditions. The efficiency of the motor at one-third load would be approximately 4 per cent. less than at full load, whilst the steam consumption of the engine would be increased at least 12 per cent., not taking into account the losses in the pipe-line, which are considerable.

The cost of supervision of the running plant can be very materially reduced where motor drives are employed, owing to the fact that, if properly designed, the motors will run for long periods without any attention whatever, and inspection once a day is all that is necessary. One electrician, to start up the plant in the morning and to pay a periodical visit to the motors throughout the day, can deal with almost any number of machines.

With regard to the question of improved drive, it is an undisputed fact that a steady uniform turning moment produces a better class of rolled material than is the case with a pulsating drive. In this respect the electric motor with its uniform constant torque is far superior to the engine.

With the even turning moment, there is not the same tendency for the rolls to fail to grip the metal; also, due to the overload capacity of the motor being in excess of that of an engine, the drop in speed whilst the metal is passing through the rolls is much less with the electric drive than with the steam drive, resulting in a higher average speed of rolling and consequent increased output from the mill.

The modern electric motor will take a momentary peak load up to 100 per cent. in excess of its normal load without any risk of injury, and is thus enabled to pull a piece of metal through the rolls when an engine of the same normal power would fail to do so, with consequent delay and loss on the mill. The effect of this property of the electric motor is that, when making a comparison between the cost of an electrical, as compared with a steam drive, it is not fair to take into account the same size of steam-engine and of motor. A larger normal horse-power of the steam-engine would be necessary to give the same maximum turning moment conditions which the motor would give.

The effect of this increase in the size of the engine is to raise the normal horse-power as compared with the average horse-power required, with resulting worse steam consumptions. In addition, larger steam-piping would be necessary to enable the full overload to be carried, which again would prove an increased source of loss.

Another point in favour of the electrical drive is the ease of starting and stopping the plant, so that, in many cases, it is found practicable when the mill is idle for short periods to shut the motor down, whereas, it would not be considered in the case of a steam-engine on account of the labour involved.

A further feature in favour of the electrical drive is the ease of determining for every pass the power being demanded to roll, making it possible materially to reduce the energy consumption per ton rolled.

Considerations of space are of particular weight in the case of works situated in the centre of the town; this condition is of such importance that, in many cases, it has been able to overcome the drawback of a heavy charge for power. When the size of a motor of moderate speed is taken and compared with the size of an engine of the same power, this advantage is very clearly seen. In one instance the replacing of the old beam-engine by the motor saved a floor area of over 40 square yards, and this space has been fully utilised by the installation of additional machinery.

The question may arise as to how increased power can be obtained. Under suitable conditions by the installation of electrical plant an extremely large saving per annum can be made, and at the same time a very largely increased power rendered available from steam already existing. An actual instance of this is the case of an iron works where three of the main engines and all the auxiliaries were replaced by motors of very considerably increased power, and a central station was put down for supplying them. Since the electrification no fewer than eight hand-fired boilers have been permanently knocked off.

There are a very large number of considerations which must be very carefully weighed before deciding that the electrical drive will not pay, even if the actual cost of electricity consumed per ton rolled is in excess of the corresponding steam cost; for instance, the cost of maintenance of an electric

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motor is very much less than that of a steam-engine. The cost of supervision is also very much less. In one case where electrical plant replaced steam drives, the reduction in the oil consumed was 80 per cent. When, in addition to the above advantages, the absence of steam-pipes with their cost of upkeep, and the cleanliness of the electric drive, are remembered, there are many cases where these advantages alone outweigh, perhaps, a slightly increased capital cost, or a power consumption cost, which would appear to be more than that of a steam engine, when taking into consideration only the steam consumption of the engine.

Although an engine may be designed to be very economical indeed on full-load, the conditions of a rolling mill are such that this condition is practically never obtained, and the only fair method of comparing the electrical with the steam drive, is to take, in the latter case, the cost of coal per annum, and not the steam consumption of the engine, and contrast this with the power cost of the motor.

When it is considered that in the last five or six years more than 200 mills have been driven electrically in this country, such drives covering every type of mill in use, the future appears to hold out the prospect of the electrical drive displacing every other.

With regard to the advisability of using continuous current or three-phase current as the source of power, this question is often settled by the conditions of supply prevailing in the district, but, if it is a question of generating power in the works themselves, very careful consideration must be given on account of a number of reasons. The cost of cables is very frequently the deciding factor as to whether three-phase or continuous current shall be employed throughout the works.

In the case of the main mill drives, the chief question in deciding the type of motor is whether a variable speed is required or not. If a variable speed is required, as in the case of merchant mills, then a continuous-current motor, which can have its speed varied by means of shunt regulation of the field, is the simplest and best proposition for the purpose. If a constant speed only is required, as in the case of a sheet mill, the disadvantages of the three-phase motor are not so great, although, even in such cases, it is very often a question as to whether the saving in efficiency by putting in the continuous-current motor does not outweigh the greater cheapness of the three-phase motor.

The only method of reducing the speed of a plain induction motor is by inserting resistances in the rotor circuit, and the loss in these resistances is proportioned to the fall in speed. To reduce the speed 10 per cent. on full-load, as is necessary to utilise beneficially the flywheel energy, a loss of 10 per cent. would occur in the resistances. On some tests which were taken on a sheet mill it was found that the average loss due to the slip resistance losses represented between 13 and 15 per cent. of the total energy consumed, and when to this loss is added the transmission loss, which may equal another 5 or 10 per cent., the advisability of installing a direct-coupled continuous-current motor to such a mill must be very carefully weighed.

This question of providing a variable speed on the drive has led to the evolution of a large number of alternative methods of enabling a three-phase motor to work at a variable speed without the serious loss in efficiency which occurs in the case of an ordinary three-phase induction motor. The method employed has usually been the addition of an auxiliary piece of apparatus which modifies the existing three-phase motor and causes it to act more on the lines of a continuous-current shunt-wound motor.

Modern practice to a great extent has gone in favour of the direct-coupled drive, even for speeds as low as those required for a heavy sheet mill, namely 32 revolutions per minute. In a great many cases the extra cost of the low-speed drive is more than counterbalanced by the gain in efficiency due to the absence of any form of transmission losses between the motor and the mill. Taking the case of gearing, the losses taking place in a single reduction represent about 5 per cent. of the power which is being transmitted. In the case of a rope drive, the loss occurring in the ropes remains practically constant whether the ropes are running light or transmitting power, and the loss can be taken as 5 per cent. on the normal power which the ropes are designed to transmit. In this respect, therefore, the rope drive is not as efficient as a gear drive, although it certainly provides a very nice flexible medium between the motor and the mill.

Belt drive has not been very extensively employed in this country for this class of work, but it has been used on the Continent for powers up to 1,800 H.P. normal and 3,600 H.P. maximum with, it is believed, very satisfactory results.

Where the question of converting an existing mill has to be considered, the method of drive adopted must be dependent, to a very large extent, on the lay-out of the works. The length of time for which the mill will have to be shut down in order to make the change-over is a consideration which, in a number of cases, lends itself to the introduction of a rope drive, as the foundations of the motor and the motor itself can be put down without interfering with the working of the mill, and the mounting of the rope pulley for coupling to the mill is very often a matter of quite a short time. In the case of a direct-coupled drive, a method of avoiding stoppage is a long intermediate spindle introduced between the pinions and the motor, this spindle spanning the space taken up by the existing engine. It is sometimes possible to put down the motor on the side remote from the steam-engine, and in some cases it is possible, by the introduction of another gear wheel, to put the motor in position without shutting down the plant.

When applying a motor drive to a mill, an important consideration is the weight of flywheel to be adopted. It is not safe to assume that the flywheel, as fitted to the existing engine, will be satisfactory in the case of a motor drive, since, when an engine is overloaded, it will slow down until finally it will stall. A motor, of course, does not act in the same way, but has a pre-determined drop in speed from no-load up to the maximum load which it can safely stand, and if this maximum load is exceeded, the circuit breaker or switch protecting the motor will operate, shutting down the plant. In the case of the engine, the whole of the stored energy in the flywheel is available to pull the metal through the rolls in conjunction with the engine, whilst in the latter case, assuming a 20 per cent. fall in speed between no-load and 100 per cent. overload, only 36 per cent. of the stored energy is available, after which the motor ceases to drive, leaving only the flywheel's stored energy. It can generally be stated that the flywheel will require to be heavier in the case of the motor drive than in the case of the engine. The heavier the wheel, of course, the steadier the power demanded from the motor, but here again the question of cost is the deciding factor, and a fluctuating load will not prove harmful to a motor provided that the maximum peaks are not excessive. This is clearly shown by the success of the motors employed for reversing mill work—where they are coupled direct to the pinions and take the full power demanded by the mill.

Discussion.

In the course of the discussion, Mr. Frank Anslow said that the author had under-rated the strength of their enemy, the steam-engine. To be fair, it was necessary to compare the modern electric plant with an up-to-date steam plant, which was far superior to the obsolete types. Also, it was not only possible, but by no means uncommon, to meet with an efficient electric drive. Dr. B. Wiesengrund said that a cast-steel flywheel running at 12,000 ft. per minute, between the motor and the pinion, had been running on a 600 H.P. plant for many years without ill-effects on the gear, and the loss in gearing could be safely put at about 3 per cent. A 100-ton flywheel on the mill shaft could often be replaced by a 10-ton wheel on the motor shaft, saving in friction loss and first cost, and obtaining a better efficiency from the high-speed motor. The gear ratio might be as high as 10 : 1. He objected to worm gear.

Mr. Arthur Holman emphasised the advantages of accurate measurement offered by the electric drive, which had enabled him to find out where excessive strains were put upon the metal in the course of rolling, especially cold-rolling, and to correct the processes accordingly. In this respect the electrical drive had an enormous advantage. Other speakers gave examples of successful conversion of steam-driven rolls to the electric drive. Mr. H. Brown said that in order to keep the flywheel within commercial limits, the D.C. motor should be compound-wound to drop in speed quickly on overloads. With a polyphase motor resistance had to be inserted in the rotor circuit, and this was best done with a contactor regulator, which could be set to act in 1-50th second, and could be arranged to limit the impact to the motor so that shut-downs through tripping of the main switch on overload were avoided. His experience with worm gears was that they were satisfactory when properly designed; their low inertia was an important consideration in a reversing mill. Mr. A. H. Hall showed how in cold-rolling brass a sudden increase in the power required could be observed with the electric drive, indicating the point where annealing became necessary.

The author replied to the points raised.

Imagination Run Riot.—Reverting to the gross misstatement (it might be described more strongly) made by *Electrical Engineering* concerning our publication of the B.E.A.M.A. resolutions, our kilowatt contemporary in making its grudging apology in its issue of October 1st, indulges in a display of Pharisaic phylacteries obviously with a view to proclaiming that it is "not as other men," and insinuating that it is more scrupulous in its procedure than ourselves. It does admit a "misunderstanding" of the facts and says "*apparently*" it was wrong in thinking that the Electrical Review "had been *definitely* informed." Certainly and very obviously our contemporary was quite wrong. With swelling pride "the engineering journal of the electrical industry" says: "We ourselves took the obviously correct course of asking the Association's permission," and being asked to delay publication "we *naturally* thought" that other papers had been asked to do the same. But why naturally think anything of the kind—who is to blame for that? When our contemporary is informed that the Electrical Review also itself took the "obviously correct course" of communicating with the Association but was not asked to refrain from publishing the resolutions perhaps it will indulge in a little more natural thinking and take what journalistically is the "obviously correct" and honourable course.

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FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

DENMARK.—Amongst the classification decisions notified by the Customs Department are the following :—

Electrical smoothing irons with two metal contact screws for connecting to a conductor, pay 0·10 öre per kilog.

Telephone switchboards with cast-iron base, and apparatus fixed in a wooden framework and including metal parts, ebonite contacts, covered conducting wires, bone keys, &c., pay 7½ per cent. *ad valorem*.

öre = 1s. 1½d.

UNION OF SOUTH AFRICA.—The revised Customs Tariffs have now been published in the Government Gazette. The following comprise such alterations as are of interest to the electrical trade.

Three per cent. *ad valorem* is the general rebate leviable on :—

Railless cars (electric) worked by current from overhead wires.

On the following goods there is a rebate of the whole of the duty on manufactures of the United Kingdom and of reciprocating British Colonies.

Formerly the general duty was 15 per cent. *ad valorem*, with a rebate of 3 per cent. *ad valorem*, under the British Preferential Tariff.

Freedom from duty is now granted in the case of catalogues or price lists of foreign firms, addressed to importers, merchants or manufacturers or public libraries and similar institutions.

ARGENTINE REPUBLIC.—The Government have amplified their Regulations in respect to the temporary admission, without payment of import duty, of goods not intended for sale. Such goods must be re-exported within a period of six months, and a bond entered into for the amount of the Customs duty otherwise leviable on them. They include machines and apparatus destined for experimental purposes; also scientific instruments and apparatus, accessories of the profession or trade of the traveller.

Pneumatic Coal Transportation.—In a paper read before the South Wales Institute of Engineers, Mr. Edward Koenings describes a pneumatic method of transporting small coal such as peas, nuts, &c., which has met with some success. It is pointed out that the pneumatic principle has been applied in practice to the transport of seed, more especially corn, but only recently to coal.

Small coal is not so uniform in size as a certain quality of grain, and it usually contains moisture which makes its suction into pipes difficult; a secondary trouble is the dust created. The difficulties have, however, been surmounted and the author proceeds to describe actual plants in use. One of these in Austria deals with 200 tons of coal in 24 hours, and consists of a double-cylinder air-pump by means of which a vacuum of about 10 in. is created in a cylindrical receiver, and two cylindrical dust catchers. To the lower part of the receiver three flexible suction pipes lead, each fitted with an isolating valve, so that either pipe may be used, two being for unloading wagons and one leading to a coal storage 200 yd. away. Each suction pipe is fitted at the inlet with a special nozzle, and when in use the incoming current of air carries the coal and dust to the receiver, where the coal falls by its own weight into the lower conical part; it is ejected through an automatic airtight discharge valve on to an automatic weigher, and subsequently passed to a receiving bunker. The dust in suspension in the receiver is drawn into the filters, collected and discharged in the same way as the coal, the remaining air passing through the pump for discharge to the atmosphere. The only attendants required by the plant are the engineer in charge of the pump and the workman looking after the suction nozzle. The only important mechanism is the pump, and the operation is dustless so far as the workers are concerned.

Another (German) plant is described for feeding 15 boilers. In this case the coal is taken from barges 160 yards away, lifted 110 ft. and passed through the type of receiver mentioned, weighed and deposited in bunkers by means of a belt conveyer. In this instance no filter is used, as a dry lubricating air pump is installed, and dust collectors are fitted between the receiver and pump.

The pump is rated at 2,400 cb. ft. per min.; the capacity of the plant, 26 tons an hour from the barge, is increased to 45 tons if coal is taken from a bunker close to the receiver. The power required is 65 H.P., and the attendance from two to three men; it is estimated that the plant will pay for itself in two years. Another plant deals with 8 tons an hour, over 100 yards and a height of 70 ft., and requires 18 H.P.

The writer considers this form of transport most useful over a distance of 100 to 300 yards; the limiting size of coal he fixes at 2 in., and of moisture at 6 per cent.

He suggests that there may be scope for such apparatus for lifting small coal from the pit bottom to the surface.

Assault.—At Salford, on October 1st, Dominic Bradley (37), was sent to prison for six weeks for an assault on Raymond G. Branston, a foreman employed by the British Insulated Co., who had discharged prisoner from his work for drinking and neglecting his duties.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

20,006. "Electric railway signalling." J. Gardner. September 21st.

20,009. "Thermo-piles and thermo-electric measuring apparatus." H. Hausrath. September 21st.

20,015. "Lamp or lantern bodies, such as head-lights for motor-cars and electric lamps for use therein and method and means of mounting same therein. H. Scholey. (Stephen Grebel, France.) September 21st.

20,020. "Combined electric torch and magnetic compass." J. Aikman, Jun. September 22nd.

20,033. "Electric illuminated signs with changeable letters and figures." H. Kipling and E. Sydney Megson (trading as James Dowling & Co.). September 22nd.

20,053. "Filaments for incandescent electric lamps." F. H. S. Shepherd and H. T. Marks. September 22nd.

20,077. "Control systems for electric motors." British Thomson-Houston Co., Ltd. September 23rd. (General Electric Co., United States.)

20,094. "Conduits for electric conductors." J. W. Manley and W. J. L. Sandy. September 23rd.

20,099. "Manufacture of armour plate." S. O. Cowper-Coles. September 24th.

20,100. "Manufacture of metallic reflectors." S. O. Cowper-Coles. September 24th.

20,101. "Solder." S. O. Cowper-Coles. September 24th.

20,102. "Process for the electrolytic coating of sheets and plates with other metals." S. O. Cowper-Coles. September 24th.

20,103. "Manufacture of electrolytically-coated metal plates." S. O. Cowper-Coles. September 24th.

20,104. "Process for the electro-deposition of iron." S. O. Cowper-Coles. September 24th.

20,129. "Electric rheostats." British-Thomson Houston Co., Ltd. September 24th. (General Electric Co., United States.)

20,130. "Rheostats." Igranic Electric Co., Ltd. September 24th. (Cutler Hammer Manufacturing Co., United States.) (Complete.)

20,131. "Rheostats." Igranic Electric Co., Ltd. September 24th. (Cutler Hammer Manufacturing Co., United States.) (Complete.)

20,132. "Dimmer handle friction-grips." A. H. Curtis & Igranic Electric Co., Ltd. September 24th. (Complete.)

20,133. "Electrical contacts." Igranic Electric Co., Ltd. September 24th. (Cutler Hammer Manufacturing Co., United States.) (Complete.)

20,137. "Circuit arrangements for writing-telegraphs." A. G. Bloxham. September 24th. (Telepantograph G.m.b.H., Germany.) (Complete.)

20,146. "Prepayment electricity meters." Landis & Gyr, Ltd. September 24th. (Convention date, September 25th, 1913, Switzerland.) (Complete.)

20,156. "Sparking-plugs for internal-combustion engines and the like." T. McClements. September 25th.

20,168. "Electric-magnetic switch." F. G. Brettell. September 25th. (Apple Electric Co., United States.) (Divided application on 10,251/14. April 25th.) (Complete.)

20,176. "Method of and apparatus for electric welding and article produced thereby." O. C. Knipe & R. H. Read. September 25th. (Complete.)

20,236. "Sparking-plugs for internal-combustion engines." B. Hopps. September 26th.

20,238. "Electric current relays." J. Schiessler. September 26th. (Addition to 20,320/11. Convention date, April 16th, 1914, Austria.) (Complete.)

20,239. "Electric regulating rheostats." L. Boothman. September 26th. (Complete.)

20,248. "Electrical resistance thermometer." Cambridge Scientific Instrument Co., Ltd., & W. H. Arthorpe. September 26th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

20,269. Telegraphic Systems employing the Morse Codes. W. S. Steljes. September 8th.

20,821. Vapour Electric Apparatus. E. E. Darmois & M. A. E. Leblanc. September 15th.

20,853. Electrically-operated Winch specially applicable as an Ash Hoist. G. F. D. Campbell. September 16th.

22,420. Electric Distribution Systems. British Thomson-Houston Co. (General Electric Co.) October 24th.

26,268. Contacts for Closing Electric Circuits used on Railway and like Tracks. J. E. Colas. November 15th. (November 15th, 1912.)

29,239. Means for Reducing the Influence of the Line Capacity in Actuating Electric Apparatus at a distance by means of pulsations obtained from a source of continuous electric current. E. H. Widegren & K. A. Widegren. December 18th. (December 30th, 1912.)

1914.

1,561. Illuminated Signs. H. L. Nicholls. January 20th. (Addition to 29,995/12.)

3,371. System of and Apparatus for Wireless Electrical Operation at a Distance of a Type-printing Machine. F. De Bernochi. February 9th. March 15th, 1913.)

4,677. Protective Metal Covering for Prismatic Shades. Holophane, Ltd. & O. A. Mygatt. February 23rd.

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Vol. LXXV.] CONTENTS: October 16, 1914. [No. 1,925.

	Page
Reconnoitring	513
Censorship	515
Rubber	515
Large Induction Motors: Some Features of Mechanical Design, by G. Moores (*illus.*) (*continued*)	515
The Brolt Electric Engine Starter for Motor-Cars (*illus.*)	517
Trading in Italy, by O. E. Allo	518
The Coolidge High-Power X-Ray Tube (*illus.*)	519
Correspondence—	
Financial Control of Electricity Supply Undertakings	520
War and the Enemy	521
Special Constables	521
"Advertising and Progress"	521
British Manufacturers and German Trade	521
No Reply	521
New Electrical Devices, Fittings and Plant (*illus.*)	522
Legal	523
War Items	524
Business Notes	527
Notes	532
City Notes	534
Stocks and Shares	535
Electric Tramway and Railway Traffic Returns	536
Market Quotations	536
Earth Connections, by F. H. Davies (*illus.*)	537
Co-operation in Trade Expansion, by C. A. Baker	539
Adventures of a G.E.C. Man at the Front	540
The British Association in Australia	541
Relation of the Automobile to the Central Station	542
The Use of Liquid Ferro-Manganese in the Steel Processes, by A. Sahlin (*illus.*)	543
The Strength of Flat Plates	544
New Patents Applied For, 1914	544
Abstracts of Published Specifications	544
Contractors' Column	Advertisement page xviii

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4, Ludgate Hill London, E.C.

RECONNOITRING.

GRADUALLY the views held by many men respecting the duration of the war have been undergoing a change. In the early days there were many to speculate and generally optimism was allowed to influence their calculations. The daily course of events has, however, brought us face to face with actual facts which we could not know before because the experience was entirely new to us all, and this course of events, with its stern realities, has led to the revision of estimates in many directions. Those who made merry at the alteration in the German time-table and expected appropriately to celebrate the coming of Peace at Christmastide care not now to venture an opinion, preferring to study the latest chapter in the story of failures and successes of the forces. Of course this changed demeanour is not in the least indicative of a lessening conviction as to the ultimate result of the combined efforts of the Allies to stamp out the Curse of Prussian militarism and to avenge the shameless and cowardly crushing of the most gallant little State of modern history by the overgrown bully who was spiteful because there came a flat refusal instead of an abject compliance with his domineering demands. The determination to win, and the conviction that we shall achieve this end for which we have set out, are as strong as, indeed stronger than, ever. But the utterance of over-optimistic views has given place to interested and serious study of such matters as strategy, the preparation of new forces, and to a strengthening of known or discovered weak places. We know now that the end is not yet, and believe that patience, endurance, sacrifice in blood and money, sacrifice national and personal, will be required of us if we are going to carry this struggle right home to such a conclusion as shall prevent a recurrence a few years later.

It has been impossible for men who have watched the splendid engineering progress of Belgium during the past decade or two to refrain from expletives of no superficial kind—expletives expressive of the deep emotions representing intermingling of anger and sympathy at the calamitous havoc wrought by the invader. The works of Cockerill and Carels Frères, the steel works achievements and the gas and oil engine building operations, the name of Greiner—these are but reminders of the Belgian industries which have for years marked out these progressive Allies of ours, industries which have now been laid low. There will not be an engineer in either hemisphere, unless he be a German, who will not have an emotion of sympathy for Adolphe Greiner and those of whom he is a type in this period of unparalleled catastrophe. May time decree that a grander, greater, still more progressive Belgium shall arise from the present ashes—ashes saturated with the blood of heroic sons who beat back the tyrant foe while protecting the home threshold, whose daughters were maltreated, and helpless babes even bayonetted, as coming generations shall be taught to know, to make a holiday for the friends of German Militarism *cum* Kultur; that there will be a penalty to pay for the events of 1914 we have no shadow of doubt.

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It sounds almost blasphemous to turn from such crimes to so sublime a truth as this: "There is a Divinity which shapes our ends rough hew them as we may." Nemesis shall shape the end in this case, whether it use therefor the forces of the Allies or some other instrument. Already Germany is degraded in the eyes of the world and of the ages that follow; already Belgium is given a permanent place of honour in the history of small nations, and sparkles as a gem of the first water in the crown of European heroism—but at what a cost! Poor Belgium! The annals of the nations are enriched by your example, by the stout resistance you have dared to offer to superior forces. You had so little to gain by refusal! And compliance would have been so easy!

But we have digressed—we did not set out with the intention to pay our homage—the fall of Antwerp must be our excuse, if any need for apology exist. Let us return without further ado to the consideration of the new attitude that necessarily affects so many of our thoughts as we resign ourselves to a protracted campaign. Take the one subject of the effect of the long war idea upon industrial and trade affairs. When we awoke one day to find that our fleet had practically shut Germany off from the markets of the world, the first idea suggested was concerned with the necessity for taking immediate action to profit from such an unthought of state of affairs. In the early ideas of a war of short duration, the phrase "Capture Germany's Trade" was produced, suggesting that if we did not go in pursuit immediately, without waiting for scheme, or plan or thought, the British Navy would have come home again, and German exporting would have resumed its normal course before we could do anything. We have written much ourselves, and, alas! have read more, much more, on this subject during these two or three months, and what do we think now? What does the British electrical manufacturer think? Have we, has he, caught this elusive creature that we call German electrical trade? Nay, may we go further and ask, has he done anything to track the wily courses of this Elusive Pimpernel? He has most assuredly grumbled about its practices long enough—does he now hold that it is not worth trying to secure?—or, peradventure, it may perform the interesting feat of capturing itself—who knows? Some appear to fancy that will be the upshot of this present little affair in which Europe is engaged.

Now, to our mind the answer to these and other questions of the same kind is to be found in the fact that passing months have taught us all to think longer and deeper thoughts about this matter of the war on German trade, and as we have become convinced that German trade is not going to be won by two or three tricks of the prestidigitateur any more than German militarism is going to be crushed out by a battle here and a battle there, so we have got down to the solid fact that German electrical trade has got to be won not by childs' play practices or by glib or sanguinary chatter, or in an exciting lassoing chase, but by the laying out of very definite plans, by the organisation of very strong forces suited to the contest, and by the adoption of far-seeing measures which shall not merely ensure a few orders here and there now, but shall retain trade connections of value, and prevent a recurrence as far as possible of unscrupulous domination of our markets long after the sword has been sheathed again. Perhaps it is because there has been too much flippancy or superficial or vindictive reference to this matter that so little appears to have been done in the electrical world. Perhaps it is that the time is not ripe for far-reaching action. Perhaps everybody is waiting for somebody else. Perhaps there is somewhere a solemn opinion that this thing is going to work itself out all right in the end. We believe that all of these reasons are factors in the situation, but there are others as well. Factories and office organisations are deprived of men who are away with the Forces. Money never easily raised for industrials of our class, can be raised less easily still at such a time. The Home market is free, and the absence of German competition therein, save as far as stocks affect the position, may be furnishing new business; also we are having replaced here contracts which Germany once had, but cannot now execute; so that our hands *may* be full—we do not say that they are. During the war the business in the United Kingdom, and from some Continental countries too, if we can handle it, may come without any "capturing." As regards the outer markets where Germany has been so powerful, though our German competitors are now absent, the demand also is affected by the same circumstances as have stopped the competition. Not a country in the world has been free from financial anxiety since this war broke out, and some of the big markets abroad that we really ought to have set about capturing electrically years ago, are of little immediate use save for what we may describe as absolute essentials. The more our cousins of the United States get seriously down to their own relation to the altered trading position due to the absence of Germany, the more do they find themselves up against the consequences of the state of financial chaos into which all the world was flung in the late July and early August days of this year.

One American authority at least is advising his readers to devote attention to the possibilities that lie awaiting attention "right here" in these United States, rather than go away on a wild-goose foreign chase. That attitude, if it continues, may suit us very well. We cannot feel that it represents the definite majority policy of American traders, but it suggests that the difficulties are dictating a wait-and-see policy so far as some of them are concerned.

Without further prolonging this article to go into some of the other factors in the situation which go to make the British electrical trade seeker hesitate in regard to the course of action best fitted to the circumstances, we think that we have said sufficient to suggest that while we are bound to benefit from the present position while it lasts, the "capturing" of outer markets and their permanent holding at a later date will require measures which will call forth all the ingenuity, skill and resource, foresight and organising ability, tact and diplomacy, of which the British electrical and allied manufacturers are possessed, and possibly some assistance from higher quarters too. We do not withdraw one word of our previously expressed view concerning the effect of the present world-wide revulsion against all things German. It will last for years; but it may not always last. That price and some other things may tell five years after the war ends or, perhaps, earlier, there is little present reason for doubting. But with the growing conviction that hostilities must long continue, and that the longer they continue the worse it will be for German industries, while there is some justification for the absence of panic-aggressive action on the part of our firms, we should like to hear of more long-thinking, whether individually or collectively, with the object of securing that British electrical industry shall be substantially and permanently advantaged by the opportunity that now offers itself. It is true, as we have said, that there are markets that cannot yield great immediate results while the financial stress and strain continue to stop new commitments on a large scale, and to render some buyers, even of bread and butter lines, insecure, but if we do not make an attempt worthy of a great British industry, then it will be to our everlasting reproach, and probably it will lead to our finding ourselves more easily beaten by the new Teutonic competition if, and when, it comes.

We are not suggesting that British electrical manufacturers are asleep, or that they have done nothing. Our postbag and our conversation with men have told us differently. Here and there individual firms are considering their own personal relation to the position: how they can in their works make this or that new line, or what prospects their particular make of article would have in a new market and how to get it known there. But there is a danger of their losing heart, because of the inevitable weakness of individual policy and isolated action. They could so much more readily and more hopefully consider the difficulties and the prospects and the financial and technical problems involved if they could only put their heads together. There is a desire on the part of some to act in co-operation, or, at any rate, to study matters in a preliminary way in conference, and we trust that as the weeks pass by this disposition may grow and something useful may be done. We should like to recommend that a public meeting of the electrical industry be summoned at which the position shall be laid before us all by an authority, and discussed seriously and in detail, and without feelings of undue reserve and suspicion.

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Cable Censorship.

In another column we publish the text of a protest lodged by the Commercial Cable Co. with the U.S. Government on August 14th last, as well as their circular of August 20th, sent to "Our Patrons" with a copy of the protest, both of which have just reached our hands. We are rather surprised at the attitude adopted by a company gaining a large share of its revenue in Great Britain, where every freedom and facility for trading is given, and one is forced to the conclusion that steps are being taken with a view to upsetting regulations and restrictions which, in the opinion of our Government, are necessary to the safety and well-being of this country. In view of the sympathy with our cause so freely expressed by the American public, we cannot bring ourselves to believe that they are not prepared to assist us by abiding by these regulations. The wording of the protest and the circular is neither well chosen nor in good taste, and, in fact, the passage: "We do not believe our patrons wish their cablegrams to be subjected to the espionage of Government officials, not even on rare occasions" is, we consider, highly offensive and improper. As a neutral country the United States is bound to censor messages and abide by the prohibitions issued here.

We are aware that traffic has suffered a considerable reduction, and that by reason of the cutting of the German cables in the English Channel, the Commercial Co. has probably suffered severely, as it works the ends of the cables at New York, but in view of the company being also registered in Great Britain, we consider that an attempt to bring about conditions inimical to our interests as a nation cannot be too severely reprehended. It is the privilege of an Englishman to grumble, but he has shown by the unstinted support he has given to his King and country that his patriotism is deep-seated, and he will bear with equanimity whatever inconvenience is imposed on him by reason of his obligations to the Government, and will not increase its burden by upholding agitations tending to prejudice measures taken for the safety of the Empire.

Rubber.

All things considered, the rubber market has kept up a firm front during the last few weeks, and there has been a steady and sustained demand met with from Russia, while there is much irregularity about the way in which arrivals are coming forward from the Near East. The general home buying is naturally of a more restrained character, for the war is beginning to make itself felt, but there are reasons for thinking that there will be a pretty steady consumption nevertheless. There is, however, hardly any reasonable likelihood of prices being advanced much because, so far as is to be gathered from the latest returns from the plantations, the production remains big. The activities of German warships in Eastern waters, while temporarily checking arrivals here, cannot have any bearing upon the output of the plantations, and at the most can only cause shipments to be delayed for a time. Hence the probabilities favour a rather easy market when temporary conditions at present ruling, such as the Russian demand and the holding up of quantities afloat, disappear. Fine hard Para continues to command a big premium over plantation grades.

Amongst the industries which it is hoped ultimately to extend largely in this country as one of the results of the war is that of rubber. There is, of course, a very large amount of capital already invested in it, but it is certain that there is ample room for extensions at the expense of Germany, and it is here that efforts are to be made. The tire trade alone represents an important branch in which Great Britain might cut a very much more important figure than is the case to-day, and this to the advantage of British interests at home and abroad. Rubber flooring is another department to which it is probable that particular attention may be given, and the efforts of the Rubber Growers' Association to introduce this material are likely to receive considerable support, for they have made a number of presentations of rubber flooring material to hospitals, and the successful adoption of rubber in this connection is bound to extend. The trade was practically a British one, but Germany has lately been cutting into it. Only a few days ago the flooring given to Guy's Hospital was officially presented, covering an area of 750 sq. yards, and weighing 30,000 lb., while about 200 sq. yards are shortly to be presented to the Children's Hospital in Great Ormond Street.

The declaration of rubber as conditional contraband came as a surprise, but it was necessary to prevent the enemy being in a position to secure supplies of material which would be of the greatest use to him in the manufacture of motor tires, waterproof ground sheets for troops, hot-water bottles for the Red Cross, and so forth. There is no doubt that the Germans have been making strenuous efforts to secure supplies of rubber, but the action of our authorities will put a spoke in their wheel, though to some extent no doubt Holland and Denmark can be looked upon as sources of supply.

According to information received by the Malay States Information Agency from the Government of the Federated Malay States, the exports of plantation rubber from the Federated Malay States for July amounted to 2,971 tons, compared with 1,781 tons in the corresponding month last year and 2,306 tons in June last.

Appended are the comparative statistics for 1912 and 1913:—

	1912.	1913.	1914.
January	1,218	2,131	2,512 tons.
February	1,212	1,757	2,364 ,,
March	1,379	1,737	2,418 ,,
April	1,020	1,626	2,151 ,,
May...	1,007	1,225	2,069 ,,
June	1,029	2,005	2,306 ,,
July	1,204	1,781	2,971 ,,
Total	8,069	12,262	16,821 ,,

LARGE INDUCTION MOTORS: SOME FEATURES OF MECHANICAL DESIGN.

By G. MOORES, B.Sc. Eng.

(*Continued from page* 508.)

Rotors.

Whilst in the case of stator cores strength is perhaps of secondary importance, in the case of rotors it is a matter for primary consideration on account of the stresses caused by centrifugal force. The various parts of a rotor which have to be considered separately from the point of view of strength are the spider, the shaft, the endplates, the core punchings, and the winding.

Spiders.—These are generally made of cast-iron, unless their peripheral speed exceeds the safe limit for this material —about 100 ft. per sec.—when cast-steel should be used. If the speed approaches the limiting speed for cast-iron, the question of the stresses due to the centrifugal force in the punchings should be considered, and generally the punchings should, in this case, be made self-supporting, so that the only stress in the spider is that caused by centrifugal force due to its own weight. It is important in designing spiders of large diameter to make sure that there can be no undue initial strains set up in the cooling of the casting. This is taken care of in several ways. Sometimes the hub is split longitudinally in two or three places equally spaced apart, and the segments are either bolted together or keyed separately on to the shaft, in which latter case the splits may be filled in with some soft metal such as lead. When this method is adopted it is important to do the keying in such a manner that each segment of the hub takes its proper share of the load. Another method used is to split the rim of the spider and tie the segments together afterwards by means of steel links bolted on. A third type, usually adopted in the case of heavy spiders which are intended to act also as fly-wheels, is the "built-up" spider, consisting of two or more sections

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bolted together. Still another method consists in making the spider without a rim and with heavy arms widened out at the ends to form a seat for the core punchings, as shown in fig. 21.

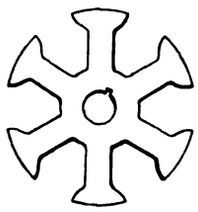

Fig. 21.

The arms of spiders are sometimes made of an oval or similar section—which gives a neat appearance to the finished rotor—but more often they are of T, or H, or similar sections, and webbed together, as in fig. 22, which illustrates the rotor of a 350-B.H.P., 180-R.P.M. motor by

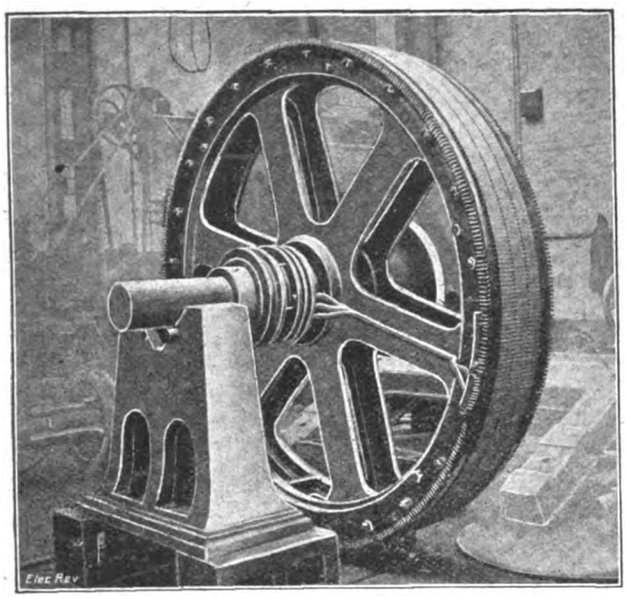

Fig. 22.—Rotor of Vickers 350-H.P. Motor.

Messrs. Vickers, Ltd. Fig. 23 shows the spider—cast in two sections — of a 605-B H P. 53-R.P.M. motor by Messrs. Siemens Bros.

End-Plates.—The primary function of end-plates is, of course, to hold the core punchings together under pressure, but provision is frequently made in them for other purposes

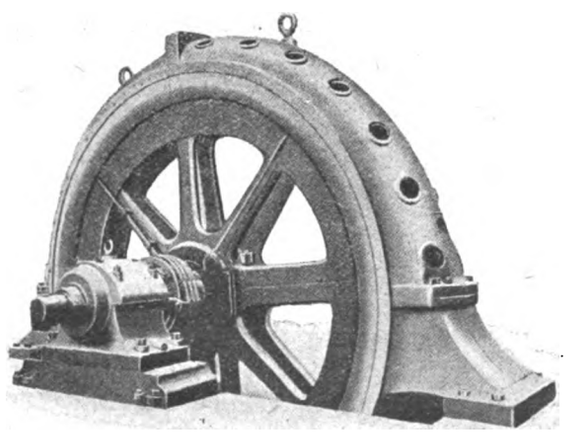

Fig. 23.—Siemens 605-H.P. Motor.

such as supporting the rotor winding, balancing the rotor, or carrying fans. Fig. 24 shows a typical cast-iron end-plate and coil support cast in one piece with recess for balancing purposes, and with fan blades bolted on.

For low or moderate peripheral speeds end-plates are usually made either of cast-iron or forged from wrought iron bar if their shape is suitable. For high speeds they should be made of cast-steel and designed of ample proportions in view of the difficulty of obtaining steel castings of this nature free from flaws.

Windings.—It is necessary to secure the windings of high-speed rotors mechanically to ensure against (1) change of shape of the end connections, and consequent disturbing of the balance of the rotor; (2) lifting of the coils due to centrifugal force.

The possibility of change of shape of the end connections, or of damage to the insulation due to vibration, may be

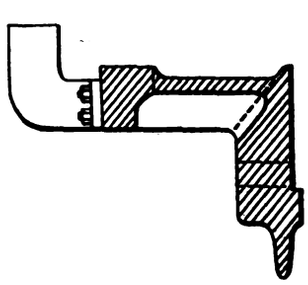

Fig. 24.

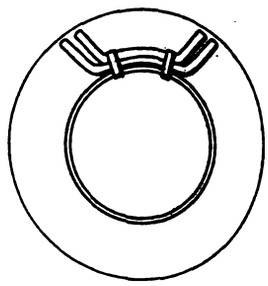

Fig. 25.

prevented, as a rule, by the provision of suitable coil supports. It has been the practice of many firms in the past to build machines without coil supports, especially machines with a large number of poles, as these are usually of comparative slow speed, and have short end connections. But experience has proved that it is better to be on the side of safety, and the practice is growing more common of providing all large motors with some form of coil support.

The prevention of lifting of the coils, due to centrifugal force, is usually accomplished by banding the winding with hard steel wire or similar material. Fig. 25 shows a method of securing a winding of the hand-wound "concentric" type by tieing down the coils to a support by small bands of phosphor-bronze strip, and fig. 26 a winding of the "barrel" type secured by a band of steel wire. The stresses in such bands should be ascertained, and an

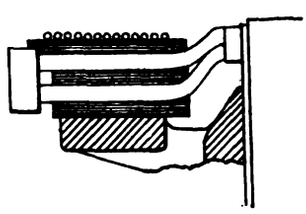

Fig. 26.

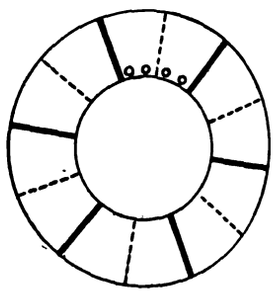

Fig. 27.

ample margin of safety allowed. These stresses may be calculated from the formula: Stress in band (lb. per sq. in.) $= W R N^2/18{,}400 A$, in which W = weight of end connections under band in lb., R = mean radius of end connections in feet, N = R.P.M., A = area of section of band in square inches, W may be taken as half the difference between the weight of copper in slots and the weight of the whole winding. The formula is derived as follows:—

Centrifugal force on end connections $= W v^2/g R$ lb. where v is in ft. per sec.

Bursting force on band $= W v^2/2 \pi g R$ lb.

Stress in band $= W v^2/2 \pi g R A$ lb. per sq. in.

$$= \frac{W}{2 \pi g R A} \times \left(\frac{2 \pi R N}{60}\right)^2 = \frac{W R N^2}{18{,}400 A}.$$

This formula neglects the stress due to the weight of the band itself. In the case of high peripheral speeds it becomes necessary to include this self-stress, for which a convenient expression is obtained as follows:—

Stress in band due to its own weight $= W R N^2/18{,}400 A$ as above, and

$W = 2 \pi R . 12 . A w$ where w is the weight in lb. per cb. in. of the material composing the band. Therefore stress

$$= \frac{2 \pi R . 12 . A w R N^2}{18{,}400 A} = \frac{w R^2 N^2}{245} \text{ lb. per sq. in.}$$

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If the band is of steel this expression becomes $R^2 N^2/940$ lb. per sq. in., where R is the radius in feet of the band and N the R.P.M.

This stress, of course, must be added to that obtained by the previous formula to obtain the actual total stress in the band. As hard steel banding wire may be obtained with an ultimate strength of 200,000 to 300,000 lb. per sq. in., a total working stress of 20,000 to 30,000 lb. per sq. in. may in this quality be safely allowed.

Rotor Cores.—The methods of constructing rotor cores are very similar to those used in the case of stator cores. There are the same two classes—keyed and bolted. In the case of rotors fixed with key rings the punchings are usually secured to the spider against centrifugal force by means of dovetails. When this is done, however, and when the punchings are in segments instead of complete circles, all the stress due to centrifugal force on the core punchings comes on the spider as well as that due to the weight of the spider itself, and in the case of high-speed rotors this becomes objectionable. One method of obviating it is to pin the punching segments together so that they shall form complete circles, and be self-supporting against centrifugal force. It is advisable in this case to determine the stresses which are set up in the core, as these may easily be excessive. The following is an example of the method of doing this from a particular machine recently built. The case is one of a 2,000-H.P. motor with a normal speed of 500 R.P.M., but the stresses are calculated for an overspeed of 625 R.P.M.

The rotor diameter was 59 in., and its length 21½ in. net. Each circle of the rotor punchings was divided into six segments, and the segments were interleaved in the building of the core, that is, each layer of punchings had its joints midway between those of the adjacent layer. The core was bound together by means of steel pins, four of which passed through each segment, as shown in fig. 27.

The total weight of iron was 6,295 lb., mean radius 2·11 ft., mean peripheral speed 141 ft. per sec. The total weight of the winding was 464 lb., mean radius 2·39 ft., mean peripheral speed 160 ft. per sec. The stresses set up in the core are calculated as follows:—

Centrifugal force of iron $\frac{6{,}295 \times 141^2}{32{\cdot}2 \times 2{\cdot}11} = 1{,}830{,}000$ lb.

Do. copper $\frac{464 \times 160^2}{32{\cdot}2 \times 2{\cdot}39} = 154{,}000$ lb.

Total centrifugal force 1,984,000 lb.

Total bursting force $1{,}984{,}000/2\pi = 314{,}000$ lb.

Depth of iron below teeth 6·45 in.

Bursting stress at joint in core = P/area

$$= \frac{314{,}000}{10{\cdot}25 \times 6{\cdot}45} = 4{,}750 \text{ lb. per sq. in. } (a)$$

Bearing pressure on bolts 1 in. diameter

$$\frac{314{,}000}{2 \times (\cdot5 \times 20{\cdot}5) \times 1} = 15{,}300 \text{ lb. per sq. in.}$$

$$\text{Bursting force per segment} = \frac{314{,}000}{10\frac{1}{4} \times 56} = 548 \text{ lb.}$$

Radial distance from bolts to mean diameter of core = 3·17 in.

Bending moment on segment due to eccentricity of bolts = 548 × 3·17 = 1,740 in. lb.

Modulus of section $b\,h^2/6 = z$.

$$\text{Stress due to bending } 1{,}740/z = \frac{1{,}740 \times 56 \times 6}{6{\cdot}45 \times 6{\cdot}45}$$

$$= 14{,}000 \text{ lb. per sq. in. } (b).$$

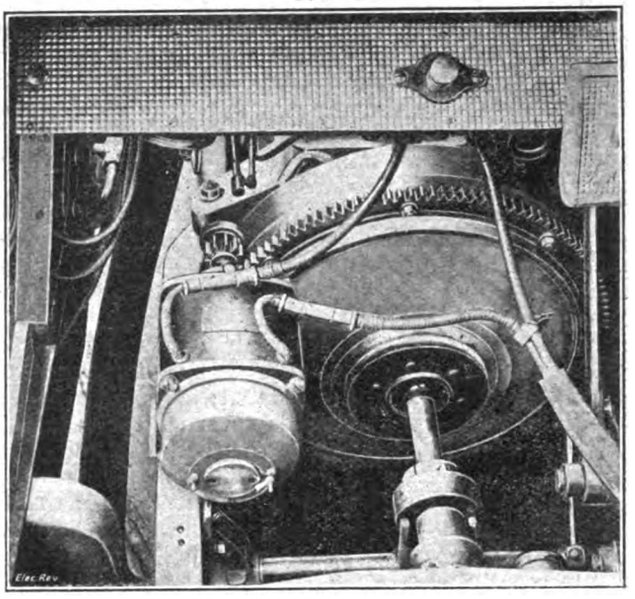
Total max. stress on punchings = $(a) + (b)$ = *18,750* lb. per sq. in.

This figure is slightly in excess of the actual stress, as there is also a second bending stress—opposite in direction to the first—which is due to the centrifugal force on the segment, but this is so small as to be practically negligible.

(*To be continued.*)

THE BROLT ELECTRIC ENGINE STARTER FOR MOTOR-CARS.

When describing, about a year ago, the various electric engine starting arrangements which have been introduced for use on petrol motor cars to render the old starting handle a thing of the past, we pointed out that the majority of such devices were designed to act through the engine flywheel, the latter being rotated either by a friction pulley or through toothed gearing. While gearing gives a more positive drive, the question of bringing the driving pinion into and out of mesh with the toothed ring formed on the periphery of the flywheel has formed a problem on which much thought has had to be centred, and one which has resulted in the introduction of a number of different methods, some more or less complicated. On the same occasion, we mentioned that one of the simplest and most effective, in so far that the engagement and disengagement of the pinion were effected entirely automatically, was that adopted on the electric engine starter made by Messrs. Brolt, Ltd., of Birmingham, for



Brolt Starter on Talbot Car.

whom Messrs. Brown Bros., Ltd., London, are the sole selling agents.

Although the principle—that of the pinion automatically winding itself into mesh when the current is switched on to the motor, and throwing itself out of gear when the engine is started—is still the same, the method of its application has, as a result of protracted experiments and experience, been somewhat modified, so that the appended particulars of the latest model may not be without interest.

At first, the extended end of the armature spindle had cut on it a spiral thread; the driving pinion, which was loose on the spindle, had a similar, internally-cut thread, the arrangement being somewhat akin to the familiar small Archimedean-screw hand drill. In its latest form, the driving end of the armature spindle is enlarged and made hollow, the interior being cut with a quick-pitch screw-thread. The pinion which drives the flywheel is cut from a solid piece of steel with an extension, which enters into and slides in the hole in the armature spindle. Two helical keys are cut on this extension and really act as part of a screw-thread, that engages with the internal thread of the armature spindle. The armature, being series-wound, accelerates rapidly when the current from the battery is switched on by pressing down a pedal, thereby inducing a spiral tendency in the pinion, which, because of its inertia,

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tends to lag relatively to the acceleration rate of the armature. As the spindle only drives the pinion through the medium of the screw-thread, the pinion is instantly drawn—towards the electric motor—into engagement with the flywheel teeth, travelling axially along until it is against the end of the armature spindle, when the whole rotates solidly together and drives the flywheel. A spring is provided to prevent any shock when the pinion reaches the end of its travel, which latter is so arranged that when the pinion is screwed home against the end of the spindle it is fully in mesh with the teeth on the engine flywheel. At the other end of its travel it is out of engagement and clear of the flywheel teeth.

As soon as the engine takes up the running, the flywheel commences to over-run the pinion, which causes it automatically to unscrew itself out of engagement, in which position it remains until again required to turn the flywheel. It will readily be seen that there is thus no risk of damaging the teeth of the gears on engaging, as no driving power is exerted until the pinion is fully into mesh, it simply floating on the screw-thread until the end of the travel has been reached.

When the Brolt starter was first introduced, some fear was expressed that the vibration resulting from a car travelling over bumpy roads might cause the driving pinion to have a slight movement along the armature spindle and so bring the teeth into contact with those on the periphery of the flywheel, to the detriment of both. In order to avoid any risk of this kind, and also to prevent any damage, even if the starter be operated while the engine is running, a small friction disk is now attached to the outer side of the driving pinion, and the flywheel is turned with two peripheries, one being of a slightly larger diameter than the other. The friction disk—which is out of contact when the engine is running—comes into action about 3 mm. before the teeth engage, so that should the starting pedal be operated with the engine running the pinion is returned to its out-of-engagement position before the teeth can come into mesh. The starter is operated by a pedal switch, which simply consists of a circuit controller, the bringing in and out of mesh of the driving pinion being, as already described, independent and entirely automatic.

The starter, which is a specially-constructed series-wound motor, is adapted to be operated in conjunction with a 44-amp.-hour battery; it is made in three sizes, *viz.*, No. 1, six volts, suitable for small engines up to 2,000 cubic centimetres capacity; weight 20 lb.; No. 2, twelve volts, for average power cars, weight, 26 lb.; and No. 3, twelve volts, for high-compression engines, or those having a greater capacity than 3,500 cubic centimetres, weight 32 lb. It is stated that the No. 2 machine, which has a 12 to 1 gear ratio, will turn an engine of 3,200 cubic centimetres cylinder capacity, at a speed of 140 revs. per min. at a current rate of 50 amps. at 12 volts, and that the torque efficiency is well over 70 per cent. It is further claimed that, if the engine is well tuned, *i.e.*, if the carburation and ignition are correct, the starter will set the engine running in not more than three-quarters of a second, the discharge of current from the battery being thus reduced to a very low figure.

The Argentine Republic.—The imports of electrical goods into the Argentine Republic during the six months ending with June last, according to some official figures just to hand, attained a value of only £960,000, as compared with £972,000 in the corresponding half of 1913.

Fire.—An outbreak of fire occurred on October 8th at the premises of Messrs. Halliwell & Co., electricians, of 43, Thomas Street, Manchester, and caused some damage on the ground floor.

TRADING IN ITALY.

Trade and Retail Supply.

By O. E. ALLO.

As manager of the Italian branch of a prominent British firm, manufacturers of electrical machinery, fittings, electric light accessories, bells, telephones, etc., I should like to give a few hints which I trust will be found useful to intending "pioneers" in that country.

In this branch of the business it is useless "starting in a small way." The trade generally looks with suspicion on the foreign firm with a "small back office," and before trading on extensive lines the contractors want to assure themselves that the newly started business is one that intends to establish itself permanently. They insist on seeing and trying the goods offered, and therefore it is absolutely necessary to have a well-appointed show-room, preferably on some main thoroughfare, and to keep a good stock; in other words, repeating myself from a previous article, "One should start in a way commensurate to the home standing and appear to be what one intends to be taken for."

In Italy suppliers to the trade also carry on retail business, and do their own wiring, installing of motors, plant, etc.

Trade Supply.

This is where the past German competition was felt most acutely, and very keen it has been. Amongst other items I can mention that of lampholders, which can be bought at 2s. a dozen (in dozen lots), and switches at 3s. 6d. per dozen; naturally these goods cannot be compared to our English equivalents, and although they are acknowledged to be "rubbish," are used practically exclusively all over the country. There are, however, ways of getting over these difficulties. With regard to lampholders, which I could not sell at less than twice the amount mentioned, noticing that all German fittings were made of ⅜in. tubing, I ordered all mine of ½in. tubing and fitted them with lampholders included in the price, with the result that I received orders for them for brackets, and spares, etc., as well as reducing nipples. The tumbler switch is difficult to sell, but I find that the electrical contractor is more to blame than the public, and for a firm doing their own wiring there would be no difficulty in selling these, provided they were of a flat pattern. Generally speaking, all switches, plugs, fuses and ceiling roses of a voluminous character are not wanted, the tendency being for flush or semi-flush work.

Bells, cells, annunciator boards at about 5d. to 7d. a number, and cheap telephones with imitation real wood cases, would sell well.

Retail Sales and Wiring.

This is by far the most profitable part of the business, as in Italy there are no standard prices; one charges "according to circumstances" with the usual "bargaining" from the customer, and for a foreign firm with goods not too well known in the Italian market it is the best way of introducing them. I should perhaps mention here that the contractors themselves have great difficulty in getting their workmen to put up or work with new materials.

In Italy the Edison screw lampholder is exclusively used (except on board ship installations), and with it a cheap gallery with a wide-mouthed globe. I adopted a way of fixing our ordinary bayonet holder globe direct on these Edison screw holders, giving a much more pleasing effect and saving the cost of the gallery with which we could not compete. This was very much appreciated.

As for fittings manufactured locally, these are mostly of an ornamental nature, floral or statuary.

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I recollect that a firm bought a few of my cast polished brass brackets intending to copy them; the results were very indifferent, and I believe could not be supplied at my price. I heard nothing more about the matter. Generally speaking, Italian made fittings cost more than German ones, and are not much, if any, better in quality as a competitive article.

In making up catalogues and prices a thorough knowledge of the Italian market must be known so that the articles can be priced, not only according to "cost price landed," but according to the local competition as well, so as to have throughout a "profitable average" price.

Customs Charges.

This is a more complicated business, but with the knowledge of how these are made by the authorities a great saving can be effected. Charges are made per weight, various metals and other materials paying fixed charges according to the nature of their component parts, finish, etc. Some of these charges are:—

	Per Quintal (2 cwt.)
Iron fittings, not lacquered or polished ...	7s.
Iron fittings, lacquered or polished	15s.
Polished copper, brass	60s.
Copper, brass, gilt or otherwise plated	100s.
Switches, plugs, fuses	30s.
Aluminium	120s.

In the case of fittings made up of different materials or finishes, such as different metals, partial gilding, aluminium parts, etc., these are charged at the "highest rated material" rate. This is very important, and by sending fittings dismantled, packing similar metals together, one can save a good deal of expense, time and trouble with the authorities, and it would well repay to install an assembling shop, which would also come in handy for the purpose of repairing and overhauling goods which arrive in a "tired condition" after the long and no doubt rough journey, even if packed with "special care."

Delivery.

This is the *bête noire* of the representative abroad, and causes more ill-feeling than anything else, both with customers and with the people at headquarters. Italians as a rule keep very little stock and then order after they have made the sale; therefore it is to the great advantage of a firm to have the reputation of having always a good stock.

In the case of a large business, a large amount of goods can be left in bonded stockrooms, the payment of the Customs charges being made as they are taken out.

Heating Apparatus.

Heating apparatus in large towns sells fairly well on account of the mode of heating the houses. The housing is done on the flats principle, and the rents include the cost of heating, which is done by steam or water pipes turned on by the janitor. The law compels the heating to be started on the 15th November and shut off on the 15th of March, keeping up during this period a maximum heat of about 17 degrees C. The owners keep strictly to their rights regardless of the state of the weather, so that during this period there is always a good demand for heating apparatus; furthermore, the price for lighting in Milan, for instance, being 3d. per KW.-HR. and from 1½d. to 2½d. per KW.-HR. for power, allows the average public to use these. Cooking apparatus, flat irons, kettles, etc., sell fairly well, but the most successful apparatus are those with interchangeable resistances, as nearly all cities and towns have as many as four different voltages.

There is also a fair field for electro-medical apparatus, Crookes tubes for X-rays, etc., these up to the present having been bought chiefly from Germany and America.

THE COOLIDGE HIGH-POWER X-RAY TUBE.

At the recent exhibition of apparatus in connection with the Clinical Congress of Surgeons, Messrs. Harry W. Cox & Co., Ltd., exhibited examples of the Coolidge pure electron discharge X-ray tube, which appears destined, by its power, flexibility and cool running, to supersede all other known types of Rontgen ray tubes. The superiority of the new tube depends on the method by which negative electrons are produced; instead of ionising some of a small amount of residual gas left within the bulb, the latter is exhausted as completely as possible and the discharge current is purely thermionic in character.

In an ordinary X-ray tube (fig. 1) a high tension discharge produces a stream of negative electrons. The velocity of these cathode rays increases with the p.d. applied to the tube and with the degree of exhaustion. High-velocity discharge pro-

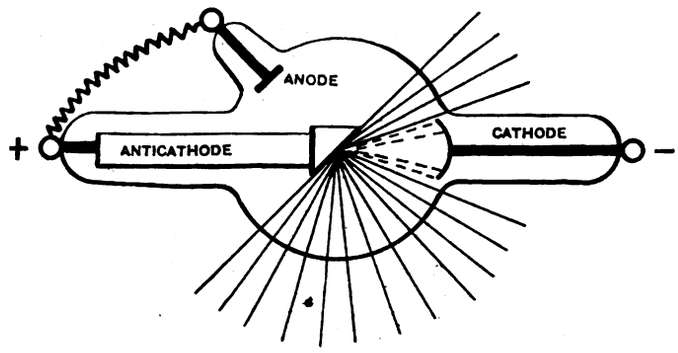

Fig. 1.

duces "hard" Rontgen rays of great penetrative power, while cathode rays of comparatively low velocity produce "soft" rays of diminished penetrative power. In (hitherto) standard focus tubes, the cathode is of aluminium and concave in form, in order that the rays may be focussed on the anticathode which is of copper-, nickel- or silver-backed platinum and sometimes water-cooled. The quantity and quality (hard or soft) of X-rays produced depend simply on the number and violence of negative electron impacts on the anticathode of the tube. Within limits, the quantity of cathode rays depends on the current flowing through the tube while the quality of the rays depends on the applied p.d. The sole source of electrons in an ordinary X-ray tube is, however, the residual air in the bulb and, since only a small, well-defined fraction of this residual gas lends itself to ionisation, it follows that up to this limit, a small variation in applied p.d. varies greatly the number of electrons produced whereas, beyond this limit, a great increase in potential has little effect.

These characteristics render an ordinary X-ray tube inflexible and limit its output. Up to a certain point both output and hardness of rays vary with the applied potential and the vacuum must be regulated so that that potential which gives proper velocity for the hardness desired also gives the right number of electrons for the desired quantity of rays. Most of the heating in an ordinary X-ray tube is due to collisions between electrons and particles of residual gas, and, as the tube warms in service, the potential must be reduced, making the rays softer, or the output must be allowed to increase greatly, making the tube hotter still. At low discharge currents the vacuum gradually improves, making the X-rays harder or more penetrating, and at high discharge currents there are very rapid vacuum changes, sometimes in one direction, sometimes in the other. If a heavy discharge be maintained for more than a few seconds, the target becomes red hot and gives off so much gas that the tube may have to be re-exhausted. Volatilisation of the copper backing of a standard target commences if the latter be allowed to reach bright red heat. Many tubes fail by chipping and cracking of the bulb glass in the zone around the cathode. The focal spot on the target often wanders rapidly or is permanently displaced by a heavy discharge, and no two tubes are exactly alike in their electrical characteristics, which are generally far from ideal in that the penetrating power of the X-rays changes with the magnitude of the discharge current. The breakdown voltage of a standard tube is much higher than the running voltage, so that from periodically intermittent current, even of constant potential, there is produced a very heterogeneous bundle of primary Rontgen rays.

The use of a solid tungsten target, which can be run continuously at white heat, eliminates the trouble due to occluded gases and volatilisation of copper, but the use of a tungsten cathode makes the tube "cranky" unless the cathode be incandesced by working (sustained, in the interim, by gas admissions). This fact and the fact that most limitations of the standard X-ray tube are traceable to the use of gas, led to the use of high vacuum bulbs, "thermionic" production of cathode rays being substituted for production of electrons by bombardment of the cathode with positive ions. The idea of using a hot cathode in a Rontgen tube is not new, but Coolidge claims to be the first to apply the principle success-

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fully in a vacuum so good that positive ions do not play an essential part. In Lilienfeld and Rosenthal's tube, for instance, current from a low-voltage source passes from an auxiliary hot cathode to the anode, and thus furnishes the positive ions which, by their bombardment of the main cathode, liberate electrons from it: without the positive ions, there is no means provided to get electrons from the main aluminium cathode. It is possible, however, to eliminate positive ions by sufficiently freeing the bulb and electrodes from gas, and Langmuir has shown that a hot tungsten cathode in a very high vacuum yields electrons continuously at a rate determined by the temperature and unaffected by high voltages up to at least 100,000 volts. For application in the fields of radiography and fluoroscopy, Coolidge has devised a tube with a pure electron discharge, a satisfactory method of focusing and a very heavy target sufficiently freed from gas.

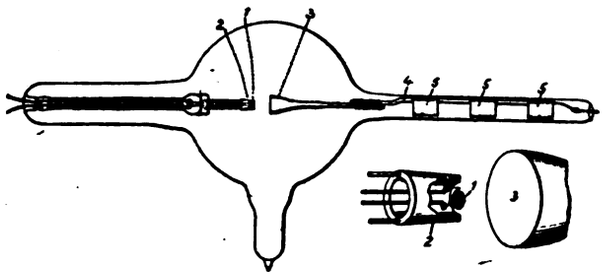

Fig. 2.

Fig. 2 illustrates a focus tube of the new type. Instead of being a few microns, the pressure within the bulb is only a few hundredths of a micron, this low value being attained by a preliminary firing of the tungsten anode and molybdenum support in a tungsten tube vacuum furnace and by substituting a Gaede molecular pump for ordinary mercury pumps. The tube-to-pump connection is large and short and in the later stages of exhausting, a heavy discharge current is maintained for an hour or so, while the bulb is fan-cooled. High vacuum and the elimination of occluded gases are essential.

The cathode consists of a tungsten spiral 1, which can be electrically heated and is mounted within a focusing cylinder 2 of molybdenum, tungsten or other refractory metal. The heated portion of the cathode serves as the source of electrons and the focusing ring or cylinder assists in shaping the electric field round the cathode so that the desired concentration of rays on the target shall result. The target 3, which serves also as anode, consists of a single piece of wrought tungsten (weighing 100 gms. and being 1.9 cm. in diameter at the end facing the cathode). It is bound by molybdenum wire on to a molybdenum rod 4. Molybdenum rings 5, riveted on to the latter, support the anode and prevent too much heat reaching the seal of the leading-in wire. Operation is satisfactory only when the vacuum is so high that 100,000 volts produces no discharge, so long as the cathode is cold.

In the particular tube to which the subjoined data refer, the cathode filament consisted of 5½ turns of 0.216 mm. wire, 33.4 mm. in length, forming a flat spiral 3.5 mm. in diameter. The filament is heated by current from a small battery B, fig. 3,

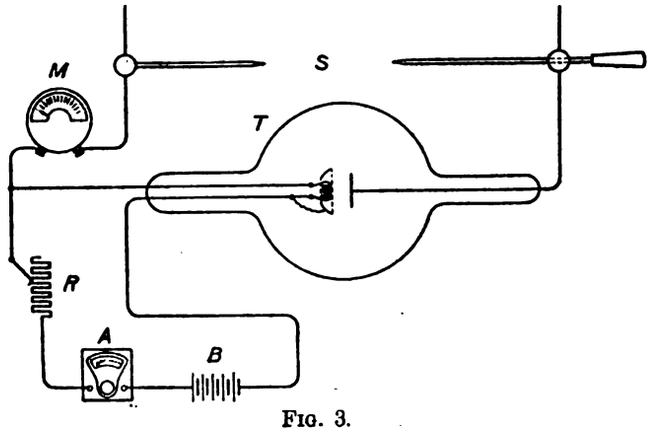

Fig. 3.

which is well insulated from earth, since it is connected to the high-tension circuit. By aid of a variable rheostat R the filament current can be regulated from 3 to 5 amps., corresponding to from 1.8 to 4.6 v. drop in the filament and filament temperatures from 1617° to 2267° C. The adjustable spark gap S is connected across the bulb terminals in series with a milliammeter M. Both S and R can be adjusted and M can be read from behind the lead screen shielding the operator. Owing to the possibility of maintaining much greater Rontgen ray intensities than heretofore, it does not follow that precautions, shown to be sufficient for work with the old tube, will be adequate for the new one.

The Coolidge tube suppresses any current in the direction which does not make the hot filament the cathode. It can therefore rectify its own current from an alternating source, but the maximum permissible energy input is then reduced by loss of complete rectifying power, due to electron emission from the hot focal spot on the target. In tubes which do not focus, the energy input which the tube will rectify completely, can be increased to any desired amount, simply by increasing the anode surface.

The discharge current through the tube depends primarily on the filament temperature and responds instantly to changes therein. In a particular case, values of discharge current and filament temperature were as follows, the equivalent spark gap varied from 4 to 14 cm. and the focal spot was practically constant at 3 mm. diameter:—

Filament temperature.		Discharge current.
1920° C	Absolute	1 milliamps.
1980° C	,, ...	1½ to 2½ ,,
2020° C	,, ...	3 to 5 ,,
2060° C	,, ...	5 to 10 ,,
2100° C	,, ...	11 to 20 ,,
2120° C	,, ...	20 to 34 ,,

These figures show the current to be practically independent of voltage and always the saturation value. The characteristics of the tube give no evidence of positive ions; the discharge is purely thermionic in nature. If the filament temperature be low, the number of electrons and the saturation are small. Increase in impressed voltage then causes no increase in current, but simply increases the hardness of the X-ray emitted. At higher filament temperatures, the special density of negative electricity in front of the cathode (in effect a back e.m.f.) exerts a surrent limiting effect which can, however, be avoided by suitable design and at the high voltages employed in Rontgen tubes.

The quantity and quality of rays from a Coolidge tube can be varied independently and over a wide range. Varying the resistance R (fig. 3) controls the filament temperature and hence the quantity of cathode rays (assuming the high-tension supply to be of adequate capacity). Adjusting the applied p.d. controls the hardness of the X-rays emitted, but not their quantity, since this depends entirely on the filament temperature. Since there are no residual gases in the bulb, heating is very slow and 20 or 30 milliamps. can be passed through the tube indefinitely with no change in the tube characteristics. As much as 100 milliamps. can be passed for a few seconds and the equivalent spark can be adjusted to anything from 1 to 10 inches, so that one and the same tube can be adapted to such different requirements as those of screening an abdomen or photographing a child's hand or a horse's leg.

The focal spot on the anode is practically constant in size and fixed in position. The elimination of secondary cathode ray bombardment (evidenced by the fact that the glass does not fluoresce) practically eliminates the useless and disturbing X-rays which emanate from the glass of an ordinary tube. Since the full supply of electrons is available directly the discharge circuit is closed, the starting and running voltages of a Coolidge tube are identical. When excited from a source of constant potential, the new tube yields a strong homogeneous bundle of primary Rontgen rays, even though the discharge be intermittent. The only limitation to the new tube is the ionisation of tungsten vapour and consequent decrease in tube resistance which occurs when the input is so great and the focusing so sharp that the target is volatilised at the focal spot. The new tube has many important applications in radiographic, diagnostic and therapeutic work and its introduction marks an important advance in Rontgen-ray apparatus and practice.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Financial Control of Electricity Supply Undertakings.

To the majority of engineers and managers of fairly large municipal electricity undertakings, the suggestion of unity of control contained in the report to the Southampton Corporation by such "experts" as Sir John Snell and Mr. Ernest Edmonds, F.C.A., should be most welcome. From time to time correspondence has appeared in these columns on this subject, but it does not seem to have been thoroughly thrashed out. Only those who are in charge of electricity departments where part of the administration is carried on under the supervision of the engineer and manager, and part under the Council's accountant, know the difficulties, and more often the chaos, which arises through such an arrangement.

The enormous amount of correspondence entailed (which to a great extent is unnecessary) is a sheer waste of time and terribly inefficient, and it would take up too much of your valuable space to enumerate the different ways in which certain work overlaps, and consequently is duplicated. Further, it is very well known that information is not always too cheerfully given by some Council accountants.

A manager of a commercial department of a local authority ought to have all the financial details at his finger ends, including the collection of moneys. Many a bad debt of considerable magnitude has been incurred through one department not knowing

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what the other has been doing with consumers, and when the electricity department is consulted it is generally too late. Keeping in close touch with consumers is of vital importance, and for this to be done thoroughly the remedy is obvious.

Where there is a competent accountant in charge of the office (as is the case in most undertakings), why should not the work be done by the electrical staff, who, by the way, are better acquainted with all matters appertaining to consumers than the practically disinterested employés who are only partly engaged on electricity work in the accountant's department?

The disunited control of commercial undertakings should be condemned by all progressive municipal authorities; one great obstacle to smooth working is the amount of unnecessary red tape introduced by most borough treasurers, which only mars the progress which managers are striving their utmost to achieve.

The true functions of a borough treasurer's or accountant's department should be the systematic internal checking of the books and records, by which they would accomplish far more useful work. It is admitted that the details as to the raising of loans, &c., should be under the direct control and supervision of the borough treasurer or accountant.

If the Corporation of Southampton adopts the suggestion offered by the engineering and financial experts before mentioned, then municipal engineers and managers of electricity undertakings should endeavour to follow this progressive lead, and do all in their power to convince the members of their Councils that unity of control is absolutely essential to efficient working, and so bring about a much needed reform in the administration and management of this particular branch of revenue-producing undertakings.

Efficiency.

War and the Enemy.

After perusing the correspondence in the local Press, I was naturally keenly anticipating your remarks regarding the contract which some two or three weeks ago was ratified by the Leeds Corporation for the large steam generating plant.

It is regrettable that a large body like the Leeds Corporation are so lacking in patriotism and a sense of justice as to help the alien enemy by placing a contract to the magnitude of £30,000, one-third of this contract only being placed with a British firm; the remaining two-thirds being captured by firms controlled by German capital.

However, we understand that the Kaiser has recently ordered a very large number of Iron Crosses, and we have no doubt the members of the Leeds Corporation Electricity Committee will be receiving this decoration from the Kaiser in due course. Or can it be the fact of their placing this contract with German firms ensures the city of Leeds immunity from an attack of Zeppelins? However, perhaps the electors of Leeds may have something to say next month, and we wonder if, when the plant is formally started up in the year 1918, the Corporation will have a full dress ceremonial and invite the German Royal family to be present.

Yorkshire Tyke.

[As the contract referred to was placed before the end of July, we fail to see what bearing it has upon the question of trading with the enemy.—Eds. Elec. Rev.]

Special Constables.

While agreeing with you that it is inadvisable to say too much about the special precautions being taken for the protection of electric generating stations, it may be as well to let undesirable persons who may contemplate an "unauthorised" entry into these premises know that they will not be "up against" the ordinary middle-aged "special."

As an illustration of only *one* precaution taken here (and to my knowledge in other stations as well), we have taken three shooting ranges fixed up in the generating station and sub-station subways for practice with the ·38 revolvers served out to our guards. Nearly every man is now proficient in the use of these weapons.

The object of this note is to suggest to any station engineer—if there is one—who has not armed his guards, to do so at once.

A. Hugh Seabrook, *General Manager.*

Borough of St. Marylebone
Electric Supply.
October 12th, 1914.

"Advertising and Progress."

On my own behalf allow me to express my kind thanks for Mr. Barham's appreciation of Mr. Hole's and my book. Mr. Hole is, unfortunately, away as a volunteer in the Russian Army, or, perhaps, his facile pen might have explained more clearly to you why "Advertising and Progress" was written.

If your reviewer came into contact in connection with advertising with as many people as I do, the question would never have been put. The average business man in this country still regards advertising as an increased cost on the article, and not as part of the selling expense. I could quote you chapter and verse for this statement, which is certainly not made at random. It is the most difficult thing possible to make the manufacturer or trader realise that advertising is part of the selling machinery, and replaces more obsolete methods of distribution, and replaces those methods at less cost than previously.

John Hart.

London, W.C., *October 12th*, 1914.

British Manufacturers and German Trade.

There are endless letters on this subject, but few with any tendency to improve existing conditions.

In the first place, to depose the Germans after the war we must be prepared with cheap and good articles to take the place of their specialities, and above all, the British manufacturers must revolutionise their methods of sale.

In the past British manufacturers have made little effort in their selling organisations as compared to Germany and America, and under existing conditions the people that will mostly benefit will be the Americans, as they appreciate and are prepared to make good use of this opportunity.

It is unfortunate that in this country with many manufacturers there is continual friction between the salesmen and the works staff, arising chiefly from the cause that British firms have, in many cases, not admitted the superior position that salesmen should occupy, and the attention that their expression of opinion should receive; this friction is aggravated by the continual employment of correspondents at the works who have never been salesmen, and who never knew or never will appreciate the difficulty of developing and promoting trade, and immediate efforts should be made to improve in this direction if we are to succeed.

We have also the growing system of manufacturers who are short of funds, or who pay no heed to their sales organisations, or, having none, seek to employ a large number of agents on commission only to make up the discrepancy. Here, again, there must be complete change; good salesmen should only be employed on this very important work of promotion and extension, and they must be provided with reasonable and ample funds to carry out what is expected of them, being rewarded by commission or in other ways for their success. Payment by commission only for such a purpose is a system of sweating important labour, which completely destroys the sympathies that should exist between salesmen and the works staff.

Again we have the want of confidence existing between commission salesmen and agents and their principals arising, perhaps, in the first stages at the works from neglect or want of method, but it must be said with regret in many cases from other reasons, and from complete failure to appreciate the necessary position of salesmen to achieve their object. It would be of great interest to know the proportion of good salesmen and agents that prefer, or have been forced, to sell foreign goods for this reason alone, although their natural instincts are patriotic in the extreme.

Lastly, we have the payment of salesmen. It is an admitted fact that the works employés must be paid weekly or monthly; not so the salesmen and agents on commission, as many firms seem to think weeks, months and years may elapse before they are paid, and by this short-sighted policy they send trade and the salesman's sympathies abroad in hundreds of cases.

Victor H. Coates, M.I.Mech.E.

London, S.W., *October 7th*, 1914.

No Reply.

In your issue dated October 2nd, there appeared an advertisement concerning a position of tramway car repair superintendent, for which application had to be made to Box 705, Electrical Review. I answered that advertisement, and up to the present have not received a reply. Surely honesty, let alone courtesy, demands a reply when a stamped addressed envelope is enclosed, and it is certainly no trouble, if pushed for paper, for advertisers to write on the flap of the envelope. I have answered about a dozen advertisements in your paper, enclosing a stamped addressed envelope, and in no instance have I received a reply. I have, therefore, naturally come to the conclusion that some, at any rate, of the advertisers' own engineering experience is limited and confined to steaming stamps off envelopes.

H. T. Gerry.

Portsmouth, *October 12th*, 1914.

[While we sympathise with our correspondent, who appears to have been exceptionally unlucky, we may suggest that possibly a very large number of replies was received—it is not uncommon for as many as 200 replies to a single advertisement to be sent in—rendering it practically impossible to acknowledge them all, especially where the clerical staff has been depleted owing to the war. Moreover, while most people would endeavour to acknowledge applications that were accompanied by stamped envelopes, it should not be assumed that even in this case the applicant has a *right* to a reply.—Eds. Elec. Rev.]

Stolen Electric Plugs.—Before the Recorder (Sir Forrest Fulton, K.C.), at the Central Criminal Court, on Tuesday, James Bernard Fay, 33, clerk, was brought up in custody and charged with stealing a parcel of electric plugs. Mr. A. H. Bodkin, who prosecuted, said that on October 3rd last, the British Xylonite Co. handed a parcel of plugs to the Midland Railway Co. for carriage to Manchester. The parcel was placed on a truck at St. Pancras Station, when the prisoner was seen to take up the goods and walk away with them. The prisoner pleaded guilty, and several previous convictions were proved against him. A sentence of 20 months' imprisonment was passed, and the Recorder directed that the goods should be handed over to the owners.

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NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

B.T.H. Transformer Oil Dryers and Filters.

The British Thomson-Houston Co., Ltd., of Rugby, has placed on the market oil filtering and drying plant for use in connection with transformers.

The reduction of dielectric strength of oil due to the presence of water or fine dust, especially metallic dust, is well known, as well as its reduced efficiency due to increase of viscosity, and the apparatus here referred to is for pumping the used oil under pressure through layers of dry white blotting paper contained in a suitable filter press. Most of the solid matter is caught by the first layer of paper, while the water is retained in the paper by capillary action. The filter consists of a series of alternate flat cast-iron plates and frames; the paper is placed between them and the whole clamped tightly by means of screw and lever.

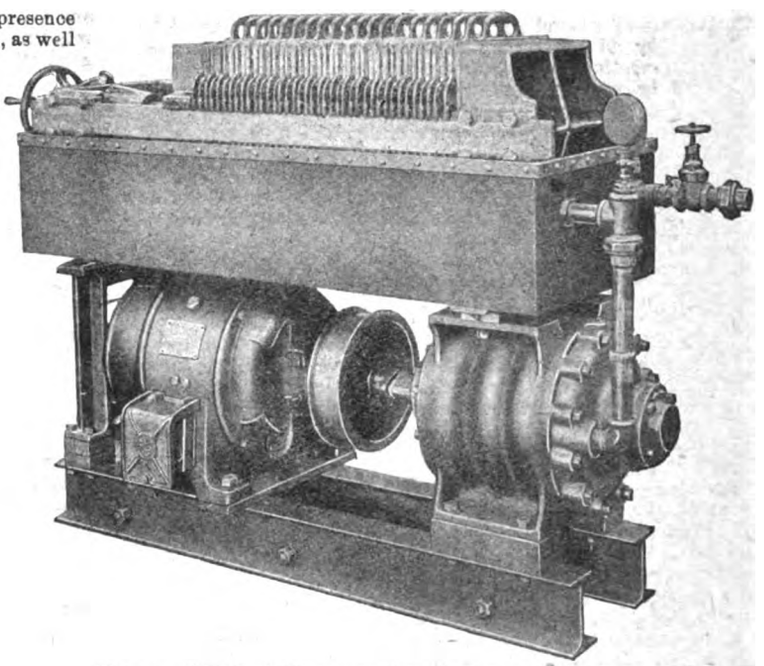

Fig. 1.—B.T.H. 20-Chamber Oil Dryer and Filter.

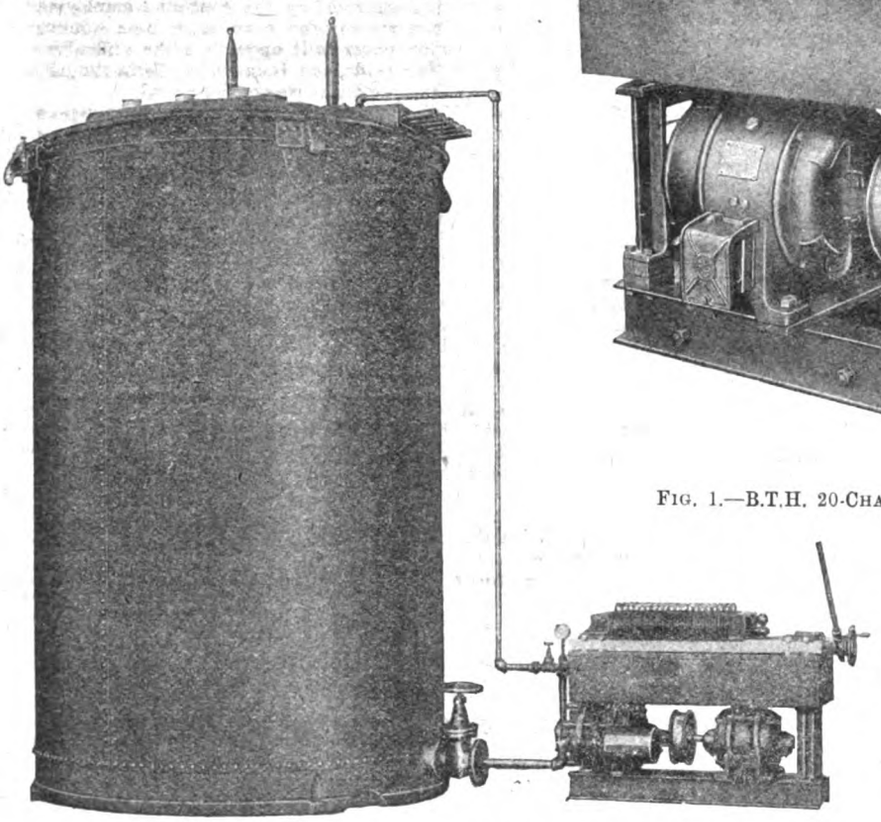

Fig. 2.—Oil Filter in Use, with Transformer in Service.

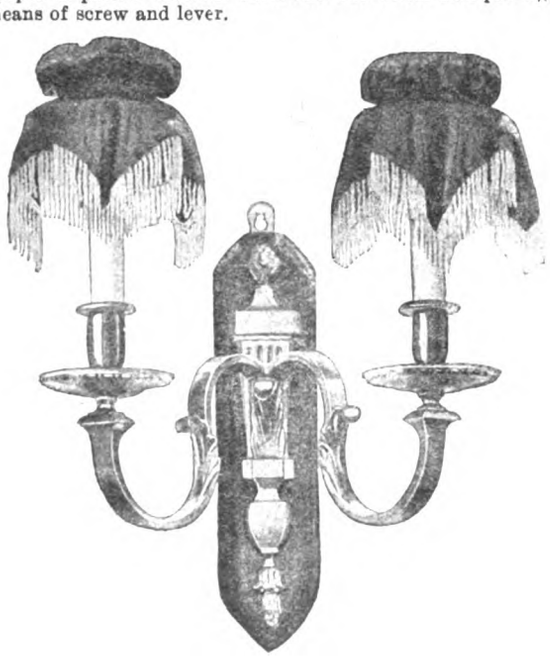

Fig. 3.—Two-light Candle Bracket.

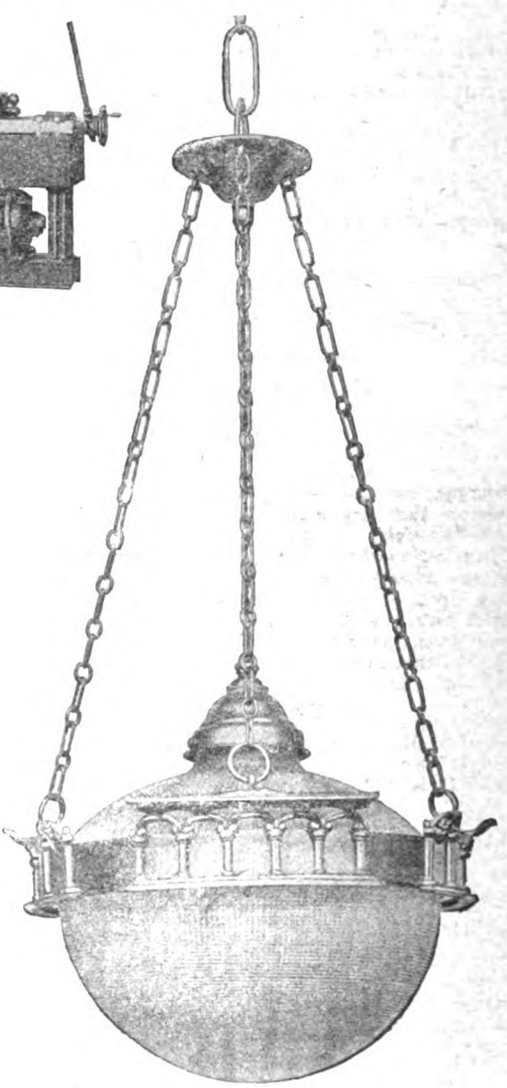

Fig. 4.—Electrolier, with Lumina Bowl and Reflector.

Townshend's Electric Fittings.

Both plates and frames have large cored holes in the lower corners serving as oil inlet and outlet respectively, and the oil entering the filter chambers at one corner, passes through the filter paper, and away at the other corner. The plates and frames are very thin, and all connected so that the oil circulates in parallel, giving a large filter surface in a small space.

Two standard sizes are supplied—7 in. 14-chamber, and 12 in. 20-chamber.

Five sheets of dried and oiled paper are placed between each filter-plate and frame; the first should be renewed at intervals of ½ to 1 hour, depending on the condition of the oil, a new sheet being placed behind the remaining ones, and all should be renewed after three displacements. For the small filter a rotary-gear

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positive-pressure pump is used, and for the larger one a multi-step centrifugal pump; these are coupled to either D.C. or A.C. motors, pump and motor being mounted in the framework beneath the filter, as shown in fig. 1.

The B.T.H. Co. also supplies electric drying ovens for each size of filter paper, built of sheet steel and fitted with a suitable heater, thermometer and regulating rheostat.

An auto-transformer can be supplied to enable one oven to be used on varying A.C. pressures.

Fig. 2 shows a large transformer with the filtering apparatus attached. The required results are usually obtained by circulating the oil from two to five times, and this can be carried on while the transformer is in operation without the use of separate oil tanks.

The first figure shows a filter supplied to the Glasgow Corporation Tramways, where transformer oil in use for ten years, before filtering broke down at 1,500 volts; after once filtering, at 10,200 volts, and after twice filtering, withstood 20,000 volts, without breaking down; electrodes on test ·05 in. apart.

The outfits are in use not only for transformer oil, but also for crude petroleum, insulating varnish, benzine, cylinder oil, &c.

The company also supplies a neat little hot air dryer for drying-out large transformers before filling.

This includes a motor-driven Sturtevant blower attached to a cylindrical heater and giving from 800 to 850 cb. ft. of air per minute at 185 to 212° F. with inlet air at 77° F. The heater is rated at 20 to 25 KW.

Townshend's Fittings.

In the accompanying illustrations, figs. 3 and 4, we show two examples of electric light fittings selected from the large number of these manufactures which are now being made by Messrs. Townshend's Art Metal Co., Ltd., of Ernest Street, Holloway Head, Birmingham, and which are included in their recently issued list of special designs for modern lighting schemes. Fig. 1 represents a two-light bracket highly finished in polished brass; it is in the Adams style, fitted with opal electric candles, and has a wooden back. In fig. 4 we show a handsome pattern of electrolier in the Greek style. It is in polished brass and has a 12-in. "Lumina" bowl and reflector; it is 4 ft. in length.

"Thermoid" Flexible.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., of Blomfield Street, E.C., have recently introduced a new type of flexible cord under the above title, which is specially designed for use with electric heating and cooking apparatus. It is provided with heat-resisting insulation and a flame-resisting external covering; the conductors are of steel and copper wire, combining strength with flexibility, and the cords will not kink. The "Thermoid" flexible is made to carry from 4 to 10 amperes, and should prove very useful, as the flexible connection has hitherto been the least satisfactory feature of portable electrical appliances, especially electric irons.

The "Safuse" Fuse.

Messrs. Donovan & Co, of 47, Cornwall Street, Birmingham, are introducing a fuse (known as the "Safuse") which they claim complies with Home Office requirements in every respect, and

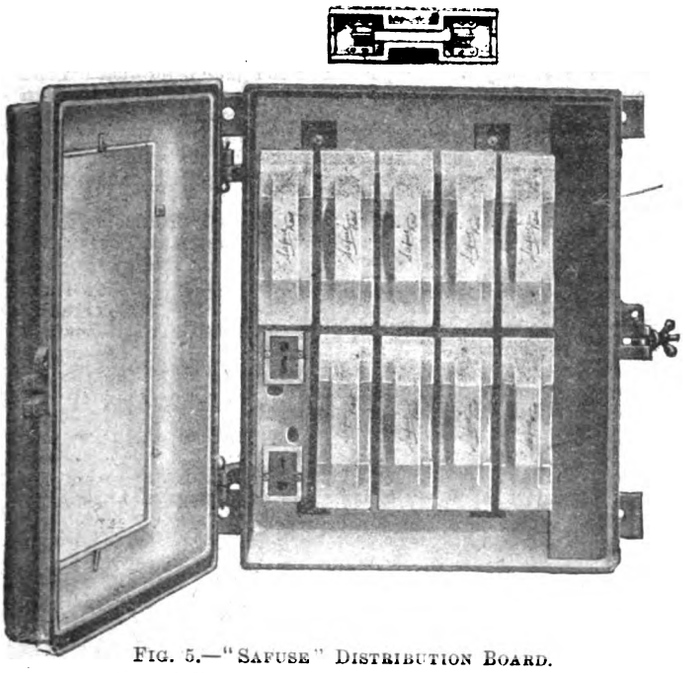

Fig. 5.—"Safuse" Distribution Board.
(Arrow indicates fibre shield covering main connections.)

is British-made throughout. Each unit consists of an English porcelain base into which the clips and terminals are recessed, the recesses being closed by unbreakable covers, slotted to receive the contact blades. A recess at the back of the base is provided for the bus-bars. The fuse-carrier of solid porcelain is so formed that the contact blades are shrouded, and cannot be inserted in the clips unless properly held, shock while inserting or withdrawing a fuse being impossible. The fuse wire passes through an asbestos

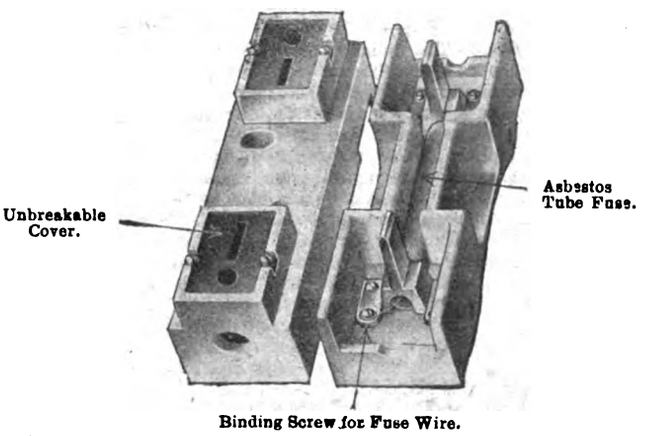

Fig. 6.—"Safuse" Base and Fuse Carrier.

tube; all binding screws are accessible, and no screws are tapped into porcelain. Figs. 5 and 6 gives a good idea of the construction employed.

LEGAL.

Renischel v. Dunbar.

In the City of London Court, on Tuesday, before his Honour, Judge Atherley Jones, K.C., an action was brought by Messrs. J. F. Renischel & Co., electrical engineers, 30, Fenchurch Street, E.C., against Mr. E. Dunbar, High Bank, Portland Crescent, Plymouth Grove, Manchester, to recover £6 16s. for an electric motor purchased by the defendant at a Manchester Exhibition.

Mr. Bircham, defendant's counsel, said that the contract was made in Manchester, and the electric motor was delivered in Manchester. The contract was made before August 4th. Therefore, the moratorium was a bar to the action proceeding. Further, the Court had no jurisdiction.

The Judge said that was the first time the point had arisen before him of an action being issued during the moratorium for a debt incurred antecedent to the moratorium. He thought that the proclamation was a prohibition to the case being tried.

Mr. Harry Strouts, plaintiffs' solicitor, urged that the moratorium was a statutory defence, and as it had not been pleaded it could not be raised then.

The Judge felt that the Court was bound to take notice of the moratorium. Otherwise it would be a very futile instrument if it had to be specially pleaded.

Mr. Strouts said he had come ready to try the case, and had a witness in attendance from Manchester.

Mr Bircham said that that being the case, he would waive the point about the moratorium, and the case proceeded.

Mr. H. B. Arnold, who was formerly in the employment of the plaintiffs as a traveller and agent, said that in May the plaintiffs had a stall at a Manchester exhibition, and he had charge of it. Defendant called and inquired about an electric motor, asking if it would be suitable to drive a washing machine. He said it would, and defendant asked what it would cost to fix. He recommended the defendant to O'Briens, of Manchester, who were competent electrical fitters. They put the price for fixing at £4. Defendant then agreed to pay £6 for the electric motor, and 16s. for a starter. Of course the £6 16s. did not include the cost of fixing the motor.

Mr. Bircham said that the motor could not be fitted, and was, therefore, useless to them. Plaintiffs told defendant that it would be suitable for driving a washing machine, and it was not. O'Briens told them it was no use fixing an electric motor in a wash-house.

Mr. Arnold was quite sure he had never told the defendant that he need not pay for the electric motor until it had been fixed and was in working order. If it went wrong it could not have been fitted properly.

Defendant said he was certain Arnold told him he need not pay for the motor until it was fixed and in working order. Arnold undertook to get it fixed for £4. The estimate from O'Briens came to £3 17s. 6d. O'Briens did the wiring, and the motor had been delivered, but they told him it was no use fixing it, as it would never work in a wash-house. It was an open motor, and as it was useless he objected to pay for it. It was not fit for the purpose for which it was bought, and which was known to the plaintiffs.

The Judge said he must find for the plaintiffs for the amount claimed, and he thought the case was important in regulating the relationship between vendor and purchaser. Defendant had not taken his objection within a reasonable time.

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WAR ITEMS.

Board of Trade Assistance.—The following further information has been received at the Commercial Intelligence Branch of the Board of Trade:—

South Africa.—The Officer in Charge of H.M. Trade Commissioner's Office at Cape Town mentions in connection with the competition experienced from Germany in the import trade of South Africa, that it is essential that British manufacturers who are desirous of competing successfully in the South African market should realise the need for both the manufacture of cheap lines and their universal distribution throughout the Union. It is obvious that the better class articles, by which British firms have made their reputation, meet the needs of the inhabitants of urban communities alone, and are unsuited by reason of their cost to the needs of the rural population of the country. It is asserted that if British firms are to succeed in their endeavours to capture the competitive trade of Germany in South Africa, they must apply themselves to meeting the most minute requirements of the market, by manufacturing articles to which the public have become accustomed, irrespective of whether these requirements are in the better classes of cheaper qualities of goods. In this connection it is urged that British manufacturers must give their customers in South Africa credit for knowing the needs of the market, and must place implicit confidence in the South African merchant when he makes known his wants in regard to quality, finish, packing, supply of catalogues, &c.

France.—H.M. Consul at Lyons states that he has received from local firms inquiries for the names and addresses of English firms who could supply the following classes of goods in place of those formerly obtained from Germany, viz.:—Carbon for electrodes, cotton tape for insulating electric wires, aluminium articles, porcelain and fancy china, cut glass and fancy glass of all kinds. H.M. Consul urges on British manufacturers who wish to substitute their goods for German products in France, the importance of sending commercial travellers who will canvass the market energetically, of furnishing catalogues in French, with prices quoted free at customer's address, and of catering for the large demand for low-priced articles of all kinds.

Spain.—H.M. Consul at Corunna also points out the necessity for British manufacturers desirous of competing successfully with their German and Austrian rivals in the Spanish market to send out competent travellers. The Consul adds that catalogues in English, with prices in sterling, and weights and measures not in the metric system, are not appreciated, however well they are got up. In addition, terms of payment must be favourable to customers, to whom German firms have been very lenient in this respect.

Italy.—H M. Ambassador at Rome writes (September 13th) that at the present moment a very favourable opportunity is offered to British firms to recapture trade in Italy, and especially in Milan. It is stated that not only are importers very uncertain as to the extent to which Germany will be able to supply their demands in the future, but such a wave of antipathy to Germany and German methods has swept over Italy, while at the same time such enthusiasm for England and the English prevail, that there is a desire to deal with British firms and to boycott German trade. It is stated that if competent travellers or agents with a knowledge of Italian, and ability to quote prices in the metric system, were to visit Milan at the present time, they would be able to do an extensive business, and possibly to find new markets. There is stated to be a good opening for pig-iron.

Japan and Corea.—H.M. Commercial Attaché has forwarded detailed reports from H.M. Consular Officers in Hakodate, Formosa, Nagasaki, Chemulpo, Shimonoseki and Dairen, dealing with the nature and extent of German trade in their respective districts, and the possibilities of British products being introduced to replace German manufactures. The reports in question, which contain comparative statistics of the imports from the United Kingdom and Germany into the various districts, and information as to the various classes of goods in the supply of which German competition is most severe, may be inspected at the Commercial Intelligence Branch of the Board of Trade.

Further publications issued by the Board of Trade Commercial Intelligence Department concerning the export trade of Germany and Austria-Hungary to neutral markets deal with (No. 70) boilers and boiler-makers' wares; (No. 71), cement; (No. 75), scientific instruments and apparatus, except electrical.

What American Authorities are Saying.—As a result of special inquiries made in South and Central America concerning the trade position, the Pan American Bureau in Washington has issued a statement which appears in the financial Press. It is reported that "the acute financial stringency caused by the war has developed in many countries a critical condition which prevents them from now purchasing as heavily from the United States as they otherwise would. What the business interests there now need is not so much manufactured products or additional ships, although these are required to a considerable degree, but active financial help in the form of necessary money advances, reasonable credits and an actual market for their raw products which usually go to Europe. The general public are, therefore, cautioned against a wrong impression which may be gained from the numerous reports purporting to describe the Latin-American commercial field without pointing out the actual but unusual economic conditions. The real Latin-American opportunity at the moment is more one for co-operation, investigation and preparation for better times than for the actual sale of products."

In the above connection we may also refer to an address recently delivered to a Chicago meeting of electrical men by Mr. A. A. Gray, the managing editor of the American *Electrical Review and Western Electrician*. Mr. Gray has made a prolonged study of the general industrial situation in the United States, and according to a report published in his *Review*, he emphasised to his hearers the necessity for a thorough understanding of the obstacles which were present in an overnight conquest of foreign trade both in South and Central America and in the Orient. He suggested that the American manufacturer would work out for himself a considerable portion of grief if it were merely attempted to translate the usual catalogue and circular into Spanish and Portuguese or other foreign language and depend upon ordinary representation for the establishment of a trade connection. The consensus of opinion of the best informed experts with regard to opportunities for establishing a foreign market for American products indicated that the greatest degree of patience must be exercised. A considerable amount of money must be expended, and only a representative thoroughly familiar with the language and customs of the people in the foreign countries could hope to secure a favourable *entrée*, and a business connection which would be of an enduring character could be built up only after a great deal of missionary effort and satisfactory performance of initial service. It was with regard to opportunities in the United States that Mr. Gray laid his greatest emphasis. He finds a practically developed demand for a big volume of electrical apparatus. "Electrical supply jobbers in every part of the country were already beginning to feel the result of this demand, and up until August 1st every condition argued well for a most prosperous season. The upsetting of every calculation and good intention with the breaking out of hostilities in Europe will check this demand for some considerable time until readjustment is made. It is very likely, however, and every indication points to the soundness of the reasoning, that our manufacturing institutions are undergoing a rapid readjustment to meet the demands which will come about in this country, due to our inability to import many necessities, and due to the demands from abroad for a great many necessities that cannot now be produced in their former markets. Manufacturers in other industries generally are up to their capacity in their workshops, based upon a normal present demand. Any unusual volume of business means a desperate attempt to increase efficiency of production, and here the use of current-consuming devices, including electric lamps and motors particularly, will find ready acceptance.

"During the greatest period of prosperity in our last commercial boom manufacturers enlarged their plants without regard to the utilisation of electrical energy and current-consuming devices. To-day practically every manufacturer in every industry is absolutely sold on electric light and current-consuming devices, and in every extension, rehabilitation or new development that is contemplated at the present time, the use of electricity forms a fundamental part of the equipment.

"There is a quite little scare on, and a good many good men are out of jobs. If a man has a good position, it is advisable that he take good care of it. This is no time for anyone to get 'fresh.' And, if the electrical salesman has considered that he has had a pretty good working knowledge of the apparatus that he is handling, it is a good time now to look into every possible opportunity where his material may effect an adaptation which will mean greater economy in production, for it is along this line that profits to the manufacturer in other industries lie. In addition to the practically developed demand for an enormous quantity of electrical material, there are still thousands of applications of current-consuming devices that are only being conjectured at this time. If the manufacturer of electrical material and the salesman will exercise only a small portion of the imagination that is now at work conjuring up visions of foreign trade opportunities, and exercise only a small portion of the grim determination and courage that is about to be let loose with regard to this foreign trade invasion, and utilise some of this energy in stimulating the undeveloped demand for material right here in these United States, he will find that there is a trade conquest to be made, and a market available that are far beyond the possibilities of all the foreign markets of the world."

Belgium. — An Invitation to British Firms. — M. E. Janssens, partner of Energie and Lumière Works at Laeken, near Brussels, writes as follows:—"Being a partner in an important electrical manufacturing concern in Brussels I take the opportunity to point out to the British firms who are interested in the matter, that we were before the war relying on Germany for the supply of earthenware and china; electrical motors; arc lamps and carbons; carbon and drawn-wire lamps; hand lamps; lamp fittings (watertight and street lights), electrical bells and all the accessories (except wire); china or brass switches; steel tubing and accessories. The works are actually closed down, due to the hostilities, but as soon as the German army withdraws from the Belgian capital it is our intention to reopen. For that purpose we wish to get into touch with British firms who could export the above goods and ask for their names and addresses (to be sent to your paper). I will be in London in a few days' time and I would be pleased to meet their representatives."

A Civilian Electrical Force at Edinburgh.—At a mass meeting of employers and employés in the electrical industry, held in Edinburgh under the auspices of the Electrical Contractors' Association of Scotland and the Electrical Trades Union, it was agreed to form a Civilian Electrical Force for home defence, the membership of which would be open to those who, for some sufficient reason, were unable to take their places in the Regular Forces. The meeting, over which Mr. Basil A. Pilkington, chairman of the Edinburgh Branch of the Electrical Contractors' Association, presided, also called upon all suitable members of the electrical industry to volunteer for service in the Regular and Territorial Forces. Already there has been a good response to the appeal.

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Imports into Australia.—We have just received from Mr. R. H. Butler, the secretary of the Australian Association of British Manufacturers and their representatives, Melbourne, a statement of the imports into Australia during the year 1913 of various classes of trade in respect to which our manufacturers are in competition with those of foreign origin. The value and percentage of imports from the United Kingdom, Germany and U.S.A. are stated in table form, and in the following we have extracted those lines which we think would interest our readers at this time. The value of the import trade in 1913 was £60,551,516, as the bottom line of the table shows. This represents an increase of over £20,000,000 since 1909—more than 50 per cent. While the proportion from the United Kingdom in 1913 compared with 1909 decreased by ·4 per cent.—yet in "value" her trade increased by £12,600,000, double the combined increases made in their trade by Germany and the U.S.A., and exceeding by more than 4½ millions the value of the increased imports from the whole of the rest of the world over that period. The United Kingdom share of the Commonwealth imports of competitive manufactured merchandise (1913) was 63·2 per cent. The percentages in the right hand section of the Table show the proportion of competitive merchandise of United Kingdom origin—taking into account imports from all countries of competitive manufactured merchandise—directly imported into each of the six States of the Commonwealth.

Northampton's Tramway Manager.—The special meeting of the Northampton Town Council to consider the position of Mr. J. Gottschalk, the tramway manager, was held on Monday evening. There is a large feeling in the town that Mr. Gottschalk should be deprived of his position because he was a German at the time of the outbreak of war, he having only recently obtained his naturalisation papers. The Council Chamber was crowded to its utmost capacity by the public, and the meeting lasted for four hours. The Tramway Committee had thoroughly considered the question at several meetings, and at a special meeting they reaffirmed their confidence in Mr. Gottschalk. Throughout the debate not a single personal charge was made against Mr. Gottschalk, and several tributes were paid to the way in which he has managed the tramway undertaking. A resolution calling upon the tramway manager to send in his resignation, and instructing the Tramway Committee to give him three months' wages in lieu of notice, was lost by 27 votes to 18. A further resolution that Mr. Gottschalk's services be suspended during the war without salary was lost by 28 votes to 18. There were several threats as to "what may happen" in the town if Mr. Gottschalk is not dismissed, and there is a possibility of November contests upon the matter.

Red Cross Kettle.—The Wigan Corporation electricity department has loaned an electric kettle to the local branch of the Red Cross Society.

Australian Imports.

Classes.	All countries.	U.K. origin. Value.	U.K. origin. Per cent.	Germany. Value.	Germany. Per cent.	U.S.A. Value.	U.S.A. Per cent.	U.K. origin. Imports into separate States. N.S.W.	Vic.	Q.	S.A.	W.A.	Tas.
								Per cent.					
Metals—Manufactured ...	£11,781,510	£8,308,788	70·5	£1,345,982	11·4	£1,642,086	13·9	65·9	69·0	75·6	80·0	78·3	72·8
„ Machinery ...	4,682,100	2,546,937	54·4	388,815	8·3	1,397,098	29·8	53·0	43·3	69·9	55·3	72·7	58·1
„ Misc. manufactured ...	5,201 995	3,535,079	67·9	394,013	7·6	659,618	12 7	62·7	71·5	41·5	78·8	78·2	65·9
„ Bars, rods, blooms ...	1,488,408	957,888	64·4	284,087	19·1	81,976	5·5	72·1	48 9	81·1	58·9	85·0	85·8
„ Pig and ingot... ...	310,773	241,740	77·8	7,145	2·3	25,949	8·3	81·7	67·3	82·2	84·8	83·1	98·0
Earthenware, cement, china, glass, &c.	1,580,615	655,778	41·5	458,007	29·0	64,482	4·1	41·8	43·3	31·9	40·5	40·7	62·5
Leather—and manufactures of	695,451	271,818	39·1	88,204	12·7	309,532	44·5	35·1	26 8	77·5	66·8	83·8	92·6
India-rubber—and manufactures of	769,001	243,351	31·6	259,346	33·7	125,539	16·3	39·0	22·1	38·3	37·0	66·0	61·6
Instruments—Scientific, surgical, &c.	754,589	333,179	44·2	114,318	15·1	234,472	31·1	41·3	40·7	54·3	61·9	78·4	55·6
Totals (including textiles and many other lines not indicated above	£60,551,516	£38,285,340	63·2	£6,886,441	11·4	£7,125,145	11·8	61·2	60·6	67·9	69·1	70·0	71·8

Bruce Peebles and the War.—Mr. Robert Shaw, A.M.I.E.E., chief estimating engineer to Messrs. Bruce Peebles & Co., Ltd., Edinburgh, has joined the engineer units of the Royal Naval Division for active service abroad, and as he will in all probability be away for some little time, Mr. William Oliver, B Sc., A.M I.C.E., has been appointed to t mporarily fill Mr. Shaw's position with the firm. Messrs. Bruce Peebles announce that since the outbreak of hostilities well over one hundred members of their staff and works have joined the forces, and unfortunately they have already received intimation that one of their men has been killed in action.

British-Made Now.—It was announced at a meeting of the Eccles Town Council last week that the Public Lighting and Electricity Supply Committee was taking steps to arrange that British firms should supply articles required which had previously been obtained from German firms.

German Exports.—In one of the last issues of *Elektrotech. Zeitschrift* are published some interesting details about the export of electrical machinery and goods from Germany to all those countries that are now in war, which show to what an extent the German electrical trade must suffer from the unsettled conditions at present obtaining. The figures in the following table represent units of 1,000 marks, or £50. It will be seen that 35 per cent. of the total exports went to the countries which are now Germany's opponents:—

Ozone for Recruiting Purposes.—On the occasion of Mr. Asquith's recruiting speech at Cardiff on the 2nd inst., representations were made to those who were attending to the arrangements that the Premier was troubled with asthma, and that an ozone generator should be installed under the table at which he was to speak, for the purpose of giving him relief. At very short notice this matter was taken up by the Corporation electric supply department, and the local branch of the Edison & Swan United Electric Light Co., Ltd., who communicated with Messrs. Ozonair, Ltd., by telephone. The latter firm sent down one of their Type 27 Ozonair machines, and this was installed in an adjoining room, the ozonised air being brought by means of a tube to a position under the Premier's table. It is understood that the result was an unqualified success.

Over 50 per cent. of the staff of Ozonair, Ltd., have enlisted in the National Services; one of their men, who is a Naval Reservist, was among those who were fortunate enough to be saved from the *Hogue*, and he has now joined another cruiser.

"As Usual" While in Camp.—Mr. T. C. Curtis, principal of the Curtis Manufacturing Co., Conduit Place, Paddington, has joined the Royal Naval Division (Engineer Units), and is in the Naval Camp at Martin Mill, near Walmer. Business will be carried on as usual in regulating plain and paralleling resistances, dimmers, sliders and all standard work.

German Electrical Exports.

Electrical goods.*	Austria-Hungary. 1913.	Austria-Hungary. 1912.	Belgium. 1913.	Belgium. 1912.	France. 1913.	France. 1912.	Great Britain.† 1913.	Great Britain.† 1912.	Russia.‡ 1913.	Russia.‡ 1912.	Servia.	
Dynamos, motors, transformers, armatures, rotary converters, &c.	4,952	5,494	4,484	4,118	2,994	2,665	4,852	3,468	8,530	5,623	31	127
Accumulators, cells, &c.	216	320	191	170	46	52	184	106	85	88	—	5
Cables	26	347	4,250	3,357	199	76	1,060	1,122	628	754	24	56
Arc lamps and ordinary lamps, searchlights	443	555	172	142	198	322	538	480	1,264	775	1	5
Incandescent lamps	4,532	4,011	2,377	2,156	2,624	2,607	4,458	6,467	8,810	10,061	45	54
Telegraph and telephone apparatus, safety and signal apparatus, &c. ...	1,021	958	1,110	735	723	585	1,870	1,263	2,078	1,893	54	18
Materials for heavy current	6,009	4,790	4,656§	3,001	7,600§	1,909	9,752§	2,743	9,720	5,991	20	71
Meters and registration apparatus, &c....	2,888	3,221	1,028	928	1,209	791	1,474	905	4,645	3,546	25	60
Insulated wire	266	208	1,718	1,431	299	179	6,160	4,540	886	829	70	5
Electrotechnical carbon‖	885	908	929	725	943	980	2,008	1,813	656	512	4	11
Total	23,329	22,663	21,745	17,510	18,391	11,540	34,421	24,381	39,601	31,792	292	446
Percentage of total exports ...	7·06	8·31	6·58	6·42	5·56	4·23	10·41	8·94	11·98	11·66	0·09	0·16

* Total German exports of electrical goods, 330,568,000 marks. † Gibraltar, Malta and Cyprus not included. ‡ Including Finland, to which went 3,983,000 marks, or 1 2 per cent. of the total exports. § Including electrical parts of internal-combustion engines for ships. ‖ Including a few non-electrical goods.

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German Electrical Goods on Offer.—A correspondent sends us a copy of a circular letter, dated October 7th, that has been issued by the Manchester Branch of the Electrical Co., Ltd., offering very large stocks of cotton, silk and enamel-covered wires at highly-competitive prices. Our correspondent informs us that as the result of inquiries he learns that the wires offered are German, and he adds: "It appears to me, at a time like this, that it is a disgrace that this firm should be supported, when there is English manufactured wire to be obtained." As the matter is considered to be of interest to the public generally, we are asked to call our readers' attention to it.

At such a time as this, it is but right and natural that feelings of patriotism should incline us all to prefer British manufactures when we can get them, but the company named is not precluded under the Trading with the Enemy Act, from conducting its business here. Proclamation No. 2, Clause 5, says: "Provided that where an enemy has a branch locally situated in British, allied, or neutral territory, not being neutral territory in Europe, transactions by or with such branch shall not be treated as transactions by or with an enemy." (Elec. Rev., September 18th, page 391.) This is the legal position; whether German goods should be purchased under the prevailing conditions, at whatever price, is a matter for the individual conscience, provided that it is not possible for the money to get to Germany during the war.

Liverpool's Objection to German Firms.—At the City Council on the 7th inst., Mr. Alfred Gates objected to certain contracts for rail-welding, &c., between the Tramways Committee and two companies, which, though registered in England, were composed, he said, almost entirely of German shareholders. He moved that any orders under these contracts which were at the option of the Committee as regards time should remain in abeyance. He quoted from the German Press to show that in Germany English firms were being subjected to a strict boycott. Mr. S. G. Relton seconded the motion. Alderman F. Smith (chairman of the Tramway Committee) hoped an expression of views would be given by the Council, as when the question was settled the Committee might enjoy a little peace on the subject. The Council, he was sure, would have regard to their legal responsibility and would not be influenced by extracts from the German Press to adopt German ways. If they owed anything to the Germans the disposition would be to pay it as soon as was proper (some dissent). He thought that was the feeling in Liverpool (more dissent). His own advice to the Council was to give Mr. Gates any amount of sympathy, but not to give him any notes (laughter). In his opinion a company registered in this country could enforce its contracts, and he would be no party to giving those people an opportunity of recovering damages. Mr. Burton Ellis asked if the Council were legally obliged to go on with the work immediately. If not, he would vote against English money going to the Germans. The Lord Mayor suggested that the matter be referred back to the Committee so that the advice of the town clerk might be obtained. The town clerk expressed a similar view, and added that the Tramways Committee would meet later in the week, when he would be prepared to give his advice in writing. He explained that the resolution of the Committee authorising the issue of orders to the firms did not by any means cover the whole of the legal question. Mr. Gates's amendment was lost by 49 votes to 43, with the result that the contracts with the two firms will be observed.

Effects in Canada.—Our contemporary, the *Power House*, says that the Canadian Westinghouse Co., Hamilton, Ont., has announced that, on account of the present unsettled condition of business throughout the Dominion, all outstanding prices and quotations on electrical apparatus and supplies unaccepted as at August 14th are withdrawn. "The necessity of this course is regretted, but that it is unavoidable, follows from existing financial conditions disturbed by the general European war, from the large increase in prices already registered in several lines of raw materials, and from the uncertainty as to a continuance of supply of various other elements of manufacture consequent on interruption of international commerce. An early improvement is hoped for on all points, and meanwhile the company will be glad to furnish quotations upon request at lowest figures permissible under the current conditions." The same contemporary says that the Canadian Tungsten Lamp Co., of Hamilton, Ont., has felt the effects of the war in a beneficial manner. "Many companies which secured most of their lamps from Germany have been forced to place their orders with the local concern, and sufficient orders to keep the plant running at a fair rate have been received. W. H. Ginder, manager of the plant, stated that, while the company had been able to secure trade which otherwise would have been given to German firms, it was facing a difficulty in that all of the platinum used in the manufacture of the lamps comes from Russia, and it is difficult to secure an adequate supply. The company has sufficient platinum to last a few months, and Mr. Ginder is hopeful that in the meantime further shipments will be received. The company is endeavouring to keep all its own men employed, and denies that a cut has been made. Owing to the difficulty in securing raw materials, the lamps will cost more, and a new price list is being issued."

Not German.—The Selson Engineering Co., Ltd., ask us to contradict the reports that are in circulation that their company is a German concern. The "company was registered in December, 1909, under the Companies' (Consolidation) Act, 1908, and is a strictly British concern both as regards capital and directorship. We manufacture in this country, having works both in Coventry and Halifax, whilst our staff and workmen, with only two exceptions, are British. Besides the tools of our own manufacture, we hold stock of a variety of American tools and machines for which we are the sole agents in this country."

"Trading with the Enemy" Questions at Oldham.—At the Oldham T.C. meeting on 7th inst., questions were asked by more than one member as to the status of certain firms with which the Corporation had dealings, the questioners being anxious to know if these were German firms. Councillor C. Hardman (chairman of the Electricity Committee) gave the result of correspondence with the firm which was to erect the new cooling towers at Greenhill. He said the Council might take it for granted that no set of men were more loyal than the members of the Electricity Committee. They learned that 22½ per cent. of the capital was owned by German subjects, and the company was formed in 1908. They had an order from the Admiralty, and a contract with a Sheffield firm, which, like the Committee, had some doubts. The Sheffield firm wrote to the Board of Trade on the matter, and the reply was that the injunction against trading with enemies attached only to companies incorporated in the enemy's country. If a limited liability company was registered in the United Kingdom, there was no objection to firms in Great Britain continuing to trade with it. The whole of the materials used in the construction of the cooling towers that the firm had in hand was being purchased from British firms, and the labour employed in the construction of the towers would be British. As to the batteries, they were being made at Dukinfield, and the Committee would not tolerate for one moment trading with a German firm.

In moving the adoption of the minutes of the Tramways Committee, Alderman Isherwood withdrew an account for the payment of £152 to a tire company. He said they had found that this was an entirely German firm, and the tires had been made in Germany, and the Committee did not propose to pay that amount at present.

Nationality and Naturalisation.

As a Scottish borderer myself, I hasten to apologise to Mr. G. E. Kerss for having suggested that he was not of British birth. My excuse must be that his name is so very uncommon, that there is only one instance of it to be found in the whole Post Office London Directory. It is of interest that Kelso, from which Mr. Kerss hails, is only a few miles from the estate and village of Swinton, from whence Mr. Campbell Swinton derives his name, and where his cousin is the thirty-fifth linear owner of the property, dating from Norman times. The family records extend over eight centuries.

I have every sympathy with Mr. Paul David, but still, I think, we should not take on unnecessary risks.

London, *October 12th*, 1914. John E. Gray.

I.C.S. Warriors.—The October number of the *I.C.S. Student* contains an illustrated description of the enrolment of the first contingent of the I.C.S. Corps, which is serving with the Royal Fusiliers in the new Army. The I.C.S. policy throughout the war will be to encourage every able-bodied man of military age to go to the Front, and, at the same time, to urge upon all who remain behind to work as hard as possible at their technical studies, so that they may the better help in the war on German trade.

It is stated that no fewer than 1,500 Australian I.C.S. students have joined the Australian Expeditionary Force.

Lieut. C. N. Spratt, of the R.F.C., is an I.C.S. student, and, according to the daily Press, he recently performed a remarkable exploit when reconnoitring at Montmorency. Sighting a German Taube aeroplane, he immediately gave chase, and, rising above the enemy, made him understand that he was covered by a gun. The German pilot, knowing himself to be out-manœuvred, offered, by means of gestures and signals, to surrender, and then volplaned downwards, but when nearing the ground he accelerated his engine and attempted to escape. The undaunted lieutenant, however, was prepared for this, and promptly dropped on the German at a height of 100 ft., both machines coming to earth with a crash. The German was hauled out of the wreckage severely injured, but Lieut. Spratt very luckily only slightly hurt his arm.

Personal.—Mr. Samuel Hulme, an employé at the Bury Electricity Works, and one of the survivors of H.M.S. *Hogue*, which was sunk in the North Sea, has left Bury again for headquarters.

News has been received at Patricroft that Mr. Fred. Ashcroft, of 17, Lime Street, who was employed at the Westinghouse Works, has been killed at the battle of the Aisne.—Mr. Jas. Bradburn, a Burnley Corporation tramcar driver, who has been serving with the Royal Field Artillery, has died at the Front.

Mr. A. M. Mulliner, assistant borough electrical engineer of Eccles, is serving with the Public Schools Corps (Malvern).

An Australian paper, dated August 29th, says that Mr. A. A. Hanson, son of Mr. A. J. Hanson (Lawrence & Hanson, electrical engineers, Sydney), who left Sydney in May, is under detention in the military prison at Paderborn, Westphalia.

Mr. L. B. Hogarth, borough electrical engineer at Whitehaven, has left to join the Royal Naval Division for active service.

Among the employés in the electricity department of the Hackney Borough Council who have joined the Colours are:—A. G. Hilling, distributing engineer (Royal Naval Division Electrical Engineers); J. Abfounder, labourer (1st Essex Regiment), and W. Elstone, arc lamp mechanic (not yet ascertained).

Recruiting Tramcars.—The Oldham tramway department has been running a recruiting car bearing 15,000 decorative lamps.

Trade with the Continent.—Mr. F. V. Wythes, A.M.I.E.E., of Paris, who has been handling English electrical and automobile specialities in France for several years, is desirous of getting into touch with British manufacturers of electrical and allied lines who wish to push their wares in France and other Continental countries. Prior to 1911 he was with electrical and engineering firms in England. Since that year he has travelled Holland, Belgium, France, Spain, Italy and Switzerland. Mr. Wythes, who is a member of the British Chamber of Commerce in Paris, is at present staying in this country, and communications should be addressed to him at Ravensden House, near Bedford.

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BUSINESS NOTES.

Bankruptcy Proceedings. — Gordon Hill Boddington, a manufacturers' agent, late of 34-6, Oxford Street, W.—In the course of his public examination, held on October 6th before Mr. Registrar Linklater at the London Bankruptcy Court, this bankrupt stated that when he came of age in 1907 he became entitled to £16,500, most of which he lost by speculating on the Stock Exchange. He lost £1,000 in connection with a wireless method for controlling clocks within a radius of 1,000 miles from a central station, an invention by Mr. E. V. Gratze. He paid about £700 to Mr. Gratze, and expended the balance over the patent. In return he was to receive a one-half share of the profits. The Marconi Co., however, claimed that the invention was an infringement of their patents, with the result that no patent was granted to Mr. Gratze. The debtor was allowed to pass upon accounts showing total liabilities £9,882 (unsecured £2,778), and net assets valued at £1,027.

H. J. Godfrey, electrical engineer, 23, Lucien Road, Tooting, late 188, Balham High Road, London.—The public examination of this debtor was held at the Court House, Wandsworth, last week, when the statement of affairs disclosed liabilities amounting to £581, and assets estimated to realise £166, leaving a deficiency of £415. Questioned by the Official Receiver, the debtor said that his business had declined in recent years. He had lost money through under-estimating on contracts to the extent of £30 or £40 on one contract and £20 on another. He had kept no books. In October last he sued a certain man for £89 work done. A counterclaim was set up for bad work, and a sum of £36 paid into Court. The debtor paid £15 into Court. The case came before the Official Referee, who found for debtor £36, and for the counterclaim £53 and costs, less the £15 paid into Court. Debtor entered an appeal, which he subsequently withdrew, and the defendant proceeded under the original judgment. Execution was levied on August 31st, and the next day the debtor filed his petition. The failure was due to losses on trading in business, under-estimating on contracts, and loss over the legal action. The case was ordered to stand over.

Catalogues and Lists.—Messrs. L. E. Wilson & Co., 10, Corporation Street, Manchester.—Price leaflet relating to the new "Thomson" dry battery pocket lamps.

The Igranic Electric Co., Ltd., 147, Queen Victoria Street, London, E.C.—Illustrated leaflet (P 617) describes their new push-button control system.

Messrs. Stockall, Marples & Co. (1912), Ltd, 6-10, Clerkenwell Road, London, E.C.—Illustrated circular describing their Stockall card system equipment.

The Wardle Engineering Co., Ltd, 196, Deansgate, Manchester.—Supplementary catalogue, No. 9, giving particulars, prices and illustrations of a number of lantern fittings, including half-watt fittings for shop front lighting, "Streetlite," "Orient," "Primus," "Inverlite," "Workslite," "Opalba," semi-indirect bowl fittings, and the Barrow suspension device.

The British Thomson-Houston Co., Ltd., Rugby.—New price list, No. 4,221 (28 pages) giving very full information, with illustrations, regarding the B.T.H. automatic circuit-breakers for A.C. and C.C. circuits.

The Westinghouse-Cooper Hewitt Co., Ltd., 80, York Road, London, N.—Price list of ultra-violet ray water sterilisers for use in hospitals, &c., which are very easily installed, and in no way affect the taste or composition of the water.

Liquidations.—Garrett, Hartley & Co., Ltd., Morena Street Works, Catford, S.E.—Under a compulsory winding-up order, accounts have been lodged showing liabilities £1,369, assets valued at £1,000, and a deficiency of £1,519, as regards contributories. Mr. H. E. Burgess, Official Receiver, reports that the company was formed in June, 1913, with a capital of £1,500 to acquire as a going concern the business of Garrett's Engineering Co., carried on at the above address, and which consisted mainly of electrical installations, principally at cinema theatres. At the date of the winding-up order, two such contracts were in hand, but they were terminated by the liquidation. The operations of the company appear to have been hampered by mismanagement and shortage of working capital, and losses have been incurred by taking contracts at cut prices. The liquidation has been left in the hands of the Official Receiver.

Consolidated Diesel Engine Manufactrers, Ltd.—Mr. W. J. Warley, Official Receiver, presided over the first meeting of creditors and shareholders at the Bankruptcy Court on 8th inst. A resolution was passed appointing Sir W. B. Peat to act as liquidator, assisted by a committee of three creditors and two shareholders. At the meeting of shareholders it was stated that whilst a dividend was not an absolute impossibility, there was no prospect of it.

The Ecuador Telephone Co, Ltd.—This company is winding-up voluntarily, with Mr. W. G. Mare, secretary of the Chile Telephone Co., 42, Old Broad Street, E.C., as liquidator.

Book Notices.—"The Electrical Conductivity and Ionisation Constants of Organic Compounds." By H. Scudder. London: Constable & Co. Price 12s. 6d. net.

"Test Questions in Wireless Telegraphy." Series 1 and 2. London: Wireless Press. Price 1s. each set.

"Wireless Telegraphy." By A. B. Rolfe-Martin. London: A. & C. Black. Price 5s. net.

"University College (University of London) Calendar, 1914-15." London: Taylor & Francis.

"The Magnet of Commerce" is the title of a bulky book published by the Great Central Railway Co.'s Publicity Department, Marylebone Road, W. It contains a great deal of information concerning our output and exports of coal, the development of our coalfields, the making of coke, the preparation of coal for the market, its distribution, together with tables showing the collieries served by four of the great railways. Detailed information is given regarding Immingham Dock, its area, charges, distances from coasting ports in the United Kingdom, also a large coloured view of the dock, and a map showing the collieries and industries served by the G.C. Railway. The book is well illustrated, and is very informing.

Trade Announcements.—The Cambridge Scientific Instrument Co., Ltd., has taken over the business connection of the Leskole Co., Ltd., Palace Works, Enfield, who have gone into liquidation. Mr. F. Wakeham, the assistant manager of the Leskole Company, has joined the company's staff.

The offices of the British Radium Corporation, Ltd, have been removed to 71, Finsbury Pavement, London, E.C.

New premises at 42, Moorland Road, Weston-super-Mare, have been opened by Mr. Percy E. Culling, electrician, late of 19, Alexandra Parade.

For Sale.—The North British Railway Co. invite offers for eleven 20-ton electric traversers for railway wagons, with motors and other equipment and spare gear. Particulars are given in our advertisement pages.

Patent Restorations. — Orders have been made restoring the following patents:—G. A Newton and J. Smalley, "Improvements in furnace or firebars," No. 10,432 of 1907; "Improvements in firebars for steam boilers and other furnaces," No. 18,273 of 1906.

Patents and Alien Enemies.—Applications have been lodged at the Patent Office for the avoidance or suspension of patents Nos. 13,067, 13,068 and 13,069, 1906, granted to Schuster and Ast for electro-magnetic clutches, by C. E. Lugard, 76, Carlton Mansions, Maida Vale, London, W.; date of hearing, November 3rd.

LIGHTING and POWER NOTES.

Ainsdale.—E.L. Scheme.—The Southport Electricity Committee intends to carry out a scheme for the lighting of Ainsdale by electricity, and also to provide power for the air compressor station in connection with the Ainsdale sewerage. The R.D.C. has consented to the laying of the necessary cable.

Altrincham.—Street Lighting.—Progress is being made with the preparatory work in connection with the lighting of the main streets by electricity, and it is expected that the scheme will be completed by Christmas.

Bacup.—Street Lighting, &c.—The conversion of street lamps from gas to electricity is to form the subject of a report to be presented to the Electricity Sub-Committee.

The agreement dated March 15th, 1911, for the management by Rawtenstall of the Bacup electricity undertaking has now been terminated, and the management is now in the hands of the Bacup Corporation.

Basingstoke.—The E.L. scheme has been completed by the T.C., and the lighting of the town has been commenced this week. The official opening of the generating station took place yesterday.

Bexley.—Annual Accounts.—The result of the year's working of the electricity and tramways undertaking for the year ended March 31st, 1914, was a surplus of £348 on the electricity side, and a deficit of £910 on the tramways.

Blackpool.—New Plant, &c.—The electrical engineer has been requested to obtain tenders for the various works and plant required in connection with the extension of the electricity undertaking.

Showroom premises for the demonstration of the latest electrical heating and cooking apparatus are to be opened in Lytham Street.

Bradford.—Cable Extensions.—The Electricity Committee has authorised the extension of mains, principally to Esholt, at an estimated cost of about £6,000.

Carshalton.—Bulk Supply.—The U.D.C. has decided to withdraw its objection to the proposed bulk supply of electricity by the County of London Electric Supply Co., Ltd., to the South Metropolitan Electric Tramway and Lighting Co., and to submit certain points for amicable consideration by the local company.

Clewer.—Street Lighting.—The electric light is being introduced into the parish by a private company, and it is probable that it will be asked to tender for the public lighting in competition with gas.

Coniston.—Proposed E.L. Scheme. — Residents of this parish have recommended that a company be formed on lines suggested by Mr. Best, of Bradford, in order to provide a supply of electricity for the parish. The nominal capital will be £2,000, and the estimated cost of the scheme is £1,400.

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Continental Notes.—Portugal.—A terrible explosion occurred recently at the Lisbon gas and electricity works. Eighty-six victims are now in hospital, while seven bodies have been recovered. It is feared that a search will disclose further bodies. The explosion affected the tramcar service, and in some cases passengers were burned by the electric current.—*Financial News.*

Norway.—It is reported from Stavanger, that the A/S Lysefaldene have applied to the Government for permission to postpone the work of harnessing the waterfalls belonging to the company for one year on account of various difficulties, which have arisen in consequence of the war. The work, according to the terms of the concession, had to be commenced on September 28th.

Dover.—At the request of the military authorities, the T.C. is laying a cable to six new blocks added to Fort Burgoyne. Terms have been agreed for the supply to the new pier station, and for a year's supply to the new Post Office; it has also been decided to give a supply from the tramway wires to the River Co-operative Society for charging electric vehicles.

Eccles.—Year's Working.—There was a surplus of £346 on the working of the electricity undertaking during the year ended March last. This has been carried to the reserve fund which now stands at £2,023.

The Public Lighting and Electricity Supply Committee is arranging with British firms to supply goods needed by the department, instead of German firms.

Flint.—Prov. Order.—A Sub-Committee entrusted with the consideration of the E.L. scheme for the borough, has recommended the T.C. to apply for a prov. order.

Gelligaer.—E.L. Scheme.—The U.D.C. has arranged to ascertain the cost of electricity for public and private lighting at Brithdir and Fochriw, from the Rhymney Iron Co. and the South Wales Electrical P.D. Co., before deciding upon terms received from Merthyr Tydfil.

Great Harwood.—Proposed Electricity Supply.—The U.D.C. is seeking an interview with the Blackburn Electricity Committee with a view to obtaining a supply of electricity.

Hazel Grove and Bramhall.—Proposed E.L.—The U.D.C. has engaged Messrs. J. Lomax, Kendal & Co., at a fee of £24, to undertake a canvass of the district for the purpose of ascertaining the probable number of electricity consumers.

Hessle.—Prov. Order.—The Hull T.C. has decided to apply for a prov. order for E.L. in the area of the Hessle U.D.C.

Hull.—Through Sir James Reckett's generosity the village streets of Swanland, near Hull, are to be supplied with electric light from the plant for lighting his residence, the Manor House. The village institute shortly to be erected, and the Congregational Church are to be similarly lighted.

Keighley.—New Plant.—The Electricity Committee has recommended the purchase of a 25-ton travelling crane.

Kendal.—The Electricity Committee has entered into an agreement to supply Messrs. McKay & Co. with 8,000 units per annum, at 1½d. per unit, as a day load.

Lanchester.—Proposed E.L.—The R.D.C. has decided to obtain powers to light the parish of Healyfield; it is suggested that the Knitsfield P.C. shall join in the scheme.

London.—The L.C.C. Finance Committee has recommended the Council to sanction the borrowing of £2,000 by Bermondsey B.C., for mains and meters.

At the L.C.C. meeting this week, it was agreed to give public notice of the Council's intention at its meeting on November 10th, to consider the promotion of legislation for carrying out the electricity scheme for London, which formed the subject of report by the Special Committee on London Electricity Supply in July last.

Luton.—Works Extension.—The Electricity Committee is making arrangements for the inauguration of the extension of the generating station, which is expected to take place about the middle of November when the works are completed.

New Zealand.—The Onehunga B.C. has under consideration a scheme to light the borough with electricity, at a cost of £7,000.

Oswestry.—Owing to the shortage in the supply of arc lamp carbons, the T.C. has decided as a temporary arrangement to light the Cross and the markets with metal-filament lamps.

Oulton Broad.—Street Lighting.—The U.D.C. has renewed for a year the public lighting contract with the electricity company, the terms being the same as last year.

Pickering.—E.L. Scheme.—The promoters of the E.L. scheme have requested the Council to allow the agreement, which stated that the works should be completed within two years, to be left unsigned for the present owing to the war. The Council decided to insist on the two years' period in the contract, and to give six months' grace at the end of the period if necessary.

Ramsbottom.—Street Lighting.—The U.D.C. has asked the Lancashire Electric Power Co. to submit an estimate for the lighting of Bury New Road, the Council to provide the standards.

Rhymney Valley.—The Electric Supply Co., Ltd., has applied to the Board of Trade for permission to use 230-volt overhead wires at Bargoed, Gilfach, Gelligaer Village, Pengam, Hengoed, and Ystrad Mynach, for the supply of energy.

Sheffield.—The Electric Supply Committee has decided on a site in Bow Street for the purpose of providing office and other accommodation for the department. The estimated cost of the buildings to be erected amounts to £43,000.

Southport.—The borough electrical engineer's estimate to supply and fix the necessary columns, wiring, &c., for the two 3,000-c.p. leading fixed lights for the Southport Channel, for the sum of £300 10s., has been accepted by the Channel Committee. The Committee is to pay £40 per annum for the current and maintenance of the lights.

Slaithwaite.—E.L. Scheme.—The U.D.C. has decided to proceed with an electricity scheme of its own, negotiations with Huddersfield Corporation and the Yorkshire E.P. Co. having failed, and is to engage an electrical engineer to advise the Council thereon.

Stockbridge.—Yorks. Power Co.'s Bill.—The Council has refused to meet a deputation from the company to discuss the proposed Bill to supply electricity in the district.

Swansea.—Annual Accounts.—The report of the electricity undertaking for the year ending March last, shows gross revenue £32,986, as against £29,765 for the previous year; and net profit of £3,312, as against £2,133. The total costs per unit sold amounted to 2·07d., as against 1·95d. for the previous year, the average price obtained being 2·16d. The balance of profit was carried to the reserve fund after transferring £1,000 to the rates.

Tavistock.—E.L. Scheme.—Owing to the war, there has been delay in the completion of the E.L. scheme, and the U.D.C. has asked the gas company to continue the public lighting for a period, the question of price to be settled by arbitration failing an agreement.

Teignmouth.—E.L. Scheme.—The Council has entered into an agreement with Messrs. Purvis, respecting an electric lighting scheme for the town, including Shaldon, the agreement to lapse if the prov. order is not obtained by the end of 1915.

Tunbridge Wells.—The B. of T. has granted the T.C. an order to supply current to premises at Speldhurst, Langton, Pembury, and Southborough. The Speldhurst P.C. has consented to overhead wires being used in the parish for the supply of current.

New Plant.—Arrangements to light electrically a portion of the military camp on the Lower Cricket Ground are being made. The engineer reports that it will be necessary, in the early part of next year, to install two additional boilers and a new water-cooling tower at the works.

Walsall.—The Electricity Committee has come to a satisfactory arrangement with representatives of local electrical contractors with regard to the exercise by the Corporation of powers contained in Sec. 52 of the Walsall Corporation Act, 1900 (Power to Supply Electrical Fittings). The Electricity Committee proposes to equip showroom premises, at a cost of not exceeding £100. The B. of T. has authorised the Corporation to supply current in part of the parish of Rushall.

The T.C. is again recommended by the Electricity Committee to apply to the L.G.B. for sanction to borrow £23,595 for the purposes of the electricity undertaking.

Warrington.—Prov. Order.—The T.C. has decided to apply to the B. of T. for a prov. order empowering it to supply electricity for lighting and other purposes in certain parishes in the rural districts of Runcorn and Warrington.

Waterford.—E.L. Scheme.—The Council has decided to proceed with the electric lighting scheme, and application is to be made to the L.G.B. for sanction to a loan of £30,000 for that purpose; the engineer has been instructed to prepare the necessary plans and estimates.

Watford.—Workhouse Lighting.—The Guardians are to consider the advisability of installing plant to supply electric current to the institution.

Weymouth.—Annual Report.—The accounts of the Corporation electricity department for the year ended March 31st, 1914, show a total revenue of £9,999, and expenditure of £5,992, leaving a gross profit of £4,007. The net profit on the year's working was £213. The number of units sold was 863,705, an increase of 211,840 on the previous year. Reductions in the price of current for heating, cooking and power, have been made, the price now obtained being 2·65d. per unit, as compared with 3·12d. The contract rate of charging has been introduced, plus 1d. per unit. The engineer reports that the works costs have increased from 1·01d. to 1·13d. per unit due to the extra cost of fuel, the total costs being 1·55d., as against 1·47d.

Proposed Loan.—The T.C. has applied to the L.G.B. for a loan of £2,100 for additions to the plant at the electricity works. The plant will not be supplied by public tender. Three firms have been asked for quotations, and these are being considered by the E.L. Committee.

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Wood Green.—E.L. Scheme.—The Tottenham Power, Light and Heat Co. expects to be able to commence lighting the district by electricity at the end of the present month. The generating station, which is now complete, contains two (one 300-H.P. and one 175-H.P.) gas-engine dynamo sets, and a battery is being installed. The engines will operate on town gas supplied by the owning company.

Worcester.—A report on pumping at the sewage works by electricity and suction gas has been referred to the Water and Sewage Committee for consideration.

Wrexham.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £3,025, including £2,500 for an economiser, and £525 for an induced draught fan.

Ystradgynlais.—Prov. Order.—The District Council has decided to apply to the B. of T. for a prov. order to authorise the Council to supply electricity within the parishes of Ystradgynlais (Higher and Lower), and to acquire the undertaking of the Glantawe Electric Supply Co., Ltd.

TRAMWAY and RAILWAY NOTES.

Accrington.—The inquiry regarding the proposed Blackburn, Accrington, Whalley and Padiham Light Railway scheme has been postponed until after the war.

Australia.—Melbourne Railway Electrification.—The Victorian Railway Commissioners have appointed Mr. G. H. Wion, of the Pennsylvania Railroad Co., U.S.A., as engineer to assist in the installation and supervision of the power and automatic signalling system now being adopted in connection with the electrification of the Melbourne suburban lines. The appointment is for five years.

Balearic Isles.—La Sociedad General de Tranvias Electricos Interurbanos, of Madrid, has acquired the concession which was recently granted for the construction of an electric tramway between O'as Catala and Palma, in the Balearic Isles.

Bingley.—The newly-constructed tramway from Bingley to Crossflatts, which is to be worked by the Bradford Corporation, was inspected by the B. of T. last week, and is expected to be open in the course of a few days. The work completes the present tramway scheme in regard to Bingley. A further extension is delayed by difficulties in the road towards Keighley.

Bournemouth.—Proposed Loan.—The T.C. has applied to the B. of T. for a loan of £3,903 for the reconstruction of the tramway track in Holdenhurst Road, with an extra loop in Ashley Road.

Bradford.—The Tramways Committee has approved a plan for doubling the tramway track in a portion of Thornton Road. It has also decided to recommend the fitting of railless-trolley vehicles with patent earthing and automatic steering arrangements, at a cost of £14 a car, and to accept the offer of the Leeds Corporation to take over the obligations of the Bradford Council with respect to 10 of the railless-trolley vehicles now being constructed under contract for the latter authority.

Burnley.—There has been a decline of nearly £2,000 in the receipts from the tramways, compared with August last year, though it is pointed out that in August, 1913, there was an increase of £1,000, due to the Royal Agricultural Show being held in the borough. A number of cars have been taken off, and a saving effected of £760.

Continental Note.—France.—A tramway accident occurred in Paris on Monday afternoon, three persons being killed and several injured; the car left the track at a corner and dashed into a house.

Ealing.—The Special Tramways Committee of the T.C. has arranged with the London United Tramways Co. as to the removal of central standards, whereby it has been agreed that an estimate of the cost of removal should be prepared and forwarded to the Council, as the company declined to incur the expense unless an extension of its agreement was granted.

London.—Improving Tramway Receipts.—The total traffic receipts from the L.C.C. tramways, from April 1st to September 30th, 1914, were £1,149,838 as against £1,100,177 for the corresponding period of 1913.

The Council's proposal to do away with the tramway "dead end" in Waterloo Road by constructing a line through the New Cut to Blackfriars Road is meeting with much opposition in the neighbourhood, as it would involve the abolition of the New Cut market, one of the principal street markets of South London.

The L.C.C. Highways Committee has recommended the alteration of the existing and provision of additional coal bunkers, ash hoppers, &c., provision of new workshops, stores and office accommodation in connection with the Greenwich generating station at a cost of £17,700.

Mexico.—A strike of 1,200 motormen and conductors occurred on the Mexico City tramways last week. The men want double wages.

New Zealand.—Dunedin.—The manager of the Corporation Tramways, after visiting the Christchurch, Wellington and Auckland tramway systems recommends the Council to adopt the Auckland type for the proposed new cars.

Poole.—Railless Traction.—The T.C. has referred to a Sub-Committee of the Railways Committee for consideration and report a proposal by the Sandbanks Railless Electric Car Co., Ltd., to establish a system of railless traction with the co-operation of the Council.

Shelf.—The U.D.C. has expressed its willingness to enter into a new agreement, as suggested by the Halifax Corporation, similar to the one previously entered into with regard to the tramways.

Rotherham.—Loan Sanction.—The B. of T. has sanctioned the borrowing of £3,761 for the construction of tramways along Corporation Street (formerly Millgate).

Sheffield.—The City Council has been recommended to proceed with the doubling of the length of single track on the Shoreham tramway route.

South Shields.—The T.C., on the recommendation of the Tramway Committee, has decided to promote a Bill in Parliament for authority to run omnibuses outside the borough limits, and to include in the Bill application for power to extend the tramway system.

U.S.A.—According to the *Railway Review* (Chicago) a recent order of the New York State Public Service Commission prohibited the use of wooden cars for passenger transport with electric trains, after September 15th. The Long Island Railway is most seriously affected by this order.

Wigan.—Borrowing powers for £1,243 are to be sought for extensions of tramway loops at Orrell and Newtown.

TELEGRAPH and TELEPHONE NOTES.

Cables Cut.—It is reported that the five German long-distance cables, which all pass through the English Channel, were cut some time ago by the British, and the direct Anglo-German cables were disconnected. The German cables between the Azores and the United States, and between Yap, in the Caroline Islands, and Menado, Shanghai, and Honolulu, have also been silenced.

Censorship of Cable Telegrams.—We give below the terms of a protest lodged by the Commercial Cable Co. with the Government of the United States at Washington, on August 14th, 1914:—

A submarine cable differs in a very important way from wireless telegraphy. The wireless, communicating with a warship at sea, is the same as a warship cutting a submarine cable and taking the end on board and operating it.

The sending of cablegrams may be considered in the same light as traffic in supplies or munitions of war.

Our citizens are not prohibited from furnishing belligerents with supplies.

The citizens of neutrals may even supply belligerents with arms and ammunition without infringing the neutral status of the State itself.

A cablegram is in many respects similar to a letter, and it certainly is not the duty of any neutral Government to censor letters to a belligerent country. That would not be tolerated either by law or public opinion.

The secrecy of telegrams is preserved in many States by statutes, which make it a criminal offence to divulge their contents.

Judge Cooley, in his work on "Constitutional Limitations" (Seventh edition, pages 432-433), doubted even the power of a Court to compel a telegraph operator to disclose the contents of a message.

During the Spanish-American War, while the United States exercised rigid censorship, the nations, which are now belligerents, did not impose any restrictions on messages to or from the United States, or to or from Spain.

The Commercial Cable Co. would feel obliged to contest, as a form of unreasonable search, the placing of censors in its offices.

The company also issued the following letter to its principal patrons, together with copies of the foregoing protest:—

The Commercial Cable Co.,
Postal Telegraph Buildings,
253, Broadway, New York.
August 20th, 1914.

To our Patrons—

In view of the reported intention of the United States Government to place censors in the offices of cable companies when the United States is not at war, nor apprehending war, the Commercial Cable Co. filed a protest with the Government at Washington, on August 14th, 1914. We enclose a copy of such protest.

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For 30 years the Commercial Cable Co. has preserved with the greatest fidelity the inviolability of cablegrams; has surrounded them with every safeguard; resisted attempts at inspection, and has taken every precaution to prevent their contents being divulged to any person whatsoever.

We do not believe our patrons wish their cablegrams to be subjected to the espionage of Government officials; not even on rare occasions.

There is a temporary financial benefit to the Commercial Cable Co. in eliminating code words and increasing the number of plain words by reason of a censorship, but we believe that in the long run the interests of the Commercial Cable Co. and the interests of its patrons are identical. We accordingly entered our vigorous protest.

If you care to express your views to the Government it might throw additional light on the subject from the standpoint of the cabling public.

THE COMMERCIAL CABLE CO.,
GEORGE CLAPPERTON,
Vice-President.

Norway.—The Bergen Telephone Co. decided some time ago to introduce a semi-automatic system at its telephone exchanges, and the installation of the new apparatus was to have been completed in the course of this year. When the war broke out the company was, however, notified by the contractors, a Belgian firm, that the work could not be completed according to the contract. Later on the contractors sent some electricians from Antwerp to Bergen to proceed with the installation, and those machine parts which cannot be got from Antwerp at present will be supplied from the firm's manufactories in England and America, so that it is expected that the work will be completed in the course of the spring next year.

Pacific Cable.—It is reported in the *Morning Post* that there is every probability of the traffic on the Pacific cable route being resumed at a reasonably early date. The *Nürnberg* damaged only the buildings and instruments on Fanning Island, which will soon be replaced. The authorities have been able to communicate the fact that the Island staff are safe.

Telephone Spy.—Reuter reports that recently the Russians entered a church, where they were courteously received by a venerable Psalm reader, and only accidentally discovered that there was a field telephone under the altar; the Psalm reader was a disguised Austrian officer.

Wireless Charge.—At West London Police Court, on October 8th, M. A. Watsdorf was charged on remand with establishing and working a wireless telegraph apparatus without a licence, and was committed for trial at the Central Criminal Court.

Telegraphists at the Front.—The *Times* prints a letter from a telegraphist on active service, from which we extract the following:—

"The Germans when retreating played havoc with the French lines, cutting the wires and cutting and burning the poles down, and that made it much harder for us to get rid of our work, as before we could do anything really our linemen, who are also P.O. fellows mostly, had to go out and put things a bit straight. We are constantly moving from place to place, so all our instruments are made to pack away, and in about half an hour after we get the word to close the office we are all ready to proceed to our next town. Further towards the front and linked up with us the messages are sent by a fellow on a cable cart, from which the line is laid down as they go along. The fellow works this with an instrument which sounds something like a bee buzzing, and one office is on the cart and another in a two-sided tent. Of course, this is all constructed for laying and taking up quickly, as the enemy may be very near, and sometimes you see them coming along at full gallop still picking up the cable. So you see there is a complete path from the landing place right up to the fighting, and as it is impossible to get letters about the country we do nearly all the correspondence."

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—MELBOURNE.—November 25th. Victorian Railways. 25 battery signal machines for operating signals. Contract 27,479. Contractors' Room, Railway Offices, Spencer Street.

December 2nd. Victorian Railways. 1,376 steel disk wheels complete for electric cars; steel disk wheel centres and steel tires for electric motor-cars; 1,376 steel disk wheels for electric motor-cars. Three separate contracts. Particulars from Contractors' Room, Railway Offices, Spencer Street.

ADELAIDE.—November 11th. Portable desiccating plant, petrol motor driven, for Postmaster-General. See "Official Notices" October 9th.

PERTH.—November 18th. 249 accumulators and power board, for Postmaster-General. See "Official Notices" to-day.

BRISBANE.—November 18th. Instruments and parts. See "Official Notices" October 9th.

December 15th. Switchboard, common battery, automatic or semi-automatic, for the Postmaster-General. See "Official Notices" October 9th.

SYDNEY.—December 9th. P.M.G. Time for tenders for various telegraph instruments and measuring instruments extended to December 9th.

The City Council has extended the time for the receipt of tenders for wet-air filters from October 26th to November 23rd.

December 21st. City Council. Motor-generators and switchgear suitable for electric vehicle battery charging. Specifications, 10s. 6d, from City Electrical Engineer.

Beckenham.—October 26th. U.D.C. Twelve months' supply of Midland small coal for the electricity works. See "Official Notices" to-day.

Birmingham.—October 26th. Electric light installation, Western Road House and Dudley Road Infirmary, for the B. of G. Messrs. Edwards & Shaw, engineers, 105, Colmore Row, Birmingham (returnable deposit of £5).

Blackpool.—Corporation. 24 cast-iron distribution pillars, H.T. and L.T. cables, earthenware conduit. See "Official Notices" October 9th.

Bradford.—October 17th. Corporation. Six or twelve months' supply of tramway stores. Forms of tender from the Tramway Offices, 7, Ings Road.

Colwyn Bay.—October 20th. Turbo-alternators and condensing plant; boilers, stokers, pumps, &c.; switchgear; cooling tower; crane; power station cabling and wiring; cables; rotaries and transformers, for the U.D.C. See "Official Notices" Sept. 25th.

Connah's Quay.—November 6th. U.D.C. (Contract 2) Gas engines, suction gas plant, pipework, cooling tank, dynamos, booster, switchboard, connections and storage battery. (3) Overhead and underground mains, services and public lighting. See "Official Notices" to-day.

Dublin.—November 5th. G.N. Railway Co. (Ireland). Twelve months' supply of stores, including a number of electrical items. See "Official Notices" to-day.

Heywood.—October 17th. Corporation. Converting plant, A.C. and D.C. switchgear and cables, battery booster, E.H.T. overhead line, E.H.T. switchgear for sub-station. See "Official Notices" September 25th.

Huddersfield.—October 21st. Corporation. Twelve months' supply of slack coal, for the Electricity Committee. Particulars from the Borough Electrical Engineer, St. Andrew's Road.

Leicester.—October 17th. Corporation. Steel plate, girders, steel troughing, &c., for the Tramways and Electricity Committee. Specifications from the Borough Engineer.

London.—October 28th. L.C.C. Installations, 160 wiring points, 200 lights, at Victoria School, Hammersmith; 126 wiring points, 170 lights, at Woolmore Street School, Poplar. See "Official Notices" October 9th.

New Zealand.—GISBORNE.—December 5th. Borough Council. Direct-current meters for electric lighting. (Deposit £25, to Town Clerk.) Specifications, &c., may be seen at Board of Trade Commercial Intelligence Department in London.

Pontypridd.—October 20th. U.D.C. 1,800 yards of ·4 concentric paper-insulated and lead-covered cable, for Electric Light and Tramways Department. See "Official Notices" October 9th.

Porth.—October 17th. E.L. installation, electricity and destructor works, Appletree, Porth, for the Rhondda U.D.C. Robert Hammond & Son, Engineers, 64, Victoria Street, Westminster, S.W. (Returnable deposit of £1 1s.)

Salford.—Erection of South Extension central car depôt, Frederick Road, Pendleton. Particulars from General Manager, 32, Blackfriars Street, Salford.

October 19th. Corporation. Purchase of 500 disused meters. See "Official Notices" October 9th.

South Africa.—November 2nd. S.A. Railways Administration. 14,080 incandescent lamps and 39,150 train-lighting lamps—all tungsten drawn-wire. Secretary to Tender Board, S.A.R. Headquarters, Johannesburg; and S.A. High Commissioner in London, 32, Victoria Street, S.W.

Spain.—October 19th. The municipal authorities of Posadas (province of Cordoba) are inviting tenders for the concession for the electric lighting of the town during a period of three years.

Tenders have just been invited for the concession for the working of the telephone exchange in the town of Valls (province of Tarragona) during a period of 20 years.

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Tunbridge Wells.—November 7th. Corporation. 12 months' supply of H.T. and L.T. cables. See "Official Notices" October 9th.

York.—October 23rd. North-Eastern Railway. Twelve or six months' supply of telegraph apparatus, telegraph wire and line stores. See "Official Notices" to-day.

November 9th. Construction of about 1½ miles of light railway, excluding overhead electrical equipment, for the T.C. Mr. F. W. Spurr, City Engineer (returnable deposit of £5).

CLOSED.

Ashton-in-Makerfield.—Messrs. Johnson & Phillips have received an order from the U.D.C., in connection with the new sewage-disposal works, for an overhead line, switchboards, control panels and wiring for power and lighting.

Australia.—According to the *Melbourne Age*, the Prahran and Malvern Tramways Trust has accepted the following tenders in connection with supply of 20 single-type trucks and equipment:—

Contract No. 49.—Horrocks, Roxburgh Pty., Ltd., £394.
Contract No. 51.—Noyes Bros. (Melbourne) Pty., Ltd., £1,860.
Contract No. 55.—British Westinghouse Electric and Manufacturing Co., Ltd., £6,280; Australian General Electric Co., £1,710.
Contract No. 52.—Horrocks, Roxburgh & Co., for special work for car depôt at Kew, &c., £2,167.

Ballyconnell (Co. Cavan).—At a meeting of the Electric Light Co., tenders for the installation of electric light in private houses were considered. It was decided to give the contract to Mr. J. C. Cave, electrical engineer, Belturbet, at the following quotations: One light point, 16s.; two ditto., 18s.; three ditto., 22s.

Bradford.—The Electricity Committee has accepted the tender of the Lea Recorder Co., Ltd., for a water meter required for the turbines at the Valley Road electricity works, at £131; and that of Messrs. Holden & Brooke, Ltd., for a vertical spindle pump for new sump at Valley Road works, at £115.

The Tramways Committee has accepted the offer of Messrs. Cole, Marchant & Morley, Ltd., for 50 sets of patent power brake equipment, at £72 each; that of the British Oxygen Co. to supply oxygen required in the permanent-way department during one year, at 32s. 6d. per 1,000 cubic feet; and the tender of the British Mannesmann Tube Co., Ltd., for steel poles as follows:—220 light poles, at £4 11s. 10d. each; 80 medium poles, at £6 8s. 1d. each; and 10 heavy poles, at £7 8s. 7d. each.

Brodsworth.—The D.C. Tramway Committee has accepted the following tenders in connection with an extension of tramways:—

Four tramcar bodies, at £482 per car.—United Electric Car Co., Ltd.
Four electrical equipments, at £290 each.—Dick, Kerr & Co., Ltd.
Four Peckham pendulum trucks, at £103 each.—Brush Electrical Eng. Co., Ltd.

Dartford.—The U.D.C. has accepted the tender of Mr. T. Knight, of Sidcup, for extensions to the electricity works, at £1,695. The tender of Messrs. Stuart & Moore for extra appliances in connection with the electric fire-alarm system has been accepted by the U.D.C., making a total of £376 12s. 6d.

Gillingham (Kent).—The T.C. has decided to place an order for five transformers in the hands of the British Electric Transformer Co.

Gloucester.—The T.C. has accepted the tender of Messrs. Sully & Co. for the supply to the electricity works of 2,000 tons of best slack coal from the Lydney and Crump Meadow Collieries, at 9s. 8d. per ton.

London.—L.C.C.—The Main Drainage Committee reports that Messrs. Leakole & Co., whose tender was accepted for the supply of electrical resistance indicators for the superheaters of the new boilers at Crossness pumping station, have gone into voluntary liquidation owing to the war, and have transferred their business to the Cambridge Scientific Instrument Co., Ltd., who offer to take over the work at the same price, and upon the same terms. The Committee has accepted their offer.

The Stores and Contract Committee reports that the war is affecting to some extent many of the Council's contracts, a number of the contractors finding themselves unable, owing to unforeseen circumstances, to meet the full obligations under their contracts, and the Committee has considered as to the best means of dealing with the situation. In some cases the contracts have been terminated, and in a few other cases special arrangements have been made, each case being considered on its merits. Tenders or quotations for the supply of stores have from time to time been accepted from firms controlled wholly or largely by persons of German or Austrian nationality. The Committee, after making the necessary inquiries in each case, is arranging, if the facts justify that course, to cease dealings with the firms in question.

The Highways Committee reports the acceptance of tenders for the provision and laying of cables, laying of cable ducts, fixing of feeder pillars, &c., in connection with the re-arrangement of tramway sub-stations and sub-station plant. The following tenders were received, for supply and laying of high and low-tension cables:—

Western Electric Co., Ltd.	(accepted)	£24,002
British Insulated and Helsby Cables, Ltd.		24,524
Johnson & Phillips, Ltd.		24,690
Callender's Cable and Construction Co., Ltd.		24,824
W. T. Henley's Telegraph Works Co., Ltd.		25,100
W. T. Glover & Co., Ltd.		26,111
Siemens Bros. & Co., Ltd.		26,150

Laying of stoneware cable ducts, &c.:—

Foote & Milne, Ltd.	(accepted)	£2,268
W. Griffiths & Co., Ltd.		2,556
May, Mortimer & Co., Ltd.		5,971

For the installation of four induced-draught fans in connection with the Babcock & Wilcox boilers at the Greenwich generating station the following tenders were received:—

	For rope-driven fans.	For direct-driven fans.
Davidson & Co. Ltd.	£4,706	£5,353
Davidson & Co., Ltd. (alternative)	4,384	4,911 (with motors by Vickers, Ltd.) 4,898 (with motors by B.T.H. Co., Ltd.)
Standard Engineering Co., Ltd.	4,762	—
Turbon Patent Fan Co., Ltd.	4,875	—
James Keith & Blackman Co., Ltd.	4,996	5,471
Musgrave & Co., Ltd.	6,117	7,115

The Committee, on the recommendation of Messrs. Kennedy and Donkin, has accepted the alternative tender of Messrs. Davidson and Co., Ltd., for fans with motors, at £4,898. Permission was given to sub-let to the British Thomson-Houston Co., Ltd., the electric motors; to Messrs. Brook, Hirst & Co., the starting switchgear and resistances.

For supply of jib crane for the third section of the Central car-repair depôt the following tenders were received:—

T. Broadbent & Sons, Ltd.	(accepted)	£610
Babcock & Wilcox, Ltd.		795

Messrs. T. Broadbent & Sons were permitted to sub-let to the British Westinghouse Electric and Manufacturing Co., Ltd., the motors and controllers; to the British Insulated and Helsby Cables, Ltd., the cables, and to Messrs. T. Bolton & Sons, Ltd., the overhead line.

The Committee states that the contract of Messrs. J. Batt & Co. (London), Ltd., for the supply of 3,000 driving, and 2,000 pony wheel tires, for the Council's tramcars, at 19s. 4d. and 16s. 7d. each respectively, has been cancelled; the company proposed to sub-let the manufacture of the tires to certain German firms, and the following arrangements for tires to be purchased have been made:—

The Bessemer & Co., Ltd.—3,000 driving wheel tires, at 23s. each; and 2,000 pony wheel tires, at £1 each.
Cammell, Laird & Co., Ltd.—500 driving wheel tires, at 22s. each; 500 pony wheel tires, at 19s. each.

The undermentioned material has been purchased for use in the tramways department:—

200 pairs of motor-axle bearings; Anti-Attrition Metal Co., £200.
18,000 ft. rubber hose for magnetic brakes; D. Moseley & Sons, Ltd., £149.
6 tons of plain tread plate; J. Bellingham, £108.
1,200 carborundum blocks for rail grinding; Carborundum Co., Ltd., £263.
200 cast-iron yokes; Anderston Foundry Co. and J. Martin & Son (100 each), £139.
1 ton of tinned copper strip; London Electric Wire Co. and Smiths, Ltd., £97.
3,000 rail clips for extended yokes; Armstrong, Stevens & Sons, Ltd., £200.
Bolts, bars, clips, &c., in connection with the reconstruction of the lines in Seven Sisters Road, N.; Baylis, Jones & Baylis, Ltd., £563.
1,700 yokes; Anderston Foundry Co., Ltd., £1,132.

For the supply of 125,000 metallic-filament traction lamps the following tenders were received:—

Siemens Bros. Dynamo Works, Ltd.	(accepted)	£6,818
" " "	alternative	7,816
Edison & Swan U.E.L. Co., Ltd.		7,816
Electrical Co., Ltd.		7,816
G.E. Co., Ltd.		8,450

For the reconstruction of motor-generators in tramway sub-stations the tender of Messrs. Newton Bros., for £7,680, has been accepted.

SOUTHWARK.—The E.L. Committee proposes to purchase a 14-H.P. motor from the Electrical Co. at a cost of £37 3s. 6d.

ST. PANCRAS.—The B.C. has referred back to the Electricity Committee the recommendation for the acceptance of the tender of Medway's Safety Lift Co. for an electro-oil lift with spare motor-driven oil pump, at £1,369.

Rotherham.—The following tenders have been accepted by the Electric Light and Tramways Committee for annual supplies:—

Chamberlain & Hookham, Ltd.—Upwards of 5-amp. meters.
Bastian Meter Co.—2½ and 5-amp. meters.
Callender's Cable & Construction Co., Ltd.—High and low-tension cables.
C. Kitson.—1,000 tons High Hazel slack coal, 8s. 9d. per ton.
J. Longbotham & Son.—1,000 tons Kilnhurst pea nuts, 8s. 8d. per ton.
Sheepbridge Coal and Iron Co., Ltd.—5,000 tons Glapwell Smitham coal 7s. 8d. per ton.
W. A. Durnford.—5,000 tons Barnsley Pit slack coal, 9s. per ton.
Tasker, Sons & Co.—Macintoshes.
Pocock Bros.—Oilskin coats.

Salford.—The Corporation has confirmed the recommendation of the Electricity Committee accepting a tender from Messrs. Willans & Robinson, Ltd., for a 5,000-KW. turbo-alternator with surface condensing plant.

Sheffield.—The following tenders have been accepted by the Electricity Supply Committee:—

Stirling Boiler Co., Ltd.—Complete sets of tubes for front banks of two Stirling boilers, £246; replace links for stokers of two boilers, £226.
A. Reyrolle & Co., Ltd.—14 panels of extra H.T. three-phase sub-station switchgear (extension of present contract), £1,682.

The City Council has been recommended to accept the tender of Messrs. Boving & Co., Ltd., to supply two electrically-driven turbo-sinking pumps, with necessary motors and other accessories; also the tender of Messrs. T. B. & W. Cockayne, Ltd., for the supply of fittings for aerial cables and for internal wiring and fittings to buildings, and the tender of the General Electric Co. for cables, insulators and lamps.

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Watford.—The tender of the British Westinghouse Co. has been accepted for a supply of transformers at schedule prices.

Wolverhampton.—The T.C. has accepted the tender of Messrs. Turner, of Rochdale, at £150, for the covering of the existing coal-bunkers.

FORTHCOMING EVENTS.

Institution of Post Office Electrical Engineers.—Monday, October 19th. At 6 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Paper on "Ethics of Supervision," by Mr. A. S. Renshaw.

Physical Society of London.—Friday, October 23rd. At Imperial College of Science, South Kensington. Presidential address on "Ionization," by Sir J. J. Thomson, F.R.S.

NOTES.

Gas on Trains.—A mail train caught fire near Ballinluig, on October 2nd, and a gas cylinder exploded, causing serious injuries to the guard. No particulars are available to show whether the explosion was the cause or the result of the fire.

Colliery Winding Gear.—Electric winding is being adopted by colliery proprietors in Scotland, although there was much hesitation at first. Various systems were advocated, and this led to confusion. If a power company is near at hand the colliery owners are inclined to substitute electric for steam winding. In connection with the new pit framework of one of the Townhill Coal Co.'s old pits in Fife, it was decided as a matter of course to put in electric plant for winding as well as haulage, owing to the fact that the Fife Electric Power Co.'s central generating station is close to the pithead.

Two new installations at Scottish mines where, in both cases, old machinery has been removed to make way for modern plant, show different types of winders. One at the Breichshale pit of the Pumpherston Oil Co. was installed by Messrs. Siemens Bros., and is on the Siemens-Ilgner system, consisting of (*a*) a continuous current separately excited winding motor, direct coupled to a winding engine, comprising two cylindrical drums, each 8 ft. diameter × 2 ft. wide; and (*b*) a fly-wheel converter set. The other winder is at the Prestwick Colliery of Messrs. William Baird & Co., and is designed on the Thury principle. To prevent the peak loads coming on the three-phase supply, a balancing set is introduced in the winding motor house, common to the winding plant for both shafts. This is a three-phase motor operated from the power house, and constantly in motion. Mounted on the same shaft is a heavy fly-wheel, and on the other end of this shaft a direct-current generator, which supplies the current for operating the motors on the winding drums.

In fitting up new plant there is a considerable saving on first cost over steam, for the rotary converter, driving motor control-gear, and winding apparatus cost much less than boilers and steam engines. Winding by electricity also works out much more cheaply. The reduced winding costs and lower depreciation and interest on capital represent a satisfactory reduction in the cost per ton of coal raised. Winding is also easy and safe to manipulate.

Other Scottish collieries fitted include the South Kenmuir pits in the West of Scotland. The winders recently installed are on the C.M.B. system, for which Messrs. Crompton & Co. hold the patent; Messrs. Crompton have done much electrical work in South Wales mines. The gear is designed for a working depth of 160 fathoms. The cages carry two hutches apiece, the loaded hutches taking 17 cwt., so that with 65 winds per hour 55 tons of coal can be brought up hourly. The ascending load totals 57 cwt., and the descending load 23½ cwt., leaving 33½ cwt. to be dealt with by the winding gear. A 120-KW. motor-generator, working at 400 volts, is employed, the two winding motors used being of 150 B.H.P., running at 400 revolutions per minute. The maximum demand from the mains is found to be only a little over 120 KW., while the units per ton working from an 85-fathom level are only 0·8, which, with energy supplied at ¼d. per unit, gives the winding cost per ton at the low figure of 0·6 of a penny. The average winding speed of the plant is 1,120 ft. per minute, and the maximum 1,360 ft., with an acceleration period of 8 seconds, a full speed of 29 seconds, and a retardation period of 8 seconds. The banking time is 10 seconds, leaving the time for each wind at 55 seconds. With a day of eight working hours the lift is, therefore, 440 tons. The power supply in this district is three-phase alternating, 25 cycles per second, at a voltage of 440. This is directly coupled up to the rotary converter through a triple-pole oil switch with overload circuit-breaker attachment, while the motor has a wound rotor with slip-rings for starting, a liquid starting resistance being employed. The alternating current panel has mounted on it the usual volt and amperemeters, and also a voltage coil which connects the leads to the emergency trip gear of the brake. The main winding drum is of the spiro-conical type, designed to minimise the torque during acceleration. Control is by a regulator in the field circuit of the motor-generator, and by a reversing switch in the winding motor circuit, the two switches being connected so that before the motor can be reversed the current must be shut off and the brake applied. The magnetic brake is automatically applied as the controller is brought back, but comes into action of its own accord should any electrical failure occur. There is also an emergency brake actuated by a pedal.

Electrolytic Iron.—Referring to the paper by Mr. Guillet, of which an abstract was published in our issue of Oct. 2nd, Mr. S. Cowper-Coles wrote to the Iron and Steel Institute, stating that he considered the paper to be very misleading in regard to some of its statements. In 1908 he read a paper before the Iron and Steel Institute, entitled "The Production of Finished Iron Sheets and Tubes in One Operation," describing in considerable detail his electrolytic process for the direct production of iron tubes, cylinders and sheets. In that process a mandrel revolving at a critical speed so as to give sufficient skin friction between the electrolyte and the deposited metal was employed, to obtain a close homogeneous deposit and at the same time to enable a high current density to be employed, the solution being kept neutral by bringing it into contact with iron oxide, as described in Mr. Guillet's paper. In the following year Mr. Boucher approached him (Mr. Cowper-Coles) regarding the process, and obtained a licence to work it in France and Switzerland. A small trial plant was thereupon set up in Switzerland, and Mr. Boucher produced a number of tubes. A company was ultimately formed, called "Le Fer," to acquire the licence that had been granted to Mr. Boucher.

Mr. Cowper-Coles's object in setting out those facts was to show that all the preliminary work was carried out in Great Britain at great expense and with much labour. That that was so could hardly be gathered from the somewhat ungenerous statement, which constituted the only reference to the process in Mr. Guillet's paper.

His process was in no way analogous to the Elmore copper process, which as most people knew consisted of using an agate burnisher. He thought it should be known that the process described in Mr. Guillet's paper had been worked out in England, and that works were to be erected in the Midlands to carry out the process on a commercial scale.

Fatalities.—At Southport on Monday, an inquest was held on Emily Jane Lloyd (21), servant, who died on the previous Friday from injuries received in a lift accident at Westminster Buildings, Lord Street, Southport, last July. Annie Foster, who with her husband is caretaker of the building, had invited the deceased and a friend to ascend with her to her rooms, and, in the course of her evidence, said that she was already in the lift when the deceased put one foot inside, and the lift at once began to go up although witness had not started it. Witness stopped the lift by the emergency button, but, upon releasing her hand to assist the deceased, the lift again went up and crushed Lloyd. John Henry Stevens, architect, of Westminster Buildings, said that, although he was not an electrician, he had studied electricity, and understood most of the parts of this particular lift. It was installed in 1906 or 1907, and there had been no accident previously. On the Sunday when the accident took place, he had used the lift, and found it in proper working order. Under ordinary circumstances the lift could not be started without the entrance gate being closed, but he had known it to move when the gate had been opened, on account of a defect in the lock. After the accident he examined the lock, and found when opening the gate that a spring in the lock failed to act and to cut off the current as it should have done. He had looked after the lift, and had frequently tested it. He was not aware that there were two recent improvements that would have obviated an accident of the kind. He had never tampered with the machinery, and had only done what he had been instructed to do by the makers. The lift was insured, and one of the conditions of the insurance was that it should be regularly examined, and this had been done by a qualified electrician, the last examination prior to the accident being on May 11th. The jury returned a verdict of "Accidental Death," and said there was no one to blame.

The death of a boy named Ernest Taylor, (13), at the slag works of Messrs. John Crombie & Sons, Ltd., formed the subject of a Coroner's inquest at Middlesbrough on Friday last. A verdict of "Accidental Death" was returned, no blame being attached to anyone.

The evidence showed that the boy was on the roof of a structure at the works, when he apparently came in contact with some live wires above it.

The foreman denied that it was part of the boy's duty to look after a hopper on a platform near the roof. The bottom of the roof was 4 ft. above the platform, and 4 ft. separated the edge of the roof from the live wires overhead. The boy had no business on either platform or roof.

Dr. Benson, who conducted a post-mortem examination, stated that the symptoms pointed to death from electric shock. Artificial respiration had apparently been attempted for a short time.

The Factory Inspector, Mr. T. K. Evans, stated that he had known a great many cases of men being brought back to consciousness by continued artificial respiration. Nevertheless he thought the doctor's chance of resuscitation a poor one, once the efforts in this direction had been relaxed.

The Coroner remarked that while they could not blame the men for ceasing attempts at artificial respiration, he thought it would have been wiser to go on till the doctor arrived.

Leitner Electrical Co., Ltd.—In the Winding-Up Court, on Tuesday (October 13th), Mr. Justice Neville heard a petition by Messrs. Alfred Herbert, Ltd., for the compulsory liquidation of the Leitner Electrical Co., Ltd.

Mr. Uthwatt stated that the petitioning company was a simple contract creditor for £650, and that it was supported by creditors whose debts amounted to £4,000.

Mr. Whinney and Mr. Hunt, on behalf of other creditors, also supported the petition.

The company did not appear, and his Lordship made the usual compulsory order.

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Institution and Lecture Notes.—Association of Engineers-in-Charge.—The following are the chief items in the programme for the coming Session of the above Association :—

December 9th.—"Electricity in the Printing Office," Mr. F. Broadbent.
" 12th.—Social dance.
January 2nd.—Social dance.
" 13th.—"Electric Accumulators." Mr. R. T. Mitchell.
February 10th.—"Boilers and Boiler Mountings," by Mr. Vernon Smith.
" 13th.—Social dance.
March 10th.—"Modern Steam Laundry Machinery." Mr. B. P. Flockton.
" 20th.—Annual dinner.
April 10th.—Social dance.
" 14th.—"Autogenous Welding." Mr. L. M. Fox.
September 15th.—Annual meeting.

Mr. Frank Bailey delivered his presidential address on Wednesday night.

Institution of Post Office Electrical Engineers.—The programme of this Institution for the Session now commencing includes :—

1914.—October 19th.—"Ethics of Supervision." Mr. A. S. Renshaw.
November 16th.—"Stores Accounting." Mr. W. T. Harris.
" "—"Cash Accounting." Mr. W. J. A. Payne.
December 21st.—"Power Circuit Interference with Telegraphs and Telephones." Mr. S. O. Bartholomew.
1915.—January 18th.—"Telephone Relays and their Application to Commercial Circuits." Mr. C. Robinson.
February 15th.—"Wireless Call Devices." Mr. L. B. Turner.
March 15th.—"Telephone Economics—Open Construction." Mr. H. A. Smith.
April 19th.—Annual General Meeting.

Manchester Association of Engineers.—On Saturday last a visit was paid by the Association to the works of the British Westinghouse Electric & Manufacturing Co., Ltd. Considerable interest was shown in the various manufacturing processes, and a large amount of work was in progress through the shops; the high degree of mechanical perfection attained in the manufacture and fixing of the turbine blading, and in the improved design of the vertical tandem gas engine, attracted special attention. Other interesting features were some examples of bent copper windings, insulating materials, fan and other small motors, and a display of electric supply fittings manufactured in the works. About 160 members of the Association attended. An admirable little book printed by the company specially for the occasion gave particulars of the departments and the jobs in hand, as well as a carefully arranged itinerary of the works.

Association of Supervising Electricians.—The first meeting of the 1914-15 Session was held at St. Bride's Institute, Ludgate Circus, on the 29th ult. Some 80 members and visitors assembled to hear the presidential address, which was followed by a paper dealing with "Private Generating Plants," read by the president, Mr. A. H. Dykes. A reference was made to the necessity of having an Association to bring into close touch with one another supervisors and foremen of the electrical contracting trades. The paper by Mr. Dykes showed a deep and intimate knowledge of his subject, and an interesting discussion followed, being the outcome of the varied experience of the members. A number of technical questions were answered by the lecturer. It is intended to include these with the paper, which is being printed and sent to all members. The Hon. Secretary announced a series of papers, which will be read during the session by authorities on the respective subjects, amongst them being "A.C. Commutator Motors," "Wiring Systems," "D.C. Motors," "Telephones" and "Lightning Conductors," and concluded by drawing attention to the inaugural dinner, which is to be held at the London Tavern, Fenchurch Street, on November 28th. Particulars of the Association and the rules can be obtained from the Hon. Secretary, Mr. C. J. Banister, 14, Pulborough Road, Southfields.

Institution of Electrical Engineers.—At the opening meeting of the Session on Thursday, October 29th, when the president, Sir John Snell, will deliver his inaugural address, a marble bust of Michael Faraday will be presented to the Institution by Mr. Llewellyn Preece, on behalf of the family of the late Sir William Preece, K.C.B., F.R.S., past-president.

Birmingham Wireless Association.—In his presidential address to the members of the Birmingham Scientific Society, last week, Mr. H. W. H. Darlaston announced that the Wireless Telegraph Association was now associated with them and shared their headquarters.

Physical Society of London.—Sir J. J. Thomson, O.M., F.R.S., will deliver his presidential address at the first meeting of the Society on Friday, October 23rd. The subject of the address will be "Ionisation," and the meeting will be held at the Imperial College of Science, South Kensington.

Stolen Metal : Sentence.—Before the Recorder (Sir Forrest Fulton), at the Central Criminal Court, on Wednesday, Alex. Farquhar, 39, metal spinner, pleaded guilty to stealing large quantities of brass and copper belonging to his employer, Mr. David Assersohn, electrical engineer, of St. Bride's Street. Counsel stated that the prisoner had been five years in the employ of the prosecutor, and was in receipt of a weekly wage, as a foreman spinner, of £2 15s. It was alleged that during the past two years prisoner had systematically robbed his employer of quantities of metal, which he surreptitiously removed to a workshop, and there made up and actually sold to his employer's customers. Prosecutor estimated his loss at £200. On his arrest there was found in the prisoner's possession a bank-book showing that he had saved over £200. The Recorder sentenced the prisoner to 15 months' hard labour, and ordered him to pay the costs of the prosecution.

London County Council.—It has been decided to raise the rate of pay of assistant night inspectors from 38s. to 40s. per week, rising by annual increments of 1s. per week to 45s., and of acting assistant night inspectors from 38s. to 39s. per week, rising after a probationary period of six months, not necessarily continuous, to 40s. per week. These changes have been rendered advisable by the fact that conductors, who are a lower grade of employés, are now receiving 39s. per week.

Some months ago the leading and ordinary cable hands in the Southern section, and the wiremen and wiremen's labourers employed in the electrical section of the tramways department, applied for an increase of pay. It was referred to the Conciliation Board, but no decision was reached. The question was, therefore, referred to a Court of Arbitration appointed by the Board of Trade, consisting of Right Hon. Sir David Harrel, K.C.B. (chairman), Sir Alexander Kaye Butterworth, Mr. Reginald J. Smith, K.C., Mr. C. W. Bowerman, M.P., and Mr. J. N. Bell. The Court met on July 16th, and on the following day decided that in all cases there should be an increase of ½d. per hour. The new rates, dated from July 20th, are therefore :—Leading cable hands, 8d. or 8½d. per hour, according as they were receiving 7½d. or 8d. per hour previously. Ordinary cable hands, 7½d. per hour. Wiremen, depôt wiring department, 10d. per hour as from May 14th last. Wiremen's labourers, 7d. or 7½d. per hour, according as they were receiving 6½d. or 7d. per hour on July 20th last. For night work add one halfpenny per hour in all cases affected by the above awards. The extra expense involved by the award is estimated at £510 for the present, and £720 during the next financial year.

It has been decided to refer to the Conciliation Board the question of advancing on the above scale the wages paid to leading and ordinary cable hands employed in the Northern section of the tramway undertaking.

Appointments Vacant.—Working] assistant engineer, married (£89 + house), for Hants County Asylum; several junior assistant engineers (15s.), for Yorkshire Electric Power Co.; testing assistant (£91), for York Corporation Electricity Department; shift engineer (32s. 6d.) and a jointer, for Gillingham. Particulars are given in our advertisement pages to-day.

Inquiries.—Makers of machinery for manufacturing china and earthenware parts for electrical apparatus from the raw material are asked for; also makers of "Ohmic" metal-filament lamps, and makers of the C. Beyers electrical hairdrier.

Osmium-Platinum Alloy.—An alloy of osmium and platinum has been introduced in the United States, to take the place of iridio-platinum alloy, owing to the scarcity of iridium. It is stated that one part of osmium replaces two and a-half times its weight of iridium, and the alloy has a high specific resistance, combined with great hardness and tensile strength, and can be drawn into the finest sizes of wire.

Copper Contraband.—The British Government has agreed that there shall be no interference with American copper shipped to neutral countries, provided that the Governments of those countries give assurances that the metal will be used for domestic purposes only, and will not be re-exported. The Dutch Government has accordingly prohibited the export of copper.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Basingstoke T.C., on October 8th, appointed Mr. G. Broadhurst as electrical engineer, at a salary of £170 per annum.

There were 128 applicants for the post of borough electrical engineer at Swansea.

Mr. H. A. Harding, electrical engineer to the Bognor electricity undertaking, was married on Thursday, October 8th, to Miss Lilian E. Humphrys, eldest daughter of Mr. and Mrs. W. B. Humphrys, of Thornlaw Lodge, West Norwood.

With reference to our statement that Mr. T. B. Briggs, of Blackburn, had been appointed senior engineer-in-charge at Newport (Mon.) electricity works, we are now informed that the successful applicant was Mr. N. B. Macaulay, senior engineer-in-charge to the Rhondda Tramway Co., at Porth, Glam., South Wales, his appointment being made on Friday last.

The St. Annes U.D.C. has increased the salary of the electrical engineer by £50 per annum.

At a meeting of the Bexhill-on-Sea T.C., on Monday, it was announced that the electrical engineer (Mr. W. T. Le Feuvre) had applied for a commission in the Army. It was decided to keep open his post, and to refer to the Council in Committee the question of his salary, with power to act. The E L. Committee had recommended that his salary should be apportioned as follows :—£225 per annum to Mrs. Le Feuvre and family, £100 per annum to the assistant engineer, (Mr. Frost), and £100 per annum to the provision for any further engineering assistance, should necessity arise.

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Tramway Officials. — Bradford Tramways Committee proposes to promote Mr. Samuel Pearson, assistant works superintendent at the Thornbury depôt, to the position of works superintendent (in lieu of Mr. T. Richardson, resigned), at a salary of £150 per annum.

On the occasion of his marriage, Mr. P. R. T. Pearce, of the Bournemouth Corporation tramway staff, has been presented by his colleagues with a marble clock and a pair of ornaments.

General.—Mr. E. J. Reed, formerly sales manager to Messrs. Miles, Sykes & Son, Ltd., and for several years chief publicity writer to the British Westinghouse Co., has been appointed advertising manager to Messrs. Ed. Bennis & Co., Ltd., of Bolton. The offices of the publicity department are at 28, Victoria Street, London, S.W.

Mr. R. H. Burnham, telegraph superintendent, has just retired after 50 years' service in the South-Eastern and Chatham Railway. The duties are divided between the engineer and the superintendent of the line. During the present crisis Mr. Burnham has been appointed censor over the telegraph service message work.

Mr. John Hammersley, inspecting and supervising engineer, has been appointed resident engineer in Manchester for Messrs. Home-Morton, Ker & Gibson, of Glasgow, Birmingham and London, consulting engineers and industrial works designers.

Obituary.—Mr. Albert Dobson.—We regret to learn of the death, which occurred on October 8th, after a serious illness, of Mr. Albert Dobson, who was long associated with the Aster Engineering Co. (1913), Ltd., as general manager and secretary. Mr. Dobson, who was in his 49th year, had been ailing for several months and very severely ill for some six weeks. He leaves a widow, two daughters and a son who is at present serving in the Territorial Force.

NEW COMPANIES REGISTERED.

Ballyconnell Electric Light and Power Co., Ltd. (4,198).—This company was registered in Dublin on October 10th, with a capital of £1,500 in £1 shares, to carry on the business of electricians, mechanical engineers and manufacturers, workers and dealers in electricity, motive power and light, &c. The subscribers are:—F. McKiernan, Cullilleenan, Ballyconnell, 50 shares; F. McGovern, Doon, Ballyconnell, merchant, 50 shares; E. Shannon, Doon, Ballyconnell, merchant, 25 shares; J. J. O'Kane, Doon, Ballyconnell, merchant, 10 shares; R. Kells, Doon, Ballyconnell, gentleman, 25 shares; J. Gardiner, Doon, Ballyconnell, C.P.S., 10 shares; J. Drum, Doon, Ballyconnell, spirit dealer, 25 shares; J. McBarron, Doon, Ballyconnell, spirit dealer, 10 shares: J. A. Bennison, Slieve, Russell, Ballyconnell, gentleman, 75 shares; J. A. Foster, Doon, Ballyconnell, merchant, 25 shares; F. J. Clancy, Doon, Ballyconnell, merchant, 10 shares. The first directors are:—Rev. F. McKiernan, F. McGovern, E. Shannon, J. J. O'Kane, R. Kells, J. Gardiner, J. Drum, J. McBarron, J. A. Bennison, J. A. Foster and F. J. Clancy; qualification, £10. Registered office, Ballyconnell, Co. Cavan.

New High-Pressure Gas Light, Chemical and Electric Supply Co., Ltd. (137,868).—This company was registered on October 5th, with a capital of £10,000 in £5 shares, to manufacture and supply gas, for lighting, heating and power purposes, to the towns and districts of Gobowen, Whittington and Ifton Heath, and other places in Shropshire, to carry on the business of a gas and electric company, and that of analytical and research chemists, manufacturers of and dealers in coke, coal tar, pitch, asphaltum, ammoniacal liquor and other residual products, &c. The subscribers are:—B. Rowlson, Gas Offices, Ruthin, North Wales, gas engineer, 5 shares: Mrs. M. E. Rowlson, Gas Works, Ruthin, North Wales, 1 share; W. F. Wilson, 55, Barton Street, Moss Side, Manchester, 5 shares; R. W. Davies, Llwyn Derw, Ruthin, 10 shares; E. Wilson, 55, Barton Street, Moss Side, Manchester, 1 share; F. Turner, 54, Claremont Road, Handsworth, Birmingham, 2 shares; F. I. Rogers, Daisy Bank, Heaton Park, Manchester, representative of gas engineers, 10 shares. Minimum cash subscription, 7 shares. The number of directors is not to be less than three nor more than seven: the first are R. Rowlson, W. F. Wilson, R. W. Davies and F. I. Rogers; qualification, £50; remuneration as fixed by the company. Registered office, Gas Works, Ruthin, North Wales.

Cicoy Magneto Co., Ltd. (137,910).—This company was registered on October 8th, with a capital of £500 in £1 shares, to carry on the business of manufacturers of the whole, or component parts of, magnetos, motor-cars, motor-cycles, cycles, and vehicles of all kinds, electricians, manufacturers of electrical goods, aeroplanes, talking machines, records and accessories, cinematograph theatre proprietors, manufacturers of films and accessories and mechanical and other toy goods, &c. The subscribers (with one share each) are:—S. R. Cohen, 359, Goswell Road, E.C., manufacturer; B. R. Cohen, 359, Goswell Road, E.C., manufacturer: W. Trowell, 83, Cicada Road, S.W., engineer. Private company. The number of directors is not to be less than two or more than five; the first are S. R. Cohen, B. R. Cohen and W. Trowell; qualification, 50 shares. Registered office, 359, Goswell Road, E.C.

Vulcan Electric and Mechanical Co., Ltd. (137,918).—This company was registered on October 8th, with a capital of £1,000 in £1 shares, to carry on the business of agricultural motor tractors, mechanical engineers, manufacturers of malleable iron and steel castings, brass, white metal and aluminium, die casters and founders, &c. The subscribers (with one share each) are:—J. P. Annacker, Springfields, Powys Lane, Palmer's Green, N., engineer; J. Rochford, jun., 24, Village Road, Enfield, fruit grower. Private company. The number of directors is not to be less than two or more than three; the first are J. P. Annacker and J. Rochford, jun., and R. Rochford; J. P. Annacker is permanent, subject to holding 250 shares; qualification of ordinary directors, 25 shares. Solicitors, Hutchison & Cuff, 6, Stone Buildings, Lincoln's Inn, W.C.

British Battery Co., Ltd. (137,905).—This company was registered on October 8th, with a capital of £1,000 in £1 shares (800 preference), to carry on the business of electricians, manufacturers of electric batteries, lamps, filament, novelties, cables, accumulators, wires, &c. The subscribers (with one share each) are:—A. H. Rose, 38-9, Beech Street, E.C., merchant; T. A. Rose, 38-9, Beech Street, E.C., electrical engineer. Private company. The first directors are A. H. Rose and T. A. Rose; qualification, one ordinary share. Registered office, 38-9, Beech Street, Barbican, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Yorkshire Incandescent Electric Lamp Co., Ltd.—Particulars of £6,000 first and £6,000 second mortgage debs., created October 1st, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issues being £300 first and £3,000 second mortgage debs. Property charged: The company's undertaking and property, present and future. No trustees.

London Electric Works Co., Ltd.—Particulars of £5,000 debs., created September 18th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,000. Property charged: The company's undertaking and property, present and future. No trustees.

Northwood Electric Light and Power Co., Ltd.—Issue on September 9th, 1914, of £1,000 debentures, part of a series of which particulars have already been filed.

CITY NOTES.

Drake & Gorham, Ltd.

The thirteenth annual general meeting of the shareholders of the above company was held on October 8th, at the offices, 66, Victoria Street, Westminster, Mr. B. M. Drake presiding.

In proposing the adoption of the report (see Elec. Rev., p. 473) the Chairman said that the net profit was somewhat lower than that of last year, although practically the same as the average for the past three years. The difference was caused mainly by additional expenditure under the heading of advertisements which included new catalogues and the circulation of a pamphlet on country house lighting, and partly to a decrease in turnover in the North, due doubtless to the condition of the cotton trade. The whole of the cost of advertisements and preparation of catalogues had been written off, and it was hoped that benefit would accrue after the war. In view of the general financial position it was also thought prudent to make a larger provision than usual for possible bad debts. Although, as might be expected, the number of new installations that were being started for private individuals was not large, there was Government work to be done, some of which they were taking at low prices in order to keep their staff employed. A fair proportion of their employés had answered the country's call to arms, and the directors had made arrangements to provide for their dependents. The firm's system of church lighting continued to find favour, a number of churches having been lit during the year. A sole agency for Lancashire and Cheshire, and a general agency elsewhere, had been arranged for commercial vehicles propelled by Edison accumulators. The use of trucks of this kind was constantly being increased in the United States, and although some headway had been made in England, it took time to persuade the public to adopt anything new. The shortage of horses caused by the war would doubtless tend to increase the use of mechanically-operated vehicles, and as the results obtained became better known and charging facilities were extended, he had little doubt that vehicles propelled by electric batteries would play an important part in the general haulage of this country. A demonstration truck to carry two tons had been purchased for use in the Lancashire and Cheshire district, and they were endeavouring to make known to contractors, railway companies, manufacturers and others, the saving which they could effect by the adoption of electric trucks and delivery vans. With regard to general business, it was difficult to regard the immediate future with any optimism, but, wherever possible, economies would be effected, and no effort would be spared to utilise the company's organisation for any new class of kindred business for which a demand might arise under the altered conditions of the future.

Mr. J. C. Hamilton, M.P., in seconding the resolution, said he was sure the shareholders were glad to know that the company was able to pay a small dividend this year, and that it had not been paid at the expense of those employés who had joined the forces, but that the company had arranged to assist their dependents as far as possible during the continuance of the war.

The report was adopted.

Auckland Electric Tramways Co., Ltd.

The directors' report for the year ended June 30th, 1914, shows that the total revenue for the year was £276,320. The traffic receipts, which amounted to £271,702, show an increase of £14,110 over the previous year. After providing for all expenses chargeable to revenue, including £21,071 for debenture and other interest, the rental and percentage of profits pay-

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able to the Auckland City Council, amounting to £5,230, and setting aside £22,500 to the renewals and depreciation account, there is a surplus on the year's working of £51,719, making, with £8,782 brought forward, a total of £60,501. The dividend on preference shares paid and accrued to June 30th, 1914, requires £9,000, and an interim dividend on the ordinary shares for the half-year ended December 31st, 1913, of 7d. per share, free of income-tax, was paid in May last, and amounted to £13,125. The directors now recommend that £10,000 of the available balance be transferred to reserve account, bringing the account to £112,500, and that a further dividend be paid on the ordinary shares of 1s. per share, free of income-tax, for the half-year ended June 30th, 1914, making a total dividend of 1s. 7d. per share for the year. This will require £22,500, and leave £5,876 to be carried forward.

During the year £25,000 first mortgage debenture stock was disposed of, and an issue was made of 100,000 ordinary shares of £1 each. The shares were offered to the existing shareholders at par *pro rata* to their holdings. The whole of the issue was taken up. Under the terms of the debenture stock trust deed, £5,150 first mortgage debenture stock was cancelled, £2,750 of the amount being drawn for redemption at 105 per centum, the balance being purchased in the market at less than that price. The premiums paid in each case have been charged direct to the revenue account. At June 30th, 1914, the issued share and debenture capital of the company was:—£150,000 in 6 per cent. preference shares, £450,000 in ordinary shares, £408,407 in first mortgage debenture stock.

The capital expenditure during the year has aggregated £55,832, the larger portion of which has been applied to the erection and equipment of the new repair works. Expenditure has also been incurred in the provision of additional rolling stock, the duplication of a portion of the lines, the laying of additional feeder cables, and other capital purposes. Ten cars were added to the rolling stock during the year, the number of cars in stock now being 166, which, it is anticipated, will be sufficient to meet the traffic requirements for some time. Twelve of the smaller cars have been coupled, and have proved very useful in dealing with rush traffic when large crowds have had to be handled expeditiously. The traffic receipts were seriously affected by the labour disturbances that took place in New Zealand at the end of last year, resulting in a general strike, when, in consequence of a shortage of fuel, the service had to be suspended for 18 days, from November 8th to 25th inclusive. In addition to the loss of revenue from this cause, the expenses were materially increased after the resumption of the service by the purchase of large quantities of foreign coal at enhanced prices, which was rendered necessary on account of the restricted output from the local mines. The closing of Queen Street during the work of reconstruction of the track and an epidemic among the Maori population in July also had an adverse effect upon the traffic receipts.

The attendances at the Exhibition in Auckland, which was open from December 1st until April 18th, suffered considerably from the effects of the strike, with the result that the extra traffic arising from this source was not so large as had been anticipated. The motor-omnibuses that were acquired by the company at the request of the Exhibition Commissioners to deal especially with the traffic to and from the Exhibition fulfilled their purpose, and the further profitable employment of the vehicles is being considered. The central repair works in the Mount Roskill district have been completed, but, owing to delays due to the labour disturbances referred to, the company was unable to occupy the premises until May of this year. Several extensions of the company's system are in contemplation and are the subject of negotiations.

	1913.	1914.
Miles open—Route miles	25·42	25·42
Passengers carried	40,331,316	42,133,315
Average receipts per passenger ..	1·53d.	1·55d.
„ expenditure per passenger ..	·93d.	1·00d.
Proportion of expenditure to receipts	60 %	65 %
Cars	156	166
Motor-omnibuses	Nil	6

Barbados Electric Supply Corporation, Ltd.—The directors report that the profit on operation for the year ended June 30th, 1914, amounted to £1,381, as compared with £395 for the previous year. This profit has been earned after charging £483 for repairs and maintenance (principally for replacement of poles), as compared with £164 in the previous year. No fees have been paid to the directors, or the members of the Advisory Committee in Barbados, since the issue of the last annual report, although fees for the year have been debited in the profit and loss account. The number of lamps and motors connected, of an equivalent of 25 c.p., was 12,715 at June 30th, 1914, as compared with 9,430 at June 30th, 1913: and the number of consumers was 737, an increase of 281 during the year. The directors consider the progress made during the year, both as regards the number of connections and revenue, as satisfactory. Prospects for the current year were also encouraging until the outbreak of the European war, which has already resulted in a falling off in the number of applications for new connections. It is also expected that the winter tourist season will be affected, with a consequent fall in the supply of current. The negotiations with the tramway company, referred to in the last report, are still pending. Capital expenditure during the year amounts to £1,830, and represents principally extensions to the mains and house connections.

Oriental Telephone and Electric Co., Ltd.—The directors have declared the following interim dividends:—3 per cent. on the 6 per cent. cumulative preference shares for the current year, less income-tax, and 4 per cent. on the ordinary shares, free of income-tax. The warrants will be posted on 31st inst.

Melbourne Electric Supply Co., Ltd.—The directors announce that the gross profit in Australia for the year to August 31st amounted to £104,339, compared with £77,092 for the previous year, an increase of 35 per cent.

Montevideo Telephone Co., Ltd. — The directors state that after providing for all charges in Montevideo and London, the net profit for the year ended July 31st last was £28,525, as against £25,834 for the previous year. The interim dividends paid on May 1st last absorbed £4,343, leaving £24,182, plus £4,464 brought forward from last year, making an available balance of £28,646. After applying £9,500 to depreciation of the company's property and plant, and transferring £9,500 to reserve for renewals, the directors recommend the payment of final dividends of 2½ per cent. upon the preference shares and 3 per cent. upon the ordinary shares, making for the year 5 per cent. on the preference and 6 per cent. on the ordinary shares, leaving £5,303 to be carried forward. The number of new subscribers during the year has again shown a moderate increase.

STOCKS AND SHARES.

Tuesday Evening.

The fall of Antwerp and the subsequent march of the German army upon Ostend served to depress in some degree the various markets of the Stock Exchange, having the effect more of checking buyers than of inducing sales. Had the House been open, no doubt considerable excitement and no little depression would have ensued; but, in the street, business simply came to a standstill, and members agreed amongst themselves that, had the enemy wished, they could probably have taken Antwerp several weeks before, so that the event, regrettable as it was from every standpoint, could scarcely have been deemed improbable.

The price of Consols remained at the officially-fixed figure of 68½; and the only quotable effect was felt in such shares as Canadian Pacifics, a few Home Railway stocks and in mining shares, while in other departments the tone took on a dull appearance. Business, therefore, is smaller again; and the revival of interest in stocks and shares to which allusion was made here in the succeeding two weeks has been damped for the time being, investor and speculator alike waiting for some better news before entering upon fresh engagements.

The feature of the week, so far, is the success which attended the issue by the London and South-Western Railway of £1,000,000 5 per cent. redeemable preference stock, offered at 99¾, the money being required mainly for the electrification work now proceeding on the railway. There was a rush for the stock; and upon its being understood that the issue would probably be allotted almost entirely to proprietors of existing securities of the company, literally hundreds of would-be buyers offered a premium of 1 per cent. or so, without finding sellers.

The stock, which, at its issue price, is a trustee security, must be considered cheap; and some of the dealers in similar stocks expressed the hope that other companies would not take it as a precedent, because, if they followed suit by offering trustee stocks on a 5 per cent. basis, this would have a marked effect upon gilt-edged securities of all kinds. As the stock is redeemable at 100 in 10 years' time, or at the same price five years hence at the option of the company, it can scarcely be said to compete directly with the present preference issues of other leading Home Railway lines. But the distinction is more apparent than real, and the sympathetic effect upon those other stocks cannot fail to be considerable.

The occupation of Brussels by the enemy, the surrender of Antwerp, and the threatening of Ostend served to remind the Stock Exchange very vividly that some of its best clients will be unhappily out of the markets for a long time to come. The Belgians had a liking almost akin to a passion for tramways and tramways shares. Brussels held large lines of Brazil Tractions, Antwerp was a lively centre for dealings in South American tramways shares, and issues of several English tramway companies were popular with investors spread all over Belgium.

It used to be axiomatic that any tramway scheme, from whatever part of the world it might emanate, would be assured of careful attention in Brussels, and two or three of the other leading Belgian cities. All this, it is only too sorrowfully to be feared, must be regarded as a thing of the past; though it may be as devoutly hoped that, when the indemnity question comes to be settled, whatever investments of the thrifty Belgians have been lost or destroyed in the course of the war will be paid for on that same lordly scale which the German maurauders demand from the cities that they "conquer."

In the Electric Railway market, the 1s. shares of the Underground Railway Company have crept up to 6s., and the Income bonds, which were offered the other day at 79½, have recovered to 81—which, by the way, is no worse than the price stood when the war broke out. The London General Omnibus Company has just received fresh orders for another large consignment of 'buses to be sent to the Continent; and the denuded fleet in London is permitted to overcrowd its remaining vehicles in a manner which is, no doubt, as profitable to the Company as it is uncomfortable to its customers. This consideration has not yet affected the price of District Ordinary stock, which remains about 19½, while Metropolitans continue at 32. In the Central London Preference group no changes have occurred.

It may be well supposed that the drastic regulations of the police with regard to London lighting have not done the market for supply issues any particular good. Some discussion has arisen as to what is likely to be the effect upon the principal companies if this order should remain in force for some months, because,

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obviously, the amount of current being taken for lighting purposes is very materially reduced, so far as the necessities of streets and shop-fronts are concerned.

Prices of Electric Supply issues are, therefore, stationary. County of London Preference shares are offered at 11¼, City of London Preference at 12¾, at which prices the yield is £5 1s., and £4 14s respectively. There is a scrap of County 4¼ per cent. Second Debenture stock on offer at 100, which looks cheap considering the nature of the security at the back of it. Urban 4½ per cent. Debenture stock can be bought to pay nearly 5½ per cent. on the money; and there is an odd lot of Metropolitan 3½ per cent. Debenture stock at 82, which gives 4¼ per cent. One of the tempting stocks to be picked up just now is the 5 per cent. Debenture of the Adelaide Electric Supply Company, which a buyer can get for 102½, free of stamp and fee, with dividends due on June 1st and December 1st. There was a rush for the stock when it came out; and the subscription lists, it may be recalled, were open for an hour or two only.

There is more going on in the shares of the companies connected with electrical manufactures and lamp-making. The war has forced German business into this country, and one hears that most of the manufacturing concerns are working to something like the utmost limit of their capacity. Edison & Swan fully-paid shares are 30s., and the partly-paid 4s. 6d., the latter being three times the price at which they stood when the war broke out. British Westinghouse Preference stock at 30s. are very firm. The company's 4 per cent. Debenture changed hands the other day at 74, at which the return is £5 8s. 1d. on the money; and the 6 per cent. Prior Liens are 98½. Electric Construction shares are 11s., Crompton 5s., and the Preference 9s. General Electric Ordinary at 11½, and the Preference at 9¾ are steady.

Amongst Telegraph and Telephone shares the tone is a little heavy, this being due mostly to sympathy with other investment sections. Prices are a shade weaker than those quoted in our last issue. Marconis eased off 1/16 to 35s., while the subsidiaries have also given way a few pence.

Armament shares of various kinds are fairly active, and private advices from Sheffield tell us that the market there is comparatively animated. B.S.A. shares, for instance, at 55s. 6d. are nearly 15s. higher than they were when the war started, although Vickers at 35s. and Armstrongs at 39s. 6d. have not greatly changed. The companies' pre-ordinary classes, however, are decidedly good; and each evidence of the probable prolongation of the struggle serves to quicken the interest of the buyers. The Rubber share market, on the other hand, keeps quiet; and although prices do not come down, business in the shares is somewhat stagnant. One of the largest of the insurance companies, by the way, has recently laid down a rubber staircase and rubber floors, in consequence of a nasty accident which occurred through an official slipping on the previous staircase and damaging himself severely.

The Rio Tinto Company—greatest of the Copper group, from the London point of view—has just passed its interim dividend, for the first time in many years; and other companies concerned with baser metals are none too popular with their usual supporters. We understand that negotiations are on foot for the formation of a large company, with several million pounds capital, for the purpose of dealing in England with the smelting work which has hitherto been almost confined to Germany. The sponsors of this scheme hope to receive Government support, either in the shape of capital itself, or else by way of a guarantee of dividends upon the money; and preliminary efforts are being made with a view to securing official assistance.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	Sept. 20	4,095	— 548	39	89,078	+ 467	..	..
Blackpool-Fleetw'd	Oct. 10	3,382	—1,058	40	75,281	— 4,874	8	..
Bristol	„ 2	34,290	— 411	40	342,002	+19,859	30·5	..
*Brit. Elec. Trac. Co.	Sept. 18	164,610	+4,613	..	..	..	429·8	..
Chatham and Dist.	Oct. 1	4,897	+ 249	39	87,484	+ 716	14·98	..
Cork	„ 1	2,041	— 106	39	19,862	+ 17	9·89	..
Dublin	„ 2	23,422	+10,047	40	2 2,528	+ 8,867	54·25	..
Hastings	Sept. 30	4,887	—1,083	..	..	— 2,536	19·3	..
Lancashire United	„ 30	6,551	— 496	39	64,955	+ 4,438	42	..
Llandudno-Col. Bay	Oct. 2	1,451	— 410	44	14,233	— 1,977	6·5	..
†London United	Sept. 18	11,821	—1,648	38	236,808	— 2,559	..	..
Tyneside	„ 20	2,981	+ 874	14	8,816	+ 1,340	11	..
Anglo-Argentine	„ 30	203,141	—14,993	40	2,118,544	—87,176	..	..
Auckland	„ 25	20,993	+1 050	13	63,950	+ 3 7 7	25 42	1·03
Brisbane	August	33,172	+3,202	31	231,827	+ 21,649	..	..
Calcutta	Oct. 10	16,261	—3,371	..	..	— 4,851	20·5	..
Kalgoorlie, W.A.	July	2,552	..	31	18,074	..	..	..
Madras	Sept. 30	3,441	— 158	39	84,483	+ 2,204	15·25	..
Montevideo	Sept.	25,2.7	—2,643	47	331,965	— 9,336	..	..
Cen. London Rly.	..	..	..	..	..	..	..	..
City & S. Lon. Rly.	..	..	..	..	..	..	..	..
Dublin-Lucan Rly.	Oct. 2	591	+ 66	13½	2,218	— 93	7	..
L'pool Overh'd Rly.	..	..	..	..	..	..	..	..
London Elec. Ry. Co.	..	..	..	..	..	..	..	..
Mersey Railway	..	..	..	..	..	..	..	..
Metropolitan Rly.	..	..	..	..	..	..	..	..
Met. District Rly.	..	..	..	..	..	..	..	..

* Three weeks. † Two weeks.

MARKET QUOTATIONS.

Owing to the war, the prices given below are, of course, more or less nominal.

Wednesday, October 14th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	Nom.	..
a „ Nitric .. .. „	„	..
a „ Oxalic .. .. .. per lb.	8d.	..
a „ Sulphuric .. .. .. per cwt.	Nom.	..
a Ammoniac Sal .. .. .. „	„	..
a Ammonia, Muriate (large crystal) per ton	£49	..
a Bleaching powder .. .. .. „	Nom.	..
a Bisulphide of Carbon .. .. „	„	..
a Borax .. .. „	£18 10	..
a Copper Sulphate .. .. .. „	£22	..
a Lead, Nitrate .. .. .. „	£32	..
a „ White Sugar .. .. „	Nom.	..
a „ Peroxide .. .. .. „	„	..
e Methylated Spirit .. .. .. per gal.	„	..
a Potassium, Bichromate, in casks per lb.	7d.	..
a Potash, Caustic (88/90 %) .. per ton	Nom.	..
a „ Chlorate .. .. .. per lb.	7½d.	..
a „ Perchlorate .. .. „	5½d.	..
a Potassium, Cyanide (98/100 %) .. „ (for mining purposes only)	Nom.	..
a Shellac .. .. per cwt.	70/-	..
a Sulphate of Magnesia .. .. per ton	Nom.	..
a Sulphur, Sublimed Flowers .. „	£9 10	..
a „ Recovered .. .. „	Nom.	..
a „ Lump .. .. .. „	£7 10	..
a Soda, Caustic (white 70/72 %) .. „	Nom.	..
a „ Chlorate .. .. .. per lb.	„	..
a „ Crystals .. .. .. per ton	„	..
a Sodium Bichromate, casks .. per lb.	8½d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£88	..
b „ Wire, in ton lots (1 to 14 S.W.G.) „	£112	..
b „ Sheet, in ton lots .. „	£113	..
g Babbitt's metal ingots .. .. „	£30 to £221	..
c Brass (rolled metal 2" to 12" basis) per lb	7¾d.	..
c „ Tube (brazed) .. .. „	9¾d.	..
c „ „ (solid drawn) .. „	8¾d.	¼d. dec.
c „ Wire, basis .. .. .. „	7¾d.	¼d. dec.
c Copper Tubes (brazed) .. .. „	9¼d.	..
c „ „ (solid drawn) .. „	9¼d.	..
g „ Bars (best selected) .. per ton	£72	..
g „ Sheet .. .. .. „	£73	..
g „ Rod .. .. .. „	£71	..
d „ (Electrolytic) Bars .. „	£56	..
d „ „ Sheets .. „	£74	..
d „ „ Rods .. „	£62	..
d „ „ H.C. Wire per lb.	7¾d.	..
f Ebonite Rod .. .. .. „	8/6	..
f „ Sheet .. .. .. „	8/-	..
a German Silver Wire .. .. „	1 7	..
h Gutta-percha, fine .. .. „	6/10	..
h India-rubber, Para fine .. .. „	2/9½	..
i Iron Pig (Cleveland warrants) .. per ton	4-/3	2/9½ dec.
i „ Wire, galv. No. 8, P.O. qual. „	£16	..
g Lead, English Pig .. .. .. „	£18 10	..
m Manganin Wire No. 26 .. .. per lb.	6/6	..
g Mercury .. .. .. per bot.	£10	£3 inc.
e Mica (in original cases) small .. per lb.	4d. to 2/6	..
e „ „ „ medium „	6/- to 5/-	..
e „ „ „ large .. „	6/6 to 10/6 & up.	..
c Nickel, sheet, wire, &c. .. .. „	Nom.	..
g Phosphor Bronze, plain castings „	1/1 to 1/3½	..
g „ „ rolled bars & rods „	1/02 to 1/8	..
g „ „ rolled strip & sheet „	1/3½ to 1/5½	..
c Platinum .. .. per oz.	185/-	..
d Silicium Bronze Wire .. .. per lb.	10½d.	..
r Steel, Magnet, in bars .. .. per ton	£141	..
g Tin, Block (English) .. .. „	£128	..
a „ Wire, Nos. 1 to 16 .. .. per lb.	2/3	..
g White Anti-friction Metals .. per ton	£44 to £194	..
k Zinc, Sh'ts (Vieille Montagne bnd.) „	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Russia.—The Allmänna Svenska Elektriska A.B. (Asea) has, as previously stated, formed a subsidiary company in Norway and one in Finland. It is now reported from Stockholm that it has formed a company at Petrograd for the purpose of erecting a manufactory of electrical goods in Russia. The name of this company is the Ryska Elektriska A B. Asea, and the capital is 600,000 roubles, the majority of the shares being in the hands of the Swedish company. At the present time the conditions are not such that people will be over anxious to invest a large amount of capital in new factories, and the building of such may thus be postponed for a time; but the Russian market is already such a big consumer of electrical goods, that there may be sufficient inducement to go on with the work, especially now, when it seems as if the German manufacturers will be almost entirely excluded from doing business in Russia.

Indo-European Telegraph Co., Ltd.—An interim dividend for the half-year ended June 30th last at the rate of 5 per cent. per annum, free of tax, has been declared.

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EARTH CONNECTIONS.

By Francis H. Davies.

It is often a matter of some difficulty to secure a permanently good connection with earth, and to this end many special devices and methods have been employed, particularly in America where, owing to the prevalence of extra high-tension generating and distributing systems, the need has been specially felt. In this sphere of work it is usual to connect to earth the frames of all generating, transforming and high-tension switching apparatus, also the metal framework of switchboards, instrument cases and the secondaries of instrument transformers, lightning arresters, etc. The majority of such earth connections are liable to have to carry comparatively large currents, and it is therefore essential that they should be of permanently low resistance and ample in area. While the fulfilment of the latter requirement should in most cases be a simple matter the former is not always so, and the difficulty often experienced has led to the introduction of numerous devices, some of which are good and many worthless. The oldest and the one still mostly in use consists of burying in a hole some 6 ft. or 8ft. square, a tinned copper plate of about No. 16 gauge. The depth should be sufficient to ensure contact with permanently damp earth, and the plate should be surrounded with two feet or so of granulated charcoal or carbon such as old arc lamp electrodes. Coke and cinders are often used, but their employment is inadvisable as, being rich in sulphur, they have a corroding effect upon the plate. A heavy wire is soldered and riveted to the plate right across its surface in order to secure a good area of contact, and the hole is filled in with earth kept moist as the work proceeds with running water. As it is so essential that the earth surrounding the plate should be permanently damp, it is best, if possible, to carry out such work after a dry season, as if damp earth is found at such a period there can be little doubt of that condition being permanent. This point is probably often overlooked, with the result that many earth connections which are efficient in winter seasons are almost if not entirely useless in summer. It is quite possible to make an excellent job of such a ground connection if the work is well done and the soil suitable; but if the latter is dry or composed of gravel, sand or clay, instead of rich moist earth, the method is not dependable, and it is necessary to keep the area thoroughly damp by means of water supplied close to the plate through a pipe. All methods of earthing dependent upon a buried electrode are alike in this respect, though the important auxiliary of a water supply is often ignored. A disadvantage of the earth plate as above applied is its cost, which it must be remembered lies greatly in the excavation of a fair sized hole. Where only one plate is required this is perhaps not a matter of moment, but in many large distributing systems the number of earths installed is considerable, and the total cost may well run into a good sum. To meet this important objection several devices have been placed on the market, one of these being shown in fig. 1. This consists of a perforated copper cone fitted with a suitable head and point connected together by a central rod and filled with pulverised carbon. For an equal area of earth contact the hole required is much smaller than with the plate, whether the latter is placed vertically or horizontally. One of the claims put forward for this cone is that in consequence of the capillary action of the charcoal in absorbing moisture the earth around it is always damp. Whether this claim can be substantiated in every instance remains to be proved, but in any case the cone is convenient to handle and should be cheap to instal. It should be bedded in granulated carbon in the same manner as the ordinary earth plate.

An American device which depends for its efficiency upon the same principle of the absorption of moisture is shown in fig. 2. A central conducting rod, insulated at the upper end, carries four ovoid-shaped discs, each 6 in. in diameter. These are made of a porous substance which readily absorbs moisture, and it is claimed that the area of efficient contact with the earth is therefore large. The upper

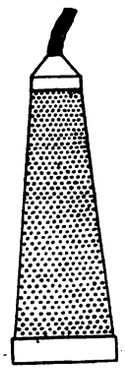

Fig. 1.

Fig. 2.

end of the stem is threaded, and may consequently be extended to any length by means of suitable rods. In the two sizes manufactured the over-all lengths are respectively 19½in. and 6ft. 2in., the corresponding lengths of the stems being 6in. and 5ft. 7½in. This device should be set at a good depth varying with the nature of the soil, and before placing it in the hole the surrounding earth should be well saturated with a saline solution.

Another American device is illustrated in fig. 3. Three copper bowls are fastened to a central rod, and each bowl is filled with pulverised carbon, which is kept in place by a metallic screen. The object of the bowls is to entrap rain-water as it filters through the ground, and so long as the surrounding earth is moist the water will remain in the bowls. In dry seasons the presence of water tends to keep the neighbouring soil moist, and it is claimed that the water in the bowls is sufficient to maintain this condition for a considerable time. The device gives a good area of contact and does not require a large hole. It is so designed as to allow the earth to be tamped firmly around it without becoming distorted.

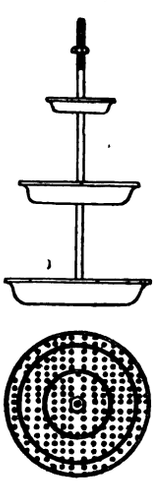

Fig. 3.

Fig. 4.

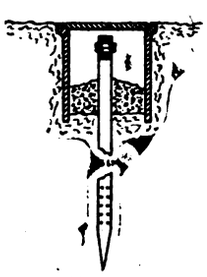

Fig. 5.

Connection is made at the top by means of a slot in the rod running parallel with its length. The wire is inserted in this, and the screwing down of the nut clamps it tight ready for soldering if required.

Under most circumstances a water main makes an excellent earth, but if there is any liability of a heavy current flowing, only large main pipes should be used, as small branches have a very appreciable resistance. The connection should be made as close as possible to the point of entry of the pipe into the ground if in a building, and on the earth side of all water

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meters, valves or other appliances. The best way to secure efficient contact with a large iron pipe is to drill and tap a ½-in. hole in the socket or flange, fitting this with a special brass or copper lug in which the earth cable is sweated. If this method is not feasible or access cannot be obtained to a flange or socket, the wire can be efficiently connected to the barrel of the pipe in the manner shown in fig. 4. The earth wire is run along the pipe parallel to its length for a few inches; it is then doubled back on itself, and finally twisted round the pipe in a close helix. The last turn is threaded through the loop as shown, and the other end of the wire is pulled in such a manner as to bring the loop hard up against the free end of the wire. This gives a good conducting area, a firm grip, and prevents the coil from unwinding. The pipe is first cleaned and tinned, and after the wire is wound on, the whole is soldered up solid. If soldering is considered unnecessary or cannot conveniently be effected, a substitute may be found in wrapping the joint with a couple of layers of tinfoil and covering the whole with several layers of adhesive tape to keep out moisture. Connection to pipes of small diameter is best obtained by means of special clips of which numbers have been devised. As they give an ample area of contact and are quickly and easily installed, they are to be preferred to the wire-wound and soldered joint which, as usually constructed, seldom has sufficient contact area to carry a current of any size. The result is often overheating and burning of the pipe at the connection, especially if it is of lead.

Under favourable conditions a good earth may be obtained by driving one or more 1½in. or 2in. galvanised iron pipes into the ground to a depth of 6ft. or 12ft., according to the nature of the soil. Such pipes should be pointed at the bottom and drilled at the lower end with a number of ¼-in. holes. When driven, a saturated salt solution should be poured into the pipe, and this, finding its way out at the holes, impregnates the surrounding soil and lowers its resistance. The result of a large number of tests carried out in various localities tends to show that such impregnation of the soil may be depended upon to lower the resistance of the "earth" by 50 per cent. or more, and on the pipe system it is a very simple matter to keep the connection up to the mark by periodically filling up with brine, although it is found that this is only required at infrequent intervals. It is possible still further to improve the pipe type of earth in this respect by employing the arrangement shown in fig. 5 or some modification of it. Here, a common drain pipe is placed round the head of the pipe and filled with rock salt and water which gradually impregnates the soil all round and to a considerable depth, thus materially improving the conductivity. It is sufficient to pack the head of the pipe with salt and fill round with earth, but the drain pipe makes a better job and is more convenient when replenishing. It is clearly a very simple matter to make a good connection to a pipe earth by means of a suitable lug screwed into the head, and as no excavation is required and the pipe itself is cheap, it is by far the least expensive type. In the absence of screwing tackle or suitable nuts, a good connection to a pipe may be made by plugging the pipe at a depth of 8in. or so from the top and pouring in molten white metal around a heavy gauge iron wire placed centrally in the pipe. This method, however, possesses the disadvantage of permanently closing the end of the pipe, thus rendering the periodical treating of the soil with a salt solution impossible without withdrawing the plug. It should be remembered that in driving such a pipe the blows set up vibration along its length, and this tends to press the soil away from the pipe and cause bad contact, and consequently high resistance. The remedy is effectual tamping of the ground, and this will be found to increase the conductivity very materially, especially in loose soils.

In a paper read before the International Association of Municipal Electricians in America some twelve months back, Mr. H. P. Liversidge describes a modified form of pipe ground which he states possesses many advantages. Strictly speaking, this apparatus belongs to the more elaborate types described at the outset of this article as will be seen from fig. 6. The galvanised iron pipe is fitted at the lower end with a circular iron frame 5in. in diameter and 12in. long, which has a number of ribs projecting radially outwards. This frame is filled with a special hygroscopic substance held in position by a galvanised iron screen, and the total contact area is about 500 square inches. As before explained, the presence of the hygroscopic material

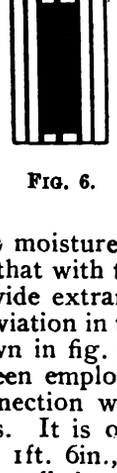

Fig. 6.

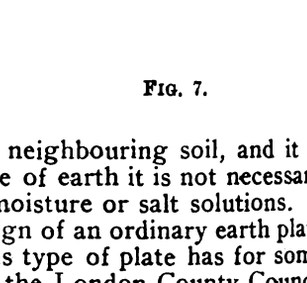

Fig. 7.

ensures moisture in the neighbouring soil, and it is stated that with this type of earth it is not necessary to provide extraneous moisture or salt solutions.

A deviation in the design of an ordinary earth plate is shown in fig. 7. This type of plate has for some time been employed by the London County Council in connection with the earthing of lightning conductors. It is of No. 16 gauge copper, measuring 3ft. by 1ft. 6in., and until recently two such plates were installed with each conductor. It is now customary to use only one plate, 3ft. square. It will be noted that a number of triangular tongues are cut out of the plate and bent upward at right angles, and the function of these is to facilitate discharge. The plate is laid flat in the hole with the tongues uppermost, and is surrounded with wood-charcoal well rammed. Connection is obtained by means of a copper strap riveted and soldered across the whole surface as shown, and this joint is protected by a thick coating of tar.

The importance of the subject of earth connection has caused a considerable number of experiments to be made, and the result of these points clearly to the following facts. The area of contact with the soil must be sufficient to preclude any possibility of heating under the largest current that is likely to flow for an appreciable period. If heating occurs, the moisture in the soil, which is so absolutely essential, is evaporated, and the "earth" becomes ineffectual. It is impossible to give any definite figure of maximum allowable current density, as everything depends upon the intimacy of contact and the nature of the soil. Average results even are unreliable, and it seems that each case, if important enough, must be studied individually and experimented with. It appears certain that good top soil yields the least resistance, clay the highest, and gravel intermediate. It is often thought that immersing an earth connection in a stream, leaving the plate lying on the bottom is an effectual method, but this is usually far from being the case, as the resistance of moderately pure water is high. A stagnant pond or very impure stream will give better results, as it is well known that owing to the organic matter held in suspension the resistance is comparatively low. On the other hand, a pipe driven into the bed of a stream or a plate buried in that position will make a good

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low-resistance earth, for it is in actual and intimate contact with permanently wet soil. Finally, it is well to remember that where possible risk to life or damage to expensive plant is concerned a single earth connection should not be depended upon. The safest system under such circumstances is to install several plates or rods, if possible, some distance apart, in order to secure whatever advantage there may be in varying wetness of the soil. These should be efficiently connected together by a cable thoroughly protected from damage, and to this end it is usual to lay it in an iron pipe. It must not be forgotten, however, that where alternating current is concerned such an arrangement is highly inductive, and in the event of a considerable current flowing the installation might be rendered practically ineffectual. The way out of the difficulty is to connect both ends of the pipe to the conductor, thus making the former part of the circuit.

CO-OPERATION IN TRADE EXPANSION.

By C. ASHMORE BAKER.

The generous and helpful offer made to the British electrical industry by the Editors of the Electrical Review in the issue of September 25th (pp. 418-419) deserves a quick and ready response.

The Review has throughout its history been a sturdy champion of "organisation," and we have to thank its editors for the existence of more than one healthy and virile sodality.

In the present case a wide field and a propitious hour should assist largely in adding another battalion to the fighting line of British trade. I submit, however, that in order to focus the attention of the British trader something more definite is required than even the magic word "co-operation."

Thus the mind is vexed with gloomy doubts whether the average manufacturer in this country knows what co-operation means.

He might discover some useful facts about it if he would consult his "hands," especially where he has works in the North Country. In some parts of the world enlightened manufacturers make a practice of seeking information from their employees. The British manufacturer, however —— (passage excised by Censor).

Banter aside, let us glance at some of the conditions which are essential to successful co-operation; and I think the first of these conditions is that the area of membership of the movement should be as wide as possible.

Thus, an association of certain firms not mutually competitive organised for the combined selling of their goods would not fill the bill. Such an organisation might form a highly successful factoring enterprise, but inasmuch as the number of firms associated in it must necessarily be limited to one or two manufacturers in each line of produce dealt with, it could not include all the firms occupied with a given industry, and the remaining houses must of necessity be left out in the cold. Membership must therefore be open to any reputable firm willing to subscribe to the articles of association, from which follows the corollary that membership should not necessarily be confined to any particular industry, which is all to the good since we thus have practically the whole trade of the country to draw upon for support.

A second essential condition is that the amount of benefit to be derived from membership of the association should be as nearly as possible proportional to the amount of business done between the member and the association. This is the basic principle underlying co-operation as now understood, and it involves the further corollary that the capital of the association must be limited both as to the maximum amount which any member should be permitted to hold and as to the maximum percentage of interest payable thereon.

The rigid application of this principle will prevent the association from becoming a sort of super-middleman owned, possibly, by persons outside the manufacturing interest altogether.

Now, as to the fields of activity in which such an association can be of use.

Obviously we must limit its functions as much as possible to those which are unlikely to be the cause of jealousy and dissension among the members or of real or suspected partiality on the part of the officials, and for this reason I doubt if the direct selling of goods co-operatively would be feasible, at least, as an immediate and general object.

Apart from direct selling, however, there are wide areas on which the members could meet on level terms without any great risk of collision between rival interests.

To begin with there is cataloguing.

One of the chief causes of complaint by foreigners against the British merchant is that he will not mark his goods in plain figures. The British esotera of feet and inches added to the kebalism of £ s. d. clothe our commerce to the Slav or Latin eye with a mystic veil and tend to exalt the art of dealing with England into the realm of the occult.

We must try and envisage the viewpoint of our customers in this respect. Consider for a moment! Should we ourselves trade more freely with a nation which persisted in expressing prices and discounts in the forms and symbols of the calculus?

Our failure in the past in this matter has not been entirely the result of stupidity; rather, it results from the structure of our system of production .

Our principal rivals have organised their production in big concerns, and the big concern, although not by any means the most efficient in all ways, possesses the advantage of being able to set up in most cases its own translation bureau, a weapon which, impossible to the smaller manufacturer working by himself, becomes cheaply available to the smallest under co-operative conditions.

Here, at least, we have a jumping-off place for co-operative development.

Let us establish a bureau for translating, printing, and generally "getting up" catalogues suitable for the countries in which they are to be circulated. Let the prices charged for the work be in the first instance comparable with those demanded in the general market for such work, and let orders be accepted from all and sundry, but let the profits be distributed among the members only, and in the form of a percentage dividend on the business done with each.

Hence the institution, while being in a position to benefit by all the orders it could book, would be protected against any accusation of cutting prices against the regular market, while members of the association would in effect get their work done at cost price or even less if the amount of work done for non-members were to form a large percentage of the whole.

A further advantage to be gained from the establishment of such a bureau would be the standardisation of and flexibility in the style of the work done—a very valuable characteristic in the eyes of the buyer.

Another promising field of action would be the gathering of information as to the demands and conditions of trade in foreign countries. This is again a matter in which the foreign type of big business has hitherto had the advantage over British individualism; which advantage can be annulled, and more than annulled, by co-operative action. The firm of moderate resources cannot afford to send expensive investigators into every market. An

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association of traders, on the other hand, would carry out this work at a comparatively moderate cost per firm, and enormous benefit would result from the knowledge thus gained of the markets for which the British producer proposes to cater.

A further direction in which individual firms might co-operate without treading on each other's corns would be the establishment of local machinery in various countries for the collection of accounts.

Short credit is one of the drawbacks to trade with Britain, and this drawback might well be lightened by some such scheme as I suggest.

This brings me to the subject of industrial banks.

German trade in particular has been greatly fostered by the German bankers' credit system, which has rendered possible the long credit which buyers in most countries usually demand (depending as they do on harvests, etc.), while at the same time it has relieved the manufacturer of the necessity for tying up money urgently needed for immediate use. Thus the buyer gets the long credit which is absolutely essential to him; the producer gets the quick return which is also his lifeblood, although those returns may be relatively small; while the banker gets the lion's share of the profit, which is what he is out for. But make the bank a co-operative concern and the big profits which must go in the first case to the bank in any event will revert ultimately to the producer in the form of dividends on the banking business done with him by the bank. In other words, he gets his credit at cost price and no outsider gets a rake-off from this particular transaction.

Now as to transport. I fear it will be some decades before the nation decides to take over the railways and thus eventually relieve its trade of the tax of thirty or forty million sterling now levied by the railway shareholders.

But there is much virtue in co-operative shipping. Freight rates are now largely dictated by the powers that rule the big lines. These big lines are steadily acquiring wider and wider powers, and as steadily concentrating those powers in fewer and fewer hands. What is to prevent this process from being carried to its logical conclusion of the establishment of a single shipping interest able to exact such a toll from over-seas trade as to make that trade barely worth doing and nothing more?

Against such a contingency there is only one safeguard for the still independent British trader, and that is a Co-operative Mercantile Fleet. A big thing? Of course it is.

British trade is a big thing, and it is going to be bigger if we set about making it so in the right way. And why should we be afraid of size if the quality is sound?

I have outlined an ambitious programme, and yet it does not cover the ground to which co-operative trading might be applied. Thus I have said nothing about insurance or the production and import of foreign grown raw material. And yet bold though the programme may seem, it is no wild-cat scheme. A similar organisation is already in being.

Even the more important items, such as shipping, insurance, the production abroad and import to this country of over-seas produce are now being carried out successfully on co-operative lines.

And by whom? By the working man. The very employee of the manufacturer, the "captain of industry" whose energy, initiative and resource are set before us as the justification for his very existence.

If his energy, initiative and resource are not sufficient to enable the "captain of industry" to help himself, even by the path already discovered and proven by his employee, then it is time he took his place in the "great limbo of vanities" along with the

"Embrios and idiots, eremites and friars."

What I hope will be realised is that the principle of co-operation will give to the individualistic British trader the advantages to be derived from the trust or the combine without the compulsion and waste which those systems involve.

This article, although necessarily containing nothing more than suggestions framed in vague and general terms may, it is to be hoped, act as a stimulus to some of those who realise the duties and possibilities arising out of the present upheaval.

ADVENTURES OF A G.E.C. MAN AT THE FRONT.

Mr. W. Niblett, of the General Electric Co., and lately with the General Electric Co. (of Belgium), Ltd., a sub-company of the General Electric Co., Ltd., residing at Berchan, St. Agathe, a suburb of Brussels, has sent home a thrilling description of a journey to Namur undertaken only two days before the occupation of the Belgian capital by the Germans.

"The enemy's aeroplanes had all day been hovering over St. Agathe," he writes. "The following morning, long before dawn, I was aroused by a uniformed messenger, who informed me that my services as an electrician had been requisitioned by the War Department. A motor car was waiting, and soon we were speeding along to Namur, 90 miles distant, at 50 miles an hour. Those two hours were crammed with adventures.

Motor-Car Breakdown.

"The Belgian roads are unsuited for heavy traffic, and the constant passage of artillery and transport wagons, laden to the brim with fodder and ammunition for the troops, had cut them about terribly. We carried two spare wheels, and we were compelled to avail ourselves of their aid long before we had completed half the journey. A German had been trapped red-handed in the act of liberating pigeons, and, face to the wall, in the first grey streaks of dawn, he had to pay the penalty of his life. It was the first occasion for me to witness the shooting of a man in cold blood, but I have since gone through so much that such incidents appear trifles.

A Tearful Request.

"We met with a serious accident to the car fifteen kilometres from our destination, and after vainly tinkering with the defective machinery, the chauffeur and I decided to tramp it, leaving the disabled car on the roadside. As we passed a little cottage, an old woman, learning that we were going to Namur, where her son was on duty in the trenches, begged us to take him a parcel. I had not the heart to refuse her tearful request, and taking the little bundle trudged wearily on. If I had know what part it was destined to play in the day's chapter of accidents, I might have hesitated to perform what seemed at first sight so simple a service. Soon we were overtaken by a car containing four officers dressed in Belgian uniform. I hailed them, and after they had listened to our story, and scrutinised our credentials, they told us to jump in. They were wonderfully good-natured fellows, I thought. We quickly made friends, and I had soon told them all I knew about the movement of the troops and the preparations to offer resistance at Namur to the German invaders.

Adventures with German Spies.

"We were travelling at a high speed along the straight road that enters Namur from the direction of Brussels, when we espied an armed patrol of the Civic Guard, who signalled us to stop. To the amazement of my companion and myself the officer at the wheel opened out the engines to full speed, and we darted forward like an arrow.

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"The Guard presented their guns and we ducked. They fired at us and shot the driver through the head, killing him instantly.

"I was seated next to him on the off-side of the car, and acting under a sudden inspiration I shut off the power and pulled back the lever applying the brakes. Had I not had presence of mind to do so we would all have met with certain death, for the car, going at a terrific speed, was oscillating wildly from one side of the road to the other. As it was the catastrophe was averted, and the guard arrested us instead. We were asked to produce our passports. The officers had none, they refused to answer questions, and remained taciturn and dour. They were German spies, masquerading in the uniform of our army. It is an every-day occurrence to find the enemy conducting their warfare with an utter disregard of 'Queensberry Rules,' and an every-day remedy was applied—they were shot before our eyes.

Objects of Suspicion.

"The candour and passports of my companion and myself I thought had entirely diverted suspicion from ourselves, but being found in such company had compromised us. Besides, I still had the parcel of the old peasant woman. With due pomp and ceremony it was opened in the presence of the Commanding Officer and the Guard who arrested us. Our lives depended upon its contents. It was undone, and found to contain cakes. How we laughed! We were released, passports were inspected at least a dozen times, and we at last arrived at the Forts.

"All day long and far into the night I worked at installing fans in the entrenchments, laying field telephones, and electrifying the barbed wire defences. When my task was over the chauffeur and I got another car and made for Brussels. We reached there only to be arrested again. We established our identity and were set free. Next day I went to the War Minister and complained about my frequent arrests, so he clothed me in the Belgian uniform, and provided me with a gun. So here I am for better or for worse."

Mr. Niblett's wife (a Cardiff lady) and their two children are with him.

THE BRITISH ASSOCIATION IN AUSTRALIA.

[BY OUR SPECIAL CORRESPONDENT.]

The visiting members of the British Association for the Advancement of Science arrived in Sydney on Thursday morning, August 13th, by three special trains from Melbourne. No formal business was arranged for the afternoon, but in the evening Prof. W. H. Bateson delivered his presidential address at the Town Hall. The various sections met at the Sydney University at 10 o'clock on Friday morning. In the Engineering Section, which met in the new Lecture Room in the Engineering School, Prof. E. G. Coker delivered his presidential address, dealing particularly with the subject of stress distribution in materials, and describing an interesting method of obtaining a graphic illustration of the stresses by observing the refractive properties of a celluloid model. Prof. Coker pointed out that mechanical measurements could not completely satisfy all our modern requirements, since they were essentially average values. He referred to the thermal methods of investigation, and mentioned that Mr. Howgrave Graham and he had examined a number of rolled metals under stress up to breaking point under Röntgen rays without, however, discovering any change in the appearance of the material as seen on the fluorescent screen. The discovery by Sir David Brewster, almost exactly one hundred years ago, of the doubly refractive properties of transparent bodies under stress was then mentioned, also Brewster's suggestion that models of arches might be made of glass and the effect of stresses due to loading rendered visible in polarised light. The difficulties attached to the use of glass were pointed out, and the solution of the problem by the use of nitro-cellulose compounds, which have optical properties very little inferior to glass, are able to bear great stresses without injury, and also are capable of being fashioned with the ease and certainty of a wooden model. Photographic processes are also able to reproduce the brilliant colour effects caused by stress in transparent materials, so that permanent records can now be made for future reference. A number of slides were shown of records of the stress distribution with a wheel on a rail, riveted plates, toothed wheels, compound springs, etc., the resulting stresses showing in a clearly defined manner. Some sixty members were present, and at the termination of the paper a vote of thanks was moved by Judge Backhouse, Vice-Chancellor of the Sydney University, and seconded by Prof. Warren, Professor of Engineering, Sydney University. Mr. L. A. B. Wade followed with a paper descriptive of the main irrigation system in New South Wales, describing in some detail the construction of the dam at Burrinjuck. The dam, which has now reached a height of 200 feet, is to be of an ultimate maximum height of 236 feet, and is built of monolithic concrete blocks each constructed of 15 feet of stone, 7 feet of sand and one cask of cement. The dam serves to regulate the flow of water in the Murrumbidgee River, and the water for irrigation is diverted from the river by a weir into the main canal, which is one chain wide and about eight feet deep. The irrigation system is operated entirely by gravitation. Owing to time being short Prof. Luigi Luiggi discussed the paper shortly, and followed with his own paper on Tripoli, describing the conditions to be met with and referring especially to a method of constructing dams in a cheap and expeditious manner. An official luncheon was given to overseas members by the Lord Mayor at the Town Hall, followed by a garden party at Government House.

The sensation of the meeting was provided in the Anthropological Section by the display of the skull of a prehistoric man, believed to date back to about the Pleistocene age, about 25,000 years ago. The skull was found by a boundary rider in the Darling Downs.

Appropriately enough, the evening lecture at the Town Hall, by Prof. G. Elliott Smith, was on "Primitive Man."

A number of members left on Friday night for week-end excursions, a large number going to the Blue Mountains, where a number of excursions had been arranged. The principal excursion which attracted the largest number was that to the Jenolan Caves. These caves, though not of great extent, are noted for the beauty of the formation and colouring, and have been made easily accessible, the principal caves being illuminated by electric light.

Another large party, principally geologists, visited the Maitland District, which is now the principal coal-mining district, and others went to the Murrumbidgee irrigation works and Burrinjuck Dam.

On Saturday evening Prof. Benjamin Moore delivered a public lecture at the Town Hall on "Brown Earth" and "Bright Sunshine." Sir Oliver Lodge delivered an address on Sunday afternoon at the Lyceum.

There was no meeting of the Engineering Section on Monday afternoon, owing to the absence of a number of members on the various excursions, with the result that the Tuesday morning meeting was

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very crowded and had to be sub-divided into three sub-sections, one joining with the Mathematical and Physics Section in a discussion opened by Sir Oliver Lodge on "Wireless Telegraphy." In Section G 1 papers were set down to be read by Mr. J. J. C. Bradfield on the proposed Metropolitan Electric Railway for Sydney, by Mr. W. E. Adams on "Australian Ports in Relation to Modern Ships and Shipping," by Dr. W. Rosenhain on "The Distribution of Phosphorus in Steel," by Prof. T. Hudson Beare on "Tests of Petrol Fire Engines" and "Resistance of Canons Hose," and by Prof. W. H. Warren on "Australian Timbers." Section G 2 started with the report of the Committee on Gaseous Explosions, presented and explained by Prof. Dalby; a paper by Prof. Coker and Mr. W. A. Scoble on "Temperature Cycles in Heat Engines" was passed over owing to Prof. Coker having to take the chair in Section G 1. Prof. Thornton then gave an interesting paper on "The Lost Pressure in Gaseous Explosions," the only contributor to the discussion being Prof. Dixon, who gave some results of experiments made in a similar direction and described an ingenious method of photographing the sound-wave immediately behind the explosion-wave. Owing to the absence of Dr. Eccles and Prof. Howe, their papers respectively on "The Balsillie System of Radio-telegraphy" and "The Capacity of Radio-telegraphy Antennae" were omitted, and Prof. Thornton continued with a paper on "The limiting Conditions for the safe use of Electricity in Coal Mining," to the discussion of which Prof. Dixon was again the only contributor. Prof. Thornton, in commencing his paper, alluded to the fact that the New South Wales Government was the first to institute an examination for colliery electricians. Prof. Dixon said that experiments with ordinary coal gas and dust did not give reliable results as regards the effects due to fire damp or methane, as methane is not so easily ignited or so violent in explosion as coal gas, and pointed out that pure methane was difficult to obtain.

A luncheon was tendered to the engineering members by joint Engineering Societies in New South Wales, including the local members of the Institution of Civil Engineers, the Engineering Association of New South Wales, the Electrical Association of New South Wales, the Institute of Architects, the Surveyors' Institute, and the Sydney University Engineering Society. The chair was taken by Mr. T. W. Keels, M.Inst.C.E., and the toast of the Visitors was responded to by Sir Oliver Lodge, Prof. Coker, and Prof. Luiggi.

Sir Ernest Rutherford's lecture on "Atoms and Electrons" on Monday night was given to a crowded house.

The conversazione at the University on Tuesday had to be postponed owing to the death on Monday evening of the Chancellor of the University, Sir Normand Maclaurin.

RELATION OF THE AUTOMOBILE TO THE CENTRAL STATION.

In a paper, by Dr. C. P. Steinmetz, which was reprinted in our American contemporary *The Central Station*, the author deals with the above subject, first of all tracing the historical development of the automobile, which, he suggests, comprises three stages: the period of initial development; then the period of culmination where it has been picked up and made the popular dominant sport of society; and then the period of decay as sport and readjustment in a permanent condition as a business proposition. The automobile has not reached the latter stage of development, and the author turns to the bicycle, showing that it is now recognised as a business convenience and, as such, has found a permanent place in modern life. The automobile has been and still is the popular sport of the exclusive, but in the last years by mass production, cheap and reliable automobiles have come on the market and within the range of people of moderate means; thus its exclusiveness has ceased, and there is now an appreciable falling off in long-distance touring by automobile by the very well-to-do set. This is the beginning of the end of automobiling as a popular sport.

Just as people have realised that it is hard work to drive a bicycle, and not a pleasure to look after it, so they will realise that maintaining and taking care of an automobile and its engine is not a pleasure, and that it is hard work driving a high-powered machine over country roads. When that time comes the automobile will find its sphere—not as an appliance of sport but as a useful commodity, a business and pleasure vehicle.

While there are more bicycles in use to-day than ever, the average riding distance has very greatly decreased, and this will follow in the case of the automobile.

The author then discusses the technical changes which will follow, showing that while the electric car had to drop out of motor propulsion as a sport automobile, because in cross-country riding the two main considerations were high speed and long distance of operation, it did not disappear but found a field of its own as a safe and convenient vehicle for business and pleasure purposes in town. These uses, in the author's opinion, will be permanent uses of the automobile after the sport period has passed. The desire of the town user to use his automobile for sporting purposes on Sundays and holidays, which has led to a preference for the petrol car, will disappear when cross-country touring by car is no longer a popular sport.

Under the changed situation the two characteristics which gave the petrol car dominance—high speed and high mileage—will cease to be of importance, and when the stimulus of the enthusiasm of a popular sport vanishes, the average man will prefer the simplicity and convenience of the electric car to the complications of control and the fixing and tuning up of the petrol car which he now considers as a recreation. The user of a bicycle considers it an inconvenience to have to take care of it, and this means in a vehicle for business that we must have as much reliability as requires no attention, in which case the advantage is with the electric.

The characteristics of the future electric car will necessarily differ from those of the present electric car. The author summarizes future requirements as: Moderate speed—a maximum of, say, 20 miles an hour, and moderate radius, possibly 30 miles, which will be practically sufficient for the day, recharging at night. This means a light battery, a correspondingly light motor and structure; a vehicle weighing, inclusive of battery, probably less than 1,000 lb. It means a fitting up not luxurious, as the present electric, but plain and simple like the low-priced petrol car. It means a price not exceeding $500.

With such an electric in the days of decadent sport of automobiling, the author considers that there will be little chance for the petrol car to compete, and he has no doubt that in ten years, probably less, the field of the pleasure and business vehicle will be covered by such an electric car and that a million or more will be used.

From the central station's point of view, a million vehicles, estimating that they required 10 kw.-hours per charge, would require about 1,500,000,000 kw.-hours a year, equal at the 5-cent. rate to $75,000,000 of business, giving a steady load of from six to eight hours. As this load could be placed in off-peak hours, it would be obtained with practically no extra investment except for charging sets.

In addition to these pleasure and business vehicles (*i.e.*, passenger cars used for pleasure and business) the author points out that there is the electric truck demand; this vehicle is already being successfully exploited, because the limited radius and moderate speed fit it to the nature of the delivery business and its lesser maintenance charge and simple control will make it supreme.

This type of vehicle will require probably another equal amount of power.

The author then considers how this business could be taken up by the central stations, and concludes that it would be undesirable to let the garage take care of automobile charging, because of its inherent preference for the petrol car, the repairs and supplies to which give it a large income, which would not be the case with the electric car. In the matter of charging, too, if the private garage did this work, the central station would again meet the competition of the isolated plant under much more formidable conditions than in the case of the business building, because the staff trained in the care of the petrol engine would be the most suitable for looking after isolated plants. So the author concludes that the central station must in the beginning take hold of this new business, and that the most promising method of doing it would be for the central station to undertake the electrical maintenance of the automobile at a fixed monthly charge of from 5 to 20 dollars, the owner leaving his car at the station garage overnight so that it would be ready for use in the morning.

The author believes that on a 5-cent rate, a charge of $10 a month would cover charging and storage costs, and make the electric cheaper to keep than a horse or a petrol car; the average cost of power he puts at less than 1 cent per kw.-hour, and the additional business valued at $75,000,000 would give $60,000,000 available as additional central station profit.

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THE USE OF LIQUID FERRO-MANGANESE IN THE STEEL PROCESSES.

By AXEL SAHLIN (Brussels).

(*Abstract of paper contributed to the* Iron and Steel Institute, *September*, 1914.)

The ordinary method of adding ferro-manganese to a charge of steel results in a loss of manganese of from 35 per cent. to 18 per cent. of the metal added. If the manganese loss could be recovered, this would, for a steel plant producing 300,000 tons of steel yearly, represent a saving of 480 tons of ferro, which, at £11 per ton, is equivalent to £5,280 saved yearly. Whether it pays to make an effort to recover part of this amount depends on the cost of melting 1,920 tons of ferro.

Until the advent of the electric furnace no suitable appliance for dealing with this problem had been available. Now, however, electric ferro-furnaces are installed in a number of steel plants.

In a paper by Mr. Indenkempen it was stated that arc furnaces—the Héroult, Girod, Nathusius and Keller—as well as induction furnaces such as the Roechling-Rodenhauser—had been used for melting ferro. He gives, as an average on which to base calculations, an energy consumption of 900 units per ton of ferro melted and kept hot. Several opponents objected to this figure, and 800 units were generally given as correct for average practice. If we compare this with the ascertained theoretical consumption of 350 units for melting and heating to 1,500° C. 1 ton of ferro, we arrive at an average furnace efficiency of 43·75 per cent. The reasons for the high power consumption in melting ferro may be traced to the following causes:—(1) Intermittence of deliveries; (2) radiation; (3) immersion of the lumps of metal in the bath, where they sink to the bottom of the furnace; (4) in the arc furnaces the proximity of the electrodes to the bath tends to set up a chemical reaction, and results in a certain loss of metal.

In 1913 there was placed on the market a new type of electric arc furnace, the invention of Mr. Ivar Rennerfelt.* The furnace is built as a steel cylinder, with length and diameter practically equal. This cylindrical shell is supported on rollers or trunnions, and is furnished with one close-fitting charging and tapping door. The inside of the shell is covered with a layer of asbestos board, about 1½ in. thick. Next to this is placed a lining of suitable first quality fire-brick. Against this rests the inner working lining of magnesite brick, fettled with a sintering composition of dolomite. Thus lined, the little furnace forms an egg-shaped melting vessel, withstanding a working temperature of above 2,000° C. Centrally in the roof, and horizontally through gables or sides, enter water-cooled bronze electrode holders, through which slide, with a very neat fit, three Acheson graphite electrodes turned to exact size. The diameter of these electrodes varies from 1½ in. for the smallest up to 4 in. for the largest furnace. Any available three-phase current, preferably of 50 to 60 cycles, is converted in stationary transformers, by Scott's coupling, into two-phase current at 70 volts pressure for the smallest, up to 90 volts for the largest furnace. One phase is coupled to each side electrode. The central vertical electrode is connected with the common point between the two phases of the transformer. When the current is turned on, the arcs, instead of passing directly between the points of the electrodes, are deflected downward, forming an inverted arrow-head or *fleur-de-lys*, with a height of 6 to 12 in. When the bath has been formed in the furnace, the points of the electrodes are adjusted at such a height above the surface of the bath, that the point of the "arrow-head" impinges on the surface of the metal, throwing out waves of heat radiating towards the edges of the bath. When the furnace is to be preheated, the current is simply turned on, there being no necessity for solid fuel or metal in the furnace. The furnace can be charged and tapped with the current on the electrodes. The consumption of electrodes for melting ferro is from 2 to 3 lb. per ton of metal. The electrodes are fed forward by hand-wheel and rack mechanism as they are consumed. They are spliced by screw joints. The whole furnace is remarkable for its simplicity and compactness, and for the small and well-protected surface, in comparison with its cubic capacity, which it exposes to radiation.

The experiments in which I have been interested were made at the instance of the Elektriska Ungar Co., Stockholm, owners of the Rennerfelt patents, and were supervised by Mr. Ivar Rennerfelt.

Test No. 1, *made at Hallstahammar Bolt and Nut Factory, Sweden, June* 11*th*-12*th*, 1914.

Capacity of furnace, 1 ton to 1¼ ton; kw., 200; diameter of electrodes, 3 in.; current supplied, two-phase 50 cycles; voltage, varying 65, 80, 95, 110 volts.

The furnace is usually employed for making steel castings and dead soft steel ingots for special purposes. The voltage is usually regulated to 110 volts at the start and 95 volts at the end of the charge.

The number of men employed when making steel is one melter and two boys per shift (five charges per 24 hours; two shifts).

Temperature of furnace, 1,588° C.; 1,000 kg. of ferro, in cold lumps, were charged. Time for melting 1 ton of ferro, 2 hours 45 minutes. Expenditure of units per ton of ferro, 441 units. Average amount of power used, 160 kw.

Other tests of a similar nature followed.

* The Rennerfelt furnace was fully described in the Electrical Review of July 17th, 1914.

During the first few minutes after charging, small reddish clouds of smoke escaped through the joint at the top of the door. Afterwards there was no sign of manganese smoke.

The consumption of electrodes was ascertained to be about 3 lb. per ton of ferro-manganese.

Assuming the cost of electric current to be 2·5 centimes (½d.) per unit, which is a safe figure for most steelworks, the cost of melting ferro in the Rennerfelt electric furnace, poured off hot into the receiver after melting, would be, per ton:—

	s.	d.
Loss of ferro, assumed, 1 per cent. at £11 ...	2	2
3 lb. of electrodes at 6d.	1	6
Repairs, from experience	1	3
Royalty, average	3	6
Current, 441 units at ¼d.	9	2
Depreciation, 15 per cent.	3	9
Labour, one man per shift	3	8
cost of melting 1 ton ferro	25	0

For a steel plant producing 300,000 tons of steel per year:—

Gross cost of ferro saved at £11 per ton... ...	£5,260
Less—cost of melting 1,920 tons of ferro at 25s.	2,400
Net saving per year ...	£2,860

This saving is a minor consideration as compared with the great advantage gained by the uniform distribution of the manganese in the steel, resulting in a higher quality of product.

By the above tests the following points were established:—

1. That the melting of 1 ton of ferro, charged into an empty and pre-heated Rennerfelt furnace, requires less than 450 (441) units. The corresponding efficiency of the furnace is 78 per cent. to 79 per cent.

2. That the melting of 1 ton of ferro, if dropped into an existing liquid bath in the furnace, will require less than 750 (average 741) units, the corresponding efficiency of the furnace being 47 per cent.

3. That the keeping hot of 1 ton of liquid ferro in the electric furnace during one hour at constant temperature requires less than 80 (77) units, or about 30·5 per cent. of the regular power consumed by the furnace when melting.

Similar tests were made at the Ljusne Works of the Ljusne-Woxna Iron Co., Sweden, and fully bore out the foregoing results.

In order to get the best results, the furnace must be used only as a melter of ferro, exposed directly to the heat rays. The metal, as soon as melted, should be removed from the furnace into a ladle or into a receiver.

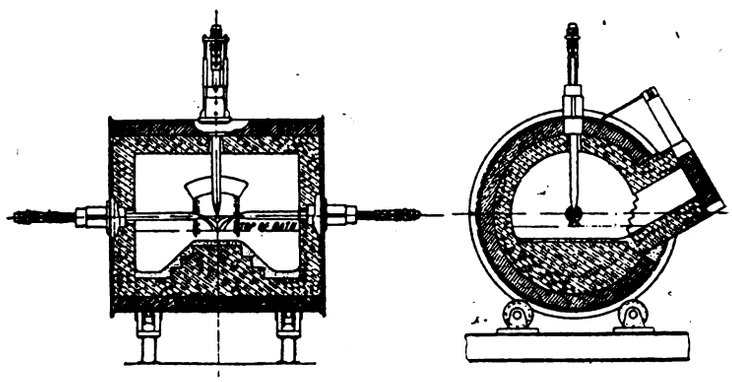

Fig. 1.—Rennerfelt Ferro Furnace with Melting Bridge.

Fig. 1 shows a furnace with, in front of the charging and tapping door, a small bridge or platform of magnesite brick. The top level of this platform should be slightly below the level of the liquid bath when the furnace is charged. The cold ferro should be placed on this bridge, in close proximity to the heat arcs, the lumps of ferro being exposed to them. To the users of the Rennerfelt furnace this offers a simple and inexpensive expedient, which is bound to maintain the economy indicated by the first melting. It is suitable for works in which the ferro is required frequently, regularly, and in small quantities.

The following sizes of furnace are recommended for plants running regularly subject to revision in case of special requirments:—

For steelworks producing up to—	Furnace capacity.
75,000 tons per year	6 cwt. (300 kg.)
200,000 ,, ...	12 cwt. (600 kg.)
400,000 ,, ...	25 cwt. (1,250 kg.)

Freemasonry.—The consecration of the Kelvin Lodge will take place at Mark Masons' Hall, Great Queen Street, at 5 p.m. on Friday, October 23rd. Members of the electrical profession who are members of the craft are cordially invited to be present at the ceremony. Brethren wishing for information concerning the Lodge are requested to communicate with the Secretary, Mr. Osborne Pearston, 4, Ludgate Hill, E.C.

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THE STRENGTH OF FLAT PLATES.

A report of the chief engineer of the Manchester Steam Users' Association deals with a number of experiments on flat plates, the strength of which has long been a matter of uncertainty. No flat surface is theoretically capable of withstanding steam pressure, for no resistance can be developed unless the plate becomes bent to a greater or less degree. Actually, therefore, in practice a flat plate becomes a modified catenary in section supported on piers or abutments. It forms to some extent a girder more or less fixed at each end. Unlike a girder, it is supported all round, and when it yields it becomes a dish. But usually a flat surface is much too large to be supported only round its edges, and in most boiler work flat plates are double, with a narrow space between them, and they are held together by stays screwed into both plates and riveted or nutted at the ends. Thus the surface resolves itself into a series of rectangles each supported by a stay at its central point, such stay to be sufficient to carry the steam load upon the plate area. But the many rectangles are joined to each other at their edges, and this adds some resistance, and when a stay fails the plate still resists by virtue of such all-round continuity with its fellows. In boiler practice it is quite usual for many stays thus to fail without the homogeneous continuity of the boiler being destroyed. But it is clear that no amount of mathematical knowledge will permit any close approximation to the strength of such constructions to be attained.

The memorandum deplores the poverty of the Board of Trade investigations of boiler explosions under the 1882 Act, and of their reports, from which it is usual to omit such information as is of any real technical value.

In Germany investigations are better carried out, and manufacturers will often assist by carrying out required tests of elucidation. The memorandum surveys one hundred of the Board's reports on failures of flat stayed plates, and says that without outside help the survey would have been valueless, for the Board's reports are of little use owing to the serious omissions named above.

The strength of flat surfaces received little experimental attention until the *Thunderer* explosion. On the question of applying a factor of safety (of five) to the experimental bursting stress, it is remarked that a bulged plate is a different structure from a flat plate, and it is obviously unfair to say that because a stay-bolt tore on a test pressure of 500 lb., the flat plate, which did not tear, must not be loaded above 100 lb. intensity if a larger stay were fitted.

Clearly there should be a reasonable approximation of strength between stay and plate. The old rule for plates generally was that one-half the hydraulic pressure producing no permanent set might safely be allowed.

The preliminary study of all available flat plate tests showed that strength depended not merely on plate thickness, but on the stay diameters and on the size of the nuts or washers of bolted stays.

There are stresses in stayed plates other than those of bending. The radii of curvature of similarly strained beams are inversely proportional to the squares of the spans, and the slopes are proportional to the cubes of the spans. The slopes of stayed plates are localised about the stay holes, and it is shown that permanent deformations occur near the stays with a stress only about an eighth of the bending stresses. The severe stresses in the material around the holes lead to cracks, and there is little room to doubt the wisdom of giving support to a plate at the stay by means of good nuts and stout washers. In no case, however, are the stresses, which are termed vortical, which are exerted in rings about the stay holes, to be considered as negligible. A curious confirmation of these already formed conclusions was soon to be given, for a locomotive firebox was found in which the plate between the stays had wasted to $\frac{1}{8}$ in., and even to $\frac{1}{32}$ in., yet this plate withstood 70 lb. per sq. in. pressure on an area 5¼ in. × 4¼ in. There was no bulging reported.

The report is interesting more particularly to locomotive engineers. In stationary work the flat stayed surface is apparently hardly used, except in Lancashire boilers, and these are daily being more made with dished ends of a curvature sufficient to avoid the use of stays of any sort.

War Lighting.—In a previous issue we referred to the reduction of street illumination which has recently been carried out in London and provincial cities, by order of the military authorities.

Apparently some people do not comprehend the finality of a military order; at any rate the Chief Commissioner of Metropolitan Police has issued a further more stringent order for enforcing the requirements in those situations where too much lighting is being employed. We notice that a Chiswick innkeeper was recently fined £5 and costs for disregarding police instructions in this matter. Apparently our contemporary, the *Gas World*, blames the electricity people (as a matter of course), for it says: "Information has reached us to the effect that some of the worst offenders against the first ordinance were some municipal electricity supply undertakings who persisted in keeping up their arc lighting. . . ." Probably it overlooked the recent announcement of the *Daily News*, that "Yesterday (October 7th) the authorities extinguished 13,000 high-power gas lights in South London." The latter paper also states that a conference of all the London electric lighting concerns has been held, and that unless the citizens respond to the proclamation, the lights will be arbitrarily lowered in a more sweeping fashion than ever.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

20,254. "Attachment of electrical conduit tubes to junction pieces." T. A. Smith & W. H. Owen. September 28th.

20,272. "Clutches for use more particularly in driving mechanism of lighting dynamos for automobiles or the like. Soc. Anon. Etablissements L. Bleriot. September 28th. (Convention date, October 2nd, 1913, France.) (Complete.)

20,274. "Telegraphy." W. Judd, A. Fraser, K. L. Wood, & Eastern Telegraph Co., Ltd. September 28th.

20,279. "Portable electric apparatus for medical or like purposes." H. Hergens. September 28th. (Convention date, September 29th, 1913, Germany.) (Complete.)

20,286. "Electrical heating-unit and method of manufacturing the same." F. W. Ball. September 28th. (Complete.)

20,293. "Reciprocating armatures." I. H. Parsons. September 29th.

20,303. "Electric glow-lamps." A. G. Smart. September 29th.

20,304. "Method or process of producing or manufacturing pure or nearly pure metallic tungsten powder. W. B. Ballantine. September 29th.

20,308. "Apparatus for transforming electric currents." Ester & Co., Ltd., and A. P. Strohmenger. September 29th. (Complete.)

20,312. "Dynamo-electrical machines." British Thomson-Houston Co., Ltd. September 29th. (General Electric Co., United States.)

20,319. "Line or wireless telegraph systems." W. H. Shephard & A. E. McKechnie. September 29th.

20,322. "Control of electric motors." Igranic Electric Co., Ltd. September 29th. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

20,330. "Electrical ignition apparatus for internal-combustion engines." M. S. Conner. September 30th.

20,331. "Dynamo-electric machines for supplying current for lighting and general purposes as well as for the ignition devices of internal-combustion engines." G. H. Woods. September 30th.

20,342. "System of and means for signalling electrically." H. Green and W. de M. Landon. September 30th. (Complete.)

20,356. "Glassware for artificial lighting." W. T. Dean. September 30th.

20,374. "Electric discharging-tubes." B. Donath. September 30th. (Convention date, October 10th, 1913, Germany.) (Complete.)

20,409. "Insulating material for electrical purposes." H. Grossman. October 1st. (Complete.)

20,436. "Railway electric signals." E. O. Evans and J. P. Saunders & Co., Ltd. October 2nd. (Addition to 20,318/13.)

20,452. "Impulse responding devices." Betulander Automatic Telephone Co., Ltd., & D. C. Crewe. October 2nd.

20,453. "Telephone exchange systems." Betulander Automatic Telephone Co., Ltd., & W. Aitken. October 2nd.

20,458. "Prepayment electricity meters." Landis & Gyr, Ltd. October 2nd. (Convention date, October 1st, 1913, Switzerland.) (Complete.)

20,459. "Construction of projectile." S. O. Cowper-Coles. October 2nd.

20,460. "Arc lamps." J. L. Dinsmoor. October 2nd.

20,478. "Means for carrying, conveying, and storing electric lamp bulbs." S. Whalley. October 3rd.

20,505. "Installations comprising electro-magnetic machines and in which the tension or intensity of these machines is subject to variations." Soc. Anon. des Etablissements L. Bleriot. October 3rd. (Convention date, October 13th, 1913, Belgium.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

19,854. Galvanic Batteries. J. E. Preston. September 2nd.

20,444. Lamps for Cycles, Motor Vehicles, Aircraft, and other service. C. Y. Hopkins. September 10th.

20,725. Holders for Incandescent Electric Lamps. E. Dobson. September 13th.

20,990. Electric Torch. J. Aikman, Jun. September 17th.

21,607. Automatically adjustable Ignition for Internal-combustion Engines. S. A. Horstmann. September 25th.

22,926. Electrical connection of the Plug and Socket Type. E. H. Leonardt. October 10th.

26,657. Shade-holder for Incandescent Electric Lamps. T. McClelland, Jun. November 20th.

28,059. Electric and Vibratory Horns or Alarms and methods of operating same. E. V. Gratze. December 5th.

1914.

441. Mercury Breaks or Interrupters. H. F. Bigge and F. R. Butt. January 7th.

6,777. Fire Alarms. G. H. Oatway and T. Watson. March 17th.

9,611. Track Circuits for Railways. W. H. Dammond. April 18th.

11,343. Means for Supporting and Insulating Conductor-rails of Electric Railways. E. P. B. Estler. May 8th.

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THE

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Vol. LXXV.] CONTENTS: October 23, 1914. [No. 1,926.

	Page
An Appeal to the Government	545
Copper	547
The Trade War	547
Trading in Italy, by O. E. Allo	548
Capturing German Trade: How to Ensure Success	549
Reviews	550
The Electrical Trades and the War	552
Legal	553
Our Legal Query Column	554
New Electrical Devices, Fittings and Plant (*illus.*)	555
War Items	555
Business Notes	557
Electricity Supply in Basingstoke (*illus.*)	559
The Aster Engine Works (*illus.*)	560
Automobile Searchlights for the French Army (*illus.*) ...	562
Notes	566
City Notes	568
Stocks and Shares	570
Exports and Imports of Electrical Goods during Sept., 1914...	571
Large Induction Motors: Some Features of Mechanical Design, by G. Moores (*illus.*) (*continued*)	572
Electric Brass Melting, by G. H. Clamer and C. Hering (*illus.*)	573
New Patents Applied For, 1914	576
Abstracts of Published Specifications	576
Contractors' Column ... ... Advertisement page xx	

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AN APPEAL TO THE GOVERNMENT.

IT is satisfactory to find some of the more responsible daily papers devoting space to a reasonable discussion of the directions in which amendment is required if we are permanently to strengthen our trade and industrial position both at home and abroad. It is unquestionable that financial considerations will largely control policy. But the problem of finance is a many-sided one. As matters stand, inability to raise capital for extending works or taking up new lines will certainly be to some firms an insuperable barrier. In this respect agents for factory-letting in London report that many traders have intimated that they would like either to extend existing works or to secure larger ones, but they are at a loss to know where to find money for the equipment and raw stock in the absence of suitable security to place with bankers. One such agent advocates that the many committees now acting in connection with the trade extension movement should meet to consider whether a proposal could be put forward for the formation of a capitalised institution where borrowers of known position, trading ability, and ascertained assets (at present locked up in their businesses), could turn at the right time for help. The case for an industrial bank has once again been fully discussed in a series of articles and letters in one of the financial dailies. The subject has been done to death in times of peace during the past 10 or 15 years, and it is inevitable that under the present circumstances it should attract attention again. Maybe the different setting will lead to something more tangible being done. There have often been private parties willing to do something, but knowledge of the extent to which financial-industrial relations have been carried in Germany leads us to approve the preference of our contemporary for a movement strongly founded, widely based and substantially backed. We agree that

if a national bank of this character is to be established and is to receive the support of the Government, it must be taken in hand by persons of the highest standing in the financial and commercial worlds. No private scheme, however ingenious, would have the slightest chance of success without this backing, and the multiplication of such endeavours would tend to defeat the great end that must be kept in view.

It is stated that banks have lately continued to show reluctance to consider favourably loan propositions, and cases are advanced of new lines, such as colour printing, offering sufficient guarantees of success, which well-known firms have been forced to decline through being unable to borrow, on reasonable terms, the money needed for laying down the new machinery required. The bankers may have very good reasons for their action in presence of the exceptional circumstances of these times, but unfortunately the policy is the same as they found it desirable to follow in the piping times of peace. We were pleased to turn the other day from the consideration of this position to the generous offer which Lord Lytton has made to assist manufacturers in the promotion of industries for the production of articles hitherto imported from Germany. He offers free sites on his Knebworth estate, 25 miles from London, for workshops of an inoffensive character. The offer may perhaps be eyed askance by those who regard it as one of the sprat-to-catch-a-mackerel order, but the would-be manufacturer may be trusted to scrutinise the value of the offer for himself. While he does not ask for charity, he does need facilities for beginning new operations, and even the possession of a free site may be of some assistance in his efforts to secure financial support.

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No doubt some of the proposals and offers that are being made are very interesting, and we have no wish to underrate their value or significance, but in a great measure they are only temporary expedients. We desire to put forward the view that what is absolutely necessary if we are going to deal with the present position in a thorough way is to investigate it authoritatively, and deal with it nationally along lines laid down as the outcome of well-considered Government policy.

While we have never advocated a Governmental policy in trade which might in the least degree obstruct the exercise in the freest and fullest possible manner of individual initiative and enterprise, we have at times seen fit to point out ways in which the Government, in our opinion, can legitimately assist British industry. Without trespassing on the field of political controversy, we may be permitted to say that we have a Government in power which is anxious to secure ample employment for British workmen. In its Trading with the Enemy measures it has been largely influenced by that consideration. In its Patents Act of 1907 also it applied legislation to the same end, and extended British manufacturing, whoever may have provided the capital. Immediately the war broke out it set its Board of Trade machinery to work with the determination of doing whatever lay within its power to assist British works to keep the wheels turning, and to capture the export trade of Germany and Austria-Hungary. Without saying anything as to the practical value of the information thus prepared—there are quite two views current—we may accept the active trade policy as indicating a willingness of the Cabinet to assist British manufacturing.

It may be that this struggle with Germany will leave its mark upon British national policy with respect to trade, and it may alter our Acts of Parliament concerning the incoming of aliens, the formation, registration, and conduct of private firms and limited companies, and many other matters bearing upon industry. It will be years after the war-guns are silenced before Parliaments have been able to reflect, in the form of amending enactments, all the effects of the war upon the mind of the British people. There are many things that will never be the same again. But the handling of matters of immediate urgency need not materially clash with the operation of these slower evolutionary forces. No doubt the Government's hands are well filled with matters of serious concern, and we do not propose that the electrical or any other industry should add to their embarrassment by re-urging all the many suggestions that we have made for the pursuance of a national trade reformation policy; some of those will probably come to fruition in the next few years. Yet we do feel the necessity for appealing to the Government to take the simple course of appointing at once a Commission to consider exhaustively the various important trade questions that have emerged since the outbreak of war. We make this appeal with the consciousness that in doing so we are representing what we may describe as a substantial manufacturing view; that compliance with the suggestion does not entangle the members of the Government in controversial questions such as it is desirable to avoid at present; and that it is entirely consistent with the trade campaign policy of the Government.

For what purposes do we suggest the setting up of this Royal Commission? Not, be it noted at once, for the purpose of adding to the untruth which Germans have set in circulation and fostered, that Britain has gone to war because of jealousy of German trade success. All opinion that counts to-day believes that if ever Britain had sacred justification for going to war we have it now. To suggest that the nation that rejected "Protection" would indulge in bloody battle for the sake of trade is stupid in the extreme, and we do not desire the nation to do anything that can fairly be interpreted in that way, but the war has shut this and other countries and our Colonies off from certain supplies of German manufacture, and has given rise to a strong and growing agitation for these to be made in England in future. As we stated last week, however, the matter is one of very great difficulty indeed, and mere agitation is not going to accomplish much.

It is most gratifying to hear from electrical manufacturers of the attention that they have been devoting to the wisdom or the possibility of their adding to the number and class of their products, but we fear that the position will not be sufficiently met unless their hands are strengthened by a statement of Government policy. So far the Government has had to limit its attention to new questions as they have arisen, but no doubt sooner or later a definite policy will be adopted which shall have for its object the ensuring of safeguards of some kind or other to assist British works to retain for a sufficient period after the war the new business which they now decide to take up. We hope it may be possible to develop and adopt such a policy along non-political lines and with the co-operation of all parties. To that end we recommend the appointment of a Royal Commission composed of manufacturers, scientific men of eminence, and Board of Trade representatives, who will make a complete investigation of the imports that we have been accepting from Germany and Austria in the past; will, with expert technical, commercial and industrial knowledge examine into the extent to which these can be produced in this country; and in cases where it is considered impracticable under prevailing conditions to manufacture them, will state the reason why, and if possible will suggest any measures which are essential in order that their profitable production may be assisted.

The Commission might have several sub-Committees dealing with different industries, these having power to confer together in case of necessity when questions of classification of particular lines arise. It seems not unlikely that some manufactures which are impossible of introduction by one class of industry alone, might become practicable by two distinct classes acting in co-operation. It is also conceivable—and this is an important point—that a success in a primary line of production would encourage many a subsidiary branch. A Commission constituted in some such way as we suggest would be capable of distinguishing between primary and secondary industries, would be able to say how far such factors as atmospheric conditions, technical training and skilled labour difficulties stood in the way; would be able to suggest whether or not it was wise, necessary or possible to avail ourselves of any specialised skill or knowledge possessed by Belgian or French refugees, and so on. Taking the fullest possible view of the situation and taking into account all these and other factors of a similar kind, we might be able to arrive at an unprejudiced and authoritative conclusion as to what new industries may be settled in this country with reasonable likelihood of success. Then the rest can be left to individual enterprise.

To our mind the department which is engaged in so elaborate a campaign urging the British trader to capture German trade, could quite consistently develop its proceedings along these lines. The individual trader would not need to stay his hand the while the larger investigation was proceeding; indeed, we should hope that he would be willing to place himself at the disposal of the Commission, as far as necessary, as it makes its inquiries.

In the course of such an investigation there would probably arise the question of the need for some basis of safety as an inducement for the manufacturer to undertake new production. It is conceivable that given some reasonable measure of certainty that demand for competitive lines would not fall away immediately foreign under-cutting and unscrupulous competition again became factors in our markets, many primary manufactures might be taken in hand.

How can this basis of safety be secured or assured? This, as it appears to us, is where the occasion would arise for the adoption of a national policy. With such a report as we have mentioned—drawn up by men of unquestioned repute in the scientific, manufacturing and industrial world, aided by men well versed in public affairs—at command, our legislative leaders would have a full insight into the whole matter, and would be enabled to arrive at conclusions making for the adoption of a national policy. They might possibly find it worth while to adopt some scheme or other under which all public money expended in the British Isles, and, with the co-operation of Colonial Governments, even in the Colonies and Dependencies too, might be employed, subject to suitable provisions, in purchasing British, instead of German, manufactures. Or in other

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ways they might find it possible to devise means which would ensure, at any rate, a certain larger measure of support for British manufacturing than it has in the past enjoyed. In our belief, they would, in the present state of feeling, have the general consensus of opinion behind them in whatever they did to that end. The Commission could probably report within six months.

With such an assurance as a basis upon which to operate, there would undoubtedly be a greater disposition to proceed. It is noteworthy that some authorities hold that without some such measure as is outlined above, all the "capturing" of German trade that can be hoped for will be the temporary filling in of blanks which are now existing, due to the lack of German imports.

Between six and seven years ago, when the country was involved in the discussion of fiscal problems and their relation to industry, the then President of the Board of Trade, who is the present Chancellor of the Exchequer, made a proposition for a Conference at the Board of Trade between himself and the 12 best brains in British industry in search of what he described as a "substantial alternative." We reproduce from our issue of March 6th, 1908, the following summary of his speech :—

He had himself thought many a time that if he could get *hold of the dozen best brains in British industry, without any respect or regard to their political or fiscal opinions*, and if he could get them to come to the Board of Trade, say, and invite them to a room and say to them : "Will you please leave all your fiscal opinions outside on the doormat with your goloshes, and just apply yourselves to the problem of giving the best counsel to the Government as to the best methods, in your judgment, whereby a Government can help British trade and industry," in his opinion those 12 men—or rather 13—an unlucky number, but he was not superstitious, would issue from that room with a trade policy, a great creative, well-thought-out trade policy that would commend itself to nine-tenths of the people of this country.

This attitude, which commended itself to us as being the right one at that date, seems to be absolutely the correct frame of mind in which to approach the position that now presents itself. We do not forget that the First Lord of the Admiralty also once made a suggestion for a round-table conference with authorities interested to settle the electric supply problem of London. The members of the Cabinet certainly have no aversion to Conferences. And we believe that we may look with confidence to the present President of the Board of Trade (Mr. Runciman) to further his Department's trade war campaign by some such arrangement as Mr. Lloyd George suggested in 1908.

We, however, incline to the opinion that a Commission to deal with the whole subject exhaustively is required in addition to the conference of the 12 best brains ; doubtless that would more or less naturally ensue as a result of the Conference.

To summarise, the Government is busy—very busy—and the time is unpropitious to burden it with many and troublesome details concerning the future of trade when we are still fighting for our national existence. But it can without much anxious thought refer the points we have mentioned to a Commission. It certainly could do no harm. It might, and we think it would, do a great deal of good.

Copper.

The tone of copper has been unsatisfactory in the extreme since last writing, and a decidedly downward movement has developed under realisations of pre-war contracts finding the market bare of buyers. The situation as regards the speculative department has developed weak spots, and has induced the Committee of the Exchange to make further regulations for the purpose of restricting trading. There is more than a suspicion that undue advantage has been taken in certain quarters of the permission accorded to deal, by using the facilities for the purpose of deliberately depressing the market. This is quite contrary to the spirit of the regulations, and the only way out of the *impasse*, therefore, was to prohibit all trading, both public and private, except in so far as it concerned the closing out of pre-war contracts. Refined copper has naturally not escaped from the disabilities imposed upon the market generally in this connection, and consumers have been able to buy at steadily receding prices. To-day £53 a ton is about the price of American electro, and business has been done at this figure. At round this price there cannot be much, if any, profit to producers, and it may soon become necessary to take a fresh view of the position. That production has been cut down at the mines by about 50 per cent. is past all question, and that this is a consideration which, in the fulness of time, must operate as a stiffening factor on prices is equally beyond dispute; the only query is when this is likely to come about.

So far the restriction at mines has not been reflected in refinery output, but the point is nearly reached when this will come into effect. It is estimated that production and consumption are about evenly balanced on the present basis of reduced output, but if it should prove that the already very drastic steps taken are insufficient to cause prices to hold up at near the present very moderate level, then the policy of restriction will undoubtedly be carried to a further extent yet. Producers and mine-owners have no intention of depleting their mineral resources at such prices as these, and although the process may take some little time, it may be implicitly relied upon that copper will not be produced (in America at all events) unless at a reasonable price to the sellers. So far as the European position is concerned it has undergone some little alteration lately owing to the attitude of Holland in the matter of the supply of copper to Germany. As soon as the war broke out Holland was put up by Germany as the intermediary for the purchase of material for war and other purposes, and in pursuance of this enormous quantities of American copper were shipped from the United States to Rotterdam. It was palpable that Holland could not consume these tonnages or anything approaching them, and our authorities then stopped Dutch steamers and exercised their rights of search, eventually declaring copper to be conditional contraband. The Dutch Government then ordered that all copper shipped to Holland should be consigned to it, and the next step taken was to forbid the exportation of copper from Holland. Germany is now frantically trying to buy copper in Scandinavia, and London merchants are bombarded with cables and letters from previously unknown firms, asking for offers of copper, spelter, and all other metals likely to be of use to Germany, but fore-warned being fore-armed it is improbable that any business has been done. Some American copper producers are, however, very keen to do business with Germany, and are charging about £10 a ton over the market price for metal sold in this way to our enemies. The next step may probably be that the Scandinavian countries, or some of them, will prohibit exports of copper, and in this way will the cord be drawn round the throats of the devastators of the 20th century, whose deeds would defile the records of a race of savages.

The Trade War.

Eleven weeks have now elapsed since the commencement of the great war—weeks charged with excitement and interest in all phases of our national life, and not least in that particular sphere with which this journal is associated. We anxiously scan the pages of our morning, evening and half-time papers in search of the latest news from the front, and have become accustomed to absorb with a thrill of emotion the glad tidings that the Allies have pressed the enemy back on the west, that the position in the Vosges is unchanged, and that there is no news from the centre, while in the eastern arena the Germans have smashed the Russians (Berlin wireless) and the Russians have smashed the Austrians (*viâ* Rome). The daily report of heavy firing in the North Sea whets our appetite for German submarines, and the nightly display of electric rays shot skywards reminds us that overhead transmission is no longer confined to electric power and telegraph lines. But little information can be gathered from the columns of our veracious lay contemporaries regarding the progress of the other war with which the electrical trade is more directly concerned, and therefore we have taken steps to obtain from the leaders of our industrial armies an expression of their views with respect to the progress of the campaign against our Continental competitors.

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From the replies which have already come to hand, some of which are dealt with on another page of this issue, we have come to the conclusion that the course of events in this region bears a decided resemblance to that which we have observed upon the Continental field of battle; no sensational and decisive victories have been scored, but steady progress is being made in various directions, the pressure is being maintained and intensified, and full confidence reigns in the breasts of our industrial forces. The initial reverses—the financial stringency and the scarcity of raw material experienced in August, the disorganisation due to the withdrawal of so many skilled engineers and workmen from their normal occupations, and the temporary interference with our freedom of transport for goods and materials by land and sea—have all been practically recovered from; there is no lack of employment, orders are coming in freely, and the vacancies in technical staffs are being gradually filled. New lines of manufacture are being taken up, and additional plant is being installed—not with headlong haste, which would be unwise, but as circumstances permit. An especially gratifying feature of the situation is the unanimous statement that the financial conditions now prevailing are such as to offer no hindrance to the maintenance of a large volume of trade; some manufacturers in the early days feared that delays in payment for goods delivered would tie their hands, but happily this has not occurred. It will be noted that the new business recorded is largely derived from home and Colonial buyers who formerly obtained their supplies from the Continent; this is only what might be expected. Too little time has passed for the effect of the new conditions to be realised to any great extent in foreign countries; our Allies' hands are fully occupied with military measures, and neutral countries cannot instantly develop close relations with new sources of supply. But the indications in this respect are distinctly favourable, and one of our most weighty correspondents explicitly adopts a highly optimistic tone.

Amongst the wares which are now receiving greater attention in this country may be mentioned ebonite, carbons, porcelain insulators and accessories, magnetos, cheaper wires and cables, small portable apparatus, incandescent lamps, small motors, batteries for pocket lamps, enamelled ironware, permanent magnets, &c., and we hope the list will extend indefinitely.

Few of our readers can be aware of the enormous variety of goods that enter this country from Germany, and are sold by British dealers who, possessing works for the manufacture of certain items, are supposed to make also the goods which they in fact import. Attention has been drawn to this in many cases by the sudden interruption of supplies from the Continent. Even where the goods are largely manufactured in this country, there are many instances in which the "raw material" is partly manufactured abroad, and perhaps the distinction between "raw" and "manufactured" material in the minds of some is rather hazy. A very significant passage in one letter shows that it has been found possible to manufacture some articles at prices comparable with those of the previously imported goods; we trust that the experiment will be tried in many other lines.

On the whole, we feel that the cheerful tone of our articles on the subject of the trade war has been amply justified by the reports which we have received from numerous sources. The contest is still only in its early stages, and German competition is not yet extinct, for goods are being exported through neutral countries, in appreciable quantities; moreover, it appears that some agents for German manufactures laid in remarkably large stocks last summer, with singular foresight or presentiment. We cannot expect, nor would it be salutary, to leap ahead—steady progress is sufficient. And after the war? We must not think that we shall retain the new business without a struggle; "he shall keep who can." While we are winning the territory let us not fail to fortify and entrench our frontier at each stage, so that our position shall be secure and impregnable to the assaults that will be made later. Some useful and timely words of caution in this regard, and of advice as to the methods that must be adopted to carry on the war with success, are given in a communicated article elsewhere in this issue.

TRADING IN ITALY.

By O. E. ALLO.

Seven years ago I was sent to Italy by an English firm, who were represented by a local agent, with a view to extending their business in A.C. meters and introducing their D.C. meters and switchboard instruments. On my initial tour I carried about with me a perfectly sound and working sample, and although I was working under the disadvantages of not knowing the language at the time (I interviewed my customers speaking French), and not having any Italian catalogues or price-lists, I came home with some 200 meters ordered as samples, as well as with orders from existing customers. This is mentioned merely for the purpose of showing how willing "chiefs" are to see and try new articles. With regard to price, we were the highest at that time, but now this firm can compete with any of the better makes of meter, and still have the reputation of supplying the best instrument of its kind on the Italian market.

The electric lighting stations in Italy might be divided into three classes:—

1. Those owned, or partly owned, by German manufacturers: Genoa, A.E.G.; Florence, Bari, Brescia, Palermo, Siemens-Schuckert, &c.
2. Municipalities and private companies, either Italian or foreign (not German).
3. Electric lighting stations in small towns and villages.

In the first instance, practically all plant and material are ordered from the interested German concerns. They generally have someone of their choosing who attends to this.

In the second instance, open competition prevails, but so far all the work seems to have been done by German and American firms.

In the third instance, the electric lighting station is generally a small transforming station, where current, which is bought in bulk at high pressure, is transformed to distributing voltage. Companies (Italian) who have the concessions for the supply of a number of these small towns and villages, have their headquarters in some large centre and buy in the most favourable market.

It may be of interest to mention here that in these small towns and villages energy is charged for by contract. A current limiter is installed instead of a meter, and is adjusted to allow the number of lights contracted for to be burnt; if one lamp above this number be put on the lot will go out until the excess lamp has been extinguished, when the others again light up.

The charge made is generally 5 lire per month per lamp; the price of the current limiter is from 7 lire.

For lighting, heating and cooking, I have seen contracts made at from 15 to 30 lire per month, with current available day and night.

This lends itself admirably to the use of heating and cooking apparatus, as well as of electrical signs.

With regard to the exaggerated fears respecting long credit, I have, while in Italy, accepted orders for large machinery at the following terms:—

One-third of the amount to be paid at the time of ordering.

One-third to be paid on receipt of goods.

One-third to be paid after three months of satisfactory working of the machinery.

Surely this is not out of the way, and would be acceptable by most British firms. In the event of any firm cancelling the order after the payment of the first one-third, it is at the option of the contractor to keep the whole or part of this payment. This I had occasion to do once; the amount came to some £60. Payments for smaller articles, stores, &c., are generally made by the larger concern a month after the receipt of the goods, and others three months after receipt.

I should say that a good field should exist now for arc lamp carbons, large motors and generators, switchboards and parts, boilers, feed pumps, water pumping plant, registering instruments, general stores, copper and galvanised wires, conduits, &c.

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CAPTURING GERMAN TRADE: HOW TO ENSURE SUCCESS.

(Communicated.)

In many influential quarters, including Governmental, the facile and glib advice has been tendered of late to the British manufacturer and exporter to seize the present opportunity of Germany's preoccupation to secure that country's foreign trade, without, however, vouchsafing regard to the means whereby that country secured her important position in the world's markets, or to the probability that those means, which aided her in obtaining, may eventually contribute to her regaining and retaining, that trade. Obviously, however, it would be futile for English manufacturers at the present juncture to bestir themselves to compete with Germans in oversea markets when most of the conditions which gave the latter their pre-eminence before the war will survive, as they certainly will in the main, after the conclusion of hostilities, and again give them the lead in the race. Wasted expenditure would be the sole return for the efforts put forth.

Two great factors have aided German trade in the past, and one of these presumably will remain unaffected by the war, while the other, although seriously affected, will only be temporarily impaired. The former factor is the far-seeing policy which the paternal and bureaucratic Imperial Government has pursued towards German trade and industries, as a whole and individually. Where the British Government has left the development of British trade almost wholly to private initiative, the German Government has made it a study how to "engineer" trades and industries, recognising them as the life and essence of the body politic. Hence it has made it its business to foster the nation's home industries in multifarious ways, and to seek outlets for their products by every means—fiscal, pecuniary, advisory, and other. If is true assistance of a like kind is also furnished by our Government, but its effective value is incomparably inferior to that enjoyed by our trade rivals. The German Government's efforts will undoubtedly undergo no intermission after this war, even though difficulty may be experienced, in an altered financial situation, in covering the votes for steamship subsidies and other transit facilities.

The second great factor which has served to aid German trade is the lavish capitalisation of industry which is a part of the German banking system. More than anything else, perhaps, this has been the means of the expansion of German industries and oversea trade. Whereas capital in England is only with difficulty drawn to industrial ventures, the contrary has been the case in Germany. With the financial collapse that must attend and follow the war, this lever of trade welfare must be seriously impaired. Recovery will, however, sooner or later set in, and this lever will then enter again into operation in favour of German trade. But the interregnum before recovery will certainly be the opportunity for our manufacturers, but only in the event, and to the extent, of their pondering over the lessons of the past and devising means for modifying or counteracting these and other conditions under which we have seen our former world-wide trade supremacy whittled away to its present dimensions. Failing this, exporters' efforts will simply land this country's trade in exactly the same position as it was previous to the war.

Of the many factors which have helped to give German goods prominence in oversea markets may be mentioned (1) price, and (2) business method. Contrary to the vulgar view, quality plays only a small rôle in the success of German foreign trade. For the fact that the German manufacturers can undersell the British in most of the oversea markets, the latter is only for a small part responsible. The German achieves his cheapness first by cheap labour, provided by the longer hours worked by German workmen, combined with relatively lower wages than the English standard. The scale of wages and hours set by British trade unions debars the English manufacturer of any like means of cheapening the cost of his products. He is equally debarred, by the indifference of his own Government, from a second assistant towards cheapness furnished by the German Government in the shape of cheap railway rates for goods destined for exportation and cheap import rates for raw materials. To these is also to be added: cheap ocean freights by means of steamship subsidies. The pockets of English manufacturers would need to be of the depth of those of a Crœsus to struggle against these accumulated factors, more especially in view of the attitude adopted by our railways with regard to railway rates.

Too much attention cannot be concentrated on the bearings and working of these cunningly devised Government and private railway and steamboat subsidies. The subsidies granted by the German Government to German shipping lines, allowing German manufacturers to export their goods to British, Colonial, and foreign markets at a cost such as to equal in many cases the saving of the whole of the sea freight, is a lever which enables the German to monopolise markets even where, as in our Colonies, English goods enjoy the advantage of a preferential tariff. In some cases these subsidies have, furthermore, been the means of enabling them to wholly oust British trade from British Colonies and neutral markets. Witness British East and Central Africa, and also the Portuguese Mozambique Coast. Should our Government persist in its refusal to grant subsidies to shipping companies for maintaining a service on half-paying trade routes, the whole of these regions will fall to the Germans after the war, as before, whatever our manufacturers may do to prevent it.

The German levers of business method, which have proved in practice superior to our own are, first, those which proceed from the Government, and, secondly, those due to private initiative. Examples of the former are the institution and sending abroad —and notably to China in a prominent instance—of permanent travelling exhibitions of German goods in particular branches, in most comprehensive detail, accompanied by estimates, catalogues, and prices, in the tongue of the natives. The commissions of experts sent on other occasions to study and report on the trade of particular countries, is a second example. Private initiative in such lands as Spain, Italy, Roumania, and Turkey is more particularly illustrated by the founding of banks and branch houses in leading foreign cities, the acquisition and development by them of mines, waterfalls and other undertakings, the working of concessions for the establishment and control of electric light and power services, the founding of industries using electric power, etc., whereby is earned for the industries of the Vaterland the reward of the control of the orders for the machinery and material which are eventually required, and the local employment of German capital and labour. Our own Colonies in South Africa furnish a striking example of this co-operation of trade and capital, first in the employment of German capital in mine development, and secondly in the permanent appropriation of all subsequent orders for mining, electric and other machinery equipment. The foregoing are illustrations of the operations of the great capitalist, industrial, and commercial trusts which mark modern German development, to which is to be added the foundation of innumerable commercial agencies, branch houses and repair shops, in cities abroad, to facilitate the sale and use of German machinery. More individual method is illustrated by the up-to-date procedure of German travellers and representatives, their detailed

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estimates, catalogues and quotations in native tongues, their delivery of goods to the purchaser's door, their solicitude for the tastes and whims of their clients—contrasted with the "take it or leave it" British attitude—their preparation, packing, labelling and dispatch of goods, and, not the least, their utilisation of the local press to glorify German goods, industries, or firms, and at the same time depreciate those of this country by the ostentatious record of orders secured here. Many of these methods are new to the procedure of our exporters, and perhaps repugnant to them, but their value has been proved by the trade success effected by their means.

From what has been set out in the foregoing it will be seen that, for our manufacturers to draw profit from the present opportunity, they must overhaul and revise all their previous methods of trade pursuit, and also probe *à fond* the *modus operandi* which has given our competitors their tangible advance in the race for the trade of the world, and show a readiness to learn even from the despised German. They will also have to gauge the full bearings of the German Government's past commercial policy, with a view to finding a fitting equivalent or counterpoise through either a reformation of the constitution of the Board of Trade or the creation of a new live Ministry of Trade. Reduced scales of railway rates and charges will, by some means or other, have to be brought about; and steamship subsidies or equivalents will have to be provided by the Government to match the aids enjoyed by the German manufacturer. Lengthening of the hours of labour and lowering of the scale of wages would appear to be beyond the possibility of achieving, and so much of prejudice to our industries will have to be submitted to. More capital will have to be invested in industrial undertakings than hitherto, and some steps to this end have already been taken with the banks. The intimate co-operation of capital and industries, as in Germany, is perhaps impossible of realisation; but the investment of capital in enterprises abroad is no new thing to us, as witness the municipal water and gas installations, railways, and industrial undertakings which, in the past, have been set up in numerous Continental cities, by the union of British capital and industries. Co-operation in the export trade must, too, be introduced, and instead of the present wasteful competitive efforts of innumerable individual firms in relatively small markets, spheres of action to a limited number must be allotted, the energies of the others being diverted to more favourable and less worked outlets elsewhere. The individual agency for securing trade will have also to be better selected, and hitherto methods of approach to and treatment of customers modified. On the part of the manufacturers, more readiness to lay themselves out for new lines will check the frequent loss of much valuable business.

These are the minimum of essentials of a successful trade warfare with our powerful rivals, and when they are realised, and not till then, will British trade be able to count with confidence on success in, and profit from, the present opportunity.

Nigeria.—According to the *Colonial Journal*, a report has recently been made by Mr. S. M. Ede for Messrs. Preece, Cardew and Snell on the supply of electricity for Port Harcourt. A steam plant is proposed on the Bonny River, with a three-wire D.C. network. The installation would cost £26,000; local coal costs 30s. per ton delivered, and it is proposed to charge 10d. per unit for electricity. For Kaduna also a scheme has been prepared to furnish light and power to the railway, waterworks and ice plant, and for town lighting, &c. An initial output of 1,285,000 units, of which the railway will take 985,000 units, is anticipated. A D.C. 440-volt system will be used for the railway shops and a 2,200-volt three-phase system for distant supply. The cost of the scheme is given as £65,000.

REVIEWS.

Picture Play Photography. By H. M. Lomas. London: Ganes, Ltd. Price 5s.

While the subject of this book is not in itself of electrical interest, it is so intimately associated with electric lighting that it may fairly claim a reference in our pages. The book is well written by a specialist in photographic art, who shows that he understands clearly the science of illumination as applied to his ends, and, moreover, is able to impart his knowledge to others. The use of the enclosed arc lamp for illuminating scenes that are to be biographed is strongly advocated, in preference to open or flame arcs; about 20 such lamps are required for an average scene, taking 15 amperes at 240 volts each. Mercury vapour lamps are also suitable.

In this connection we find ourselves in conflict with the author, who, after justly satirising a so-called "skilled engineer" who had never heard of a cathode, takes us to task for stating that "no ultra-violet rays could pass through glass," and goes on to suggest that "for purely commercial reasons certain people who ought to know better make inaccurate statements, and do not trouble either to test them or to look up reliable information on the matter." But he is speaking of the actinic rays of which he makes use in photography, while we, as our article clearly showed, were referring to the rays which injure the eyes and burn the skin—the ultra-violet rays of short wave-length, which are of no use to the photographer because, we repeat, they cannot pass through glass, and which are not present in sunlight because they cannot penetrate the earth's atmosphere to any great distance. Needless to say, we carefully verified our facts before we made the statements criticised by Mr. Lomas, and we may quote here Dr. C. P. Steinmetz, one of the greatest living authorities on electrical science:—"These very short ultra-violet rays are extremely destructive to the eye: exposure even to a moderate intensity of them for a very few minutes produces a severe and painful inflammation, the after-effects of which last for years." Has Mr. Lomas ever heard of these rays? Dr. Steinmetz goes on to say that "even a very thin sheet of glass is opaque for these radiations." "Clear transparent glass thus offers a practically complete protection against the harmful effects of ultra-violet light, except when the latter is of excessive intensity, and thus arcs enclosed by glass globes are harmless." The matter is very fully discussed in his work on "Radiation, Light and Illumination," pp. 52—62. Prof. S. P. Thompson, whose authority is also unquestioned, states that "Even the lightest crown glass, though moderately transparent to waves from 15 millionths to 11 millionths of an inch long, is totally opaque to all waves smaller than 11 millionths." Now, the injurious rays have a wave-length in the neighbourhood of 8 millionths of an inch—an octave above the point of maximum chemical activity. These are not the only authorities that we consulted at the time, before we made the remarks to which Mr. Lomas has taken exception, and we may also refer to the important note on "Ultra-violet Rays" in our issue of Oct. 9th. He does not mention us by name, and this is fortunate, in view of the injustice of his insinuations.

Full instructions for the arrangement of the electric lighting of the living pictures are given in the book, in minute detail and with abundant illustrations; the differences between natural and artificial illumination are clearly brought out, and the reader is warned against the production of unnatural effects. The technique of the photographic processes is no less fully treated of, and while we are not competent to criticise this portion of the book, it gives us the impression that the author is a master of his craft, and an able teacher.

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Electric Light Accounts and Their Significance. By H. M. Edwards, Auditor to The New York Edison Co. London: Hill Publishing Co. Price 8s. 4d. net.

The author in his preface states that in his preparation of the work he has undoubtedly been influenced by his connection for many years with one of the largest electricity supply companies, and also by his work with the accounting committee of the National Electric Light Association, though the system of accounting advocated is not in all its details the one followed by the New York Edison Co., and it differs in some respects from the system adopted by the National Electric Light Association. However, these differences are not material, and the book's chief claim to the reader's interest, he believes, lies in the explanations that accompany the accounts.

The matter contained in the book and the manner in which it is presented are good, though naturally the terminology and technicality employed are American, and more or less inapplicable here, while the ground traversed by the writer has been, it may be incidentally stated, covered (in regard to British practice) in various forms on different occasions in the columns of the *Review*. The diction or style is that of condensed and terse expression, and the author tells his story, if we may so term it and which may be read with advantage, of "Electric Light Accounts" interestingly.

The treatment of the subject resolves itself into three parts:—

I. Balance Sheet.—Description of balance sheet, plant investment, assets, suspense accounts, liabilities, reserves, capital, stock.

II. Income Accounts.—Definition of income, gross earnings from operations, operating expenses accounts.

III. Miscellaneous.—Account symbols, work order system, customers' accounts and records, accounting for surplus renewal and contingency reserves, the income statement and what it should contain, analysis of balance sheet.

In the chapter on customers' accounts and records the author states that there are two systems of handling customers' accounts in general use. In one of these all the facts are embodied in the ledger, and in the other the facts are divided between a billing medium and the ledger. The system first referred to follows long-established gas practice, and the second is the outgrowth of conditions peculiar to the electric light business.

As regards the gas ledger, one account can be kept for each meter set, and although the customer may have several meters it is usual to render a separate bill for each one. The entry in the gas ledger need show simply the date and the state of the meter, the indicated consumption and the extension thereof at the given rate. The accounts are entered therein in geographical order and usually maintain that order.

Electric current is sold at differential rates. A customer may have more than one form of contract on the same premises, and several meters may be furnished him under each contract, the charge being based on the sum of the meter readings so furnished. The data entering into the calculation is varied in character, especially if a maximum demand charge is involved or if the rate is based upon a guaranteed amount of consumption. There are many variations of all the factors in use, the result being that electric light calculations are complex in their nature and require considerable room for the spreading out of the details making up the charges. The business is continually increasing, and it is not an unusual occurrence for whole block of buildings to be connected to the mains at one time. If, therefore, it is desired to enter the accounts in geographical order some kind of flexible binder must be provided to permit new accounts being inserted in their proper place. In these conditions the billing medium has been devised in which the details of the individual charges are spread out and the amounts then posted to the debt of the customer in a separate record. Such a billing system usually consists of loose sheets with the name of the customer printed on the left-hand side of the sheet, the names appearing on succeeding lines in geographical order. In vertical columns across the sheet appear details of the meter readings and the consumption rate, and extension and additional columns are frequently provided for distribution purposes. Such sheets when bound constitute a record which fulfils all requirements.

The Year Book of Wireless Telegraphy and Telephony, 1914. London: Marconi Press, Ltd. Price 2s. 6d. net.

The most frequent comment on the first edition of this Year Book was that it was too good value for its price, yet nearly two hundred pages of text have been added to the present edition while the price remains the same. The chronological record of development in wireless telegraphy has been extended back to 1881, the date of Michael Faraday's discovery of electromagnetic induction; for the years subsequent to 1896, however, the record presented is little more than that of development of the Marconi system and interests. Predominant though these be, it is surely desirable to include in such a record the tale of achievement by other systems. Indeed, the whole book is still essentially a Marconi Year Book, and though this does not detract from the value of the great mass of information presented concerning laws and regulations, call letters and station lists and general technical matters, it is desirable to intimate in its title the, in some cases limited, scope of the book. Little information is presented concerning the progress and prospects of the Imperial wireless chain. A useful report of the articles and regulations of the International Convention on Safety of Life at Sea (London, 1914) has been included, and the existing sections on the Radiotelegraphic Convention, laws and regulations and wireless telegraph stations of the world have been retained and brought up to date where necessary. In the tables of land and ship stations, the system employed should surely be indicated, and other technical details such as the plant kilowatts installed would greatly increase the value of the work to technical readers. The alphabetical list of call letters for land and ship stations is a valuable feature.

The special articles on various wireless topics have all been written for this edition and maintain the high standard set in last year's volume. Prof. J. A. Fleming writes on Wave and Wave Motions; Dr. Erskine Murray on the Function of the Atmosphere in Transmission; Prof. E. W. Marchant on the Measurement of Strength of Wireless Signals; C. E. Prince on Problems of Telephony; G. E. Turnbull on Wireless in the Merchant Service; R. G. K. Lempfert on the Application of Wireless to Meteorology; and A. R. Hinks on Wireless Time Signals and Longtitudes. It is doubtful whether these articles will be intelligible and readable to the layman; to the expert they will be interesting though presenting nothing new; but to the student and amateur wireless worker they should prove very useful.

The chapters on international time and weather signals and on the work of the B.A. Radio-telegraphic Committee are of universal interest, and, in particular, to those who have installed time signal receiving sets or who are in a position to render amateur (but by no means trivial) assistance to the B.A. Committee by making systematic records of strays and X's. The valuable collection of formulæ and equations, tables, glossary of terms, code signals and so on are retained, and the lists of

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patent applications and wireless telegraph companies, biographical and obituary notices and the classified bibliography of wireless telegraphy and telephony have been brought up to date. An international directory of amateur wireless societies is included, and thirty-two personal photographs and plates illustrating land and ship stations and equipment are presented, these being different from those in the first edition. The wireless map of the world is but one of the many features, any one of which may easily be worth far more to the reader than the cost of the whole volume. Is it not possible, however, to show on the map lighthouse, lightship and naval stations not open to public correspondence but available for use in emergency; also to show at least the more important ones of the many private experimental stations now in operation? Such a map would be invaluable to all wireless workers whether amateur or professional. The general character of the Year Book remaining as before, its size being so substantially increased, and so much fresh and excellent material being added, the volume is even better value than was the first edition, but, for the same reasons, the criticisms levelled against the latter apply even with greater force to the second edition. Do or can the technical sections of the work appeal to the man in the street, and are they sufficiently terse and comprehensive to meet the requirements of the expert? The inclusion of wireless telephony in the title of the book is hardly justified by the information presented on this subject. The index is still rather short and not easy to find quickly.

THE ELECTRICAL TRADES AND THE WAR.

Our readers will remember that during the first week after the declaration of war between this country and Germany we addressed inquiries to a number of leading electrical manufacturers, in order to ascertain their views on trade prospects, and we summarised their replies in an article published in our issue of August 14th. Those replies were so generally optimistic and concordant, that eventually we cut short our investigations, feeling that to make further inquiries was superfluous. We have not lost sight, however, of the obvious fact that ideas formed at so early a stage must be very largely speculative in character and based on abstract, not concrete, foundations. We have therefore renewed our inquiries, in the hope that the period of two months which has elapsed may have enabled manufacturers to form more definite opinions as to the probable effect of the war on the course of trade; and in order to crystallise ideas to some extent we have invited a large number of electrical manufacturers to favour us with their views on the following points, together with any others that may appear to them worthy of comment:—

1. Have you sufficient orders in hand to keep your works fully employed?
2. Have you any difficulty in obtaining an adequate supply of labour?
3. Are new orders coming in at a satisfactory rate?
4. Is new business coming in which formerly went to Continental firms, from neutral countries, our Allies, and the British Empire?
5. Is the supply of raw materials sufficient for your requirements?
6. Are the financial conditions prevailing such as to enable you to accept orders freely?
7. Are you starting new lines of manufacture formerly dealt with only by Continental firms?

A number of replies have already come to hand, a first instalment of which is dealt with below. Further extracts from letters will be published in our next issue, and if any of our readers who have not been directly approached—for our list was by no means exhaustive—feel disposed to add their comments, we shall be glad to receive them. Our thanks are due to our correspondents for their prompt response to our invitation.

A Large Manufacturing Firm.

1. At present our works are fully employed—in some directions we are working overtime.
2. We have a difficulty in obtaining an adequate supply of skilled labour. Of course, the number of men who have left us to join the Colours has been a handicap, and we have not yet been able fully to overcome it.
3. The volume of our orders is, as a whole, satisfactory, and it is interesting to note that from August 1st to date, the volume is greater than for the corresponding period of 1913; but we have not so many contracts for heavy apparatus, which indicates that our small orders (*i.e.*, those under £5,000 each) are considerably in excess of the corresponding period a year ago.
4. There has been no substantial amount of new business coming to us which formerly went to Continental firms; our business has been (from the standpoint of its source) substantially normal. We have a few orders which would probably have been taken by Continental firms.
5. The supply of raw materials is sufficient for our requirements.
6. Financial conditions have been very good, *i.e.*, our collections have been excellent, and practically no one dealing with us has taken advantage of the moratorium. It is obvious that under present conditions, however, there will be some difficulty in financing new enterprises on a large scale, but I am optimistic enough to believe that this will not be a serious handicap (witness the recent issue of the South-Western Railway as evidence of what I mean). A lot of very small people owing us money have come to grief, but the aggregate is trifling, so much so as to be almost negligible.
7. We are not starting new lines of manufacture formerly dealt with only by Continental firms; our line has been very extensive, and practically covered the entire field. We are, of course, making every effort to push our business in the foreign field, but we have always done this in the past, though, of course, the present conditions have removed, for the time being at least, some of our most serious competitors.

Another Large Firm.

1. We have sufficient orders in hand to keep our works fully employed for some months to come.
2. We have no difficulty in obtaining an adequate supply of labour.
3. New orders are coming in at quite a satisfactory rate, and, so far, have not been below the average for previous months in this year.
4. We are getting a considerable amount of business which formerly went to Continental firms, the destination being chiefly the United Kingdom and the Colonies. Many of the orders we have obtained are orders which were in process of manufacture in Germany before the war broke out, which have been cancelled, and our machines ordered to replace them.
5. The supply of raw material is generally sufficient for our requirements, but we are finding a little inconvenience in some material, of which we do not use a great amount; but the Board of Trade Commercial Intelligence Department have arranged with various people to manufacture these parts, and the B.E.A.M.A. have also taken the matter up with their members.
6. The financial conditions prevailing at present are such as to enable us to accept orders freely, but if we are going to take German trade later, the financial facilities which are at present available in this country will have to be considerably extended, in order to meet the long credit which has to be given in the Colonies and foreign countries.
7. We are starting one or two lines of manufacture which were formerly dealt with by Continental firms, but we are not at liberty at the moment to reveal these.

With regard to general remarks on this subject, we would point out that a great deal of the business which we have done is the provision of motors for driving machine tools and other machines for ammunition machinery, and various armament work. If this demand falls off, the dynamo and motor business will probably also fall off very considerably, as the demand for motors in ordinary industries, especially in the textile trade, has completely fallen off.

Messrs. Gent & Co., Ltd.

We are very glad to have the opportunity of answering the questions which you put to us.

1. We have sufficient orders in hand at the present moment to keep our works fully occupied. In fact, part of our works are working overtime.
2. With regard to the difficulty in obtaining an adequate supply of labour, we have had several vacancies in our works owing to members of our staff having enlisted, and some of these it has been rather difficult to fill. We are, however, doing our best in this direction.
3 and 4. New orders are coming in fairly well, but still there is room for plenty more. We are pleased to say there is a good deal of business coming to us which formerly went to Continental firms, but it is more from the home trade than from abroad. Personally, we are inclined to think it is a little too early to expect orders from Overseas Dominions, but, we may say, we have plenty of inquiries for new business from allied countries.
5. The supply of raw material is a little restricted, but we are not suffering a great deal from this respect.
6. Financial conditions prevailing are, fortunately, such as to enable us to accept orders freely.
7. We are pleased to say that we are starting several new lines of manufacture formerly dealt with by Continental firms, but these

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are no great departure from our own business, but merely an extension of it.

To sum up the whole matter, we are, if anything, profiting by the war in that a large number of orders which, under ordinary circumstances, would have gone to Continental firms, or, at any rate, which have Continental control, are coming to us, and we expect that we shall shortly have to extend our premises in order to deal with the increased business.

MESSRS. WARD & GOLDSTONE.

1. Since the war began there has been a very considerable demand for our manufactures, particularly in wires, cables, &c., which, in the past, have been so extensively purchased from the Continent.

We are increasing our plant and filling up every corner of our works with new machinery in order to cope with the demand, which is not only for the home trade, but more particularly the export trade.

2. With regard to your question as to difficulty in obtaining labour, we find this is quite normal.

3 and 4.—We have a large number of inquiries from neutral countries which formerly purchased from Germany and Austria, but the prices at which they have placed their orders in the past are such that it is only with reluctance that they pay the advanced prices demanded by us, though they appreciate that they are receiving better quality material.

5. We have no difficulty whatever in connection with the supply of raw materials, but there is great delay in connection with fine wire drawing, owing to the immense demand for Government purposes.

6. With regard to the financial conditions, we can only express our extreme gratitude to the trade generally for the way they have met their liabilities in spite of the moratorium. Generally speaking, we think that there were not 5 per cent. of our customers who took advantage of the moratorium, and those that did were generally firms who would take advantage of any opportunity to evade payments. We think the manner in which payment has been made is highly creditable to the nation and to our trade generally.

7. We are starting making many new lines which, in the past, were considered to be practically the monopoly of Continental firms, and we are associating ourselves with other manufacturers in order to obtain these lines.

For instance, such lines as porcelain cleats, reels, and insulators generally, have been imported in immense quantities from the Continent. We are now arranging to have these made in England, and already supplies are starting to come in.

Enamelled iron shades, which in the past have been almost entirely imported from abroad, are now being made for us in this country, at prices that compare not unfavourably with those of foreign make.

Such articles as electric massage vibrators, portable heating and cold-air-blowing apparatus, are now being made by us, and we find to our surprise that they can be made at prices that are practically as favourable as those at which the foreigners supplied us in the past.

In conclusion, there is one observation that we should like to make, and that is, that we are doubtful whether the efforts made by us and other manufacturers to wrest some of the foreign trade may be ultimately successful, as we find that such is the patriotism (!) of some firms, that even now they are obtaining their supplies of wires from German houses, who, remarkable to relate, particularly in one instance of which we are aware, appear to have laid in such an abnormally large stock, that they seem to be able to supply indefinitely such lines as cotton and silk-covered instrument wires, enamelled wires, dynamo wires, &c.

THE BRITISH ELECTRIC TRANSFORMER CO., LTD.

Questions 1-6 are answered on the same general lines as the foregoing. The company is not at present starting any new lines of manufacture.

MESSRS. T. HARDING CHURTON & CO., LTD.

Answers to questions 1-6 are equally satisfactory, but it is not possible immediately to replace the specially skilled labour of a large number of employés who have joined the Colours.

The company has not yet undertaken the manufacture of any fresh lines formerly dealt with principally by foreign firms, but it has some under consideration.

THE WALSALL ELECTRICAL CO., LTD.

We have lost 28 of our men, 26 of whom have volunteered for active service, and the other two were Reservists, and due to this reduction our works are fully employed, the diminution in orders being only slight. We have during the last few days been endeavouring to increase our hands, but there is a dearth of labour in this district; as a matter of fact, the Walsall Labour Exchange on Monday only had two boys on their books.

With regard to the rate of orders coming in, this is quite satisfactory, and we have during the last few weeks received inquiries from Russia, Norway, Sweden and France which we have not previously had. We are not experiencing any difficulty with raw materials, as we have been able to overcome the difficulties we had during the month of August. With regard to financial conditions, we are experiencing practically no difficulty in this direction.

We have commenced to manufacture one or two lines which were hitherto manufactured on the Continent, and trust we shall be successful in retaining this trade when hostilities cease.

(To be continued.)

LEGAL.

OSRAM LAMP WORKS, LTD., *v.* CORONA LAMP WORKS, LTD.

APPLICATION was made on behalf of the defendants in this action by Mr. Frost, on Friday, October 16th, to Mr. Justice Sargant, in the Chancery Division, for a postponement of the trial until after the expiration of the war.

COUNSEL said the ground for the application was the difficulty of getting expert evidence from Germany, and the fact that some of the witnesses required at the trial were serving with the British forces.

MR. JUSTICE SARGANT remarked that he could not assume that the Germans were the only persons competent to give expert evidence.

MR. WALTER, K.C., for the plaintiffs, opposed the application, and reminded his Lordship that under an order of the Court experiments had been conducted in the presence of experts on both sides. The evidence of these experts was available.

MR. FROST submitted that there could be no hurry for the trial as the defendants had discontinued the manufacture of the lamp complained of about two years ago. The writ in the action was issued so long ago as December, 1912, and the plaintiffs had been in no hurry to bring the action to trial.

MR. WALTER said he would not oppose a reasonable adjournment, so that defendants could put their evidence properly before the Court, but he reminded his Lordship that by agreement the evidence was to be limited to the process as demonstrated before the experts. He would not oppose an adjournment for a month.

HIS LORDSHIP thought the defendants should have longer than that. He would direct that the case should not come into the list for hearing before six weeks, and if the defendants found it impossible to be ready by that time they could make a further application. The order would be without prejudice to any further application that might be made.

HERBERT MORRIS, LTD., *v.* SAXELBY.

Question of Service Agreement.

ON Thursday, October 15th, was concluded, before Mr. Justice Sargant, in the Chancery Division, the hearing of this action brought by Herbert Morris, Ltd., of the Empress Works, Loughborough, and elsewhere, to restrain an alleged breach of covenants contained in a service agreement of April, 1911.

The plaintiffs' complaint was that, though carrying on a general engineering business, they specialised in such things as overhead electric runs, and the fact that the defendant had left their employ and entered that of Messrs. Vaughan, a trade rival, was calculated to do them serious injury.

The defence was that as regards the covenant not to disclose anything that had come to his knowledge as a servant of the plaintiffs, the defendant had not disclosed, nor did he propose to disclose, any confidential information, and as regards the clause prohibiting him for a period of seven years from entering into the employment of any firm in the United Kingdom which traded in the goods specialised in by the plaintiffs, it was too wide and not necessary for the plaintiffs' protection.

The case was argued by Mr. Walter, K.C., and Mr. Kerly, K.C., for the plaintiffs, and Mr. Mark Romer, K.C., and Mr. Sheldon for the defendant.

In opening the case, Mr. Walter said that the plaintiffs were a firm established about the year 1880, who, besides carrying on a very large general business, made a speciality of pulley blocks, electric overhead runs, and overhead tramways and cranes. For the purpose of carrying out this part of their business they had standardised certain things, after numerous experiments and trials, with the result that they could go to the trade with an advantage over competitors. Secrecy as to measurements and the like was of great importance to them. The defendant entered their employ as a young man straight from school, and was taught draughtsmanship. By 1906 he had become chief departmental draughtsman, and in 1908 he was sent to Cardiff as resident engineer. In February, 1909, he was transferred to London, and in 1910 to the plaintiffs at Loughborough, where he was given charge of the selling department of the special branch of the business in question. In 1911 he was asked to and did enter into an agreement, the restrictive covenants of which it was alleged he had infringed. The agreement was for two years certain, but terminable by four weeks' notice on either side. Shortly before April, 1913, when the two years would expire, the defendant gave notice to determine the agreement, and he left the plaintiffs on April 19th, 1913. He then went to a French firm who had done business with the plaintiffs, but returned to England in February, 1914, and entered the service of Vaughan & Sons, who were active competitors with the plaintiffs in the supply of the very things the plaintiffs had made their speciality.

In answer to a question from his Lordship, MR. ROMER said the defendant was not now with Messrs. Vaughan.

MR. WALTER said that the plaintiffs were in 1911 almost without competitors in the pulley blocks and other things that they had made their speciality, and that formed about three-quarters of their business. The defendant had acquired much information as to details of size, width, strength and the like of the various parts used by the plaintiffs, which information would be very valuable to competitors.

MR. MORRIS gave evidence in support of the plaintiffs' case, which was summed up by MR. KERLY, who submitted that in such

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a case the prohibition was not too wide for the plaintiffs' protection.

Mr. Walter stated that they had not evidence of actual disclosure by the defendant.

Mr. Saxelby gave evidence for the defence, and said that before accepting an engagement with the French firm he tried to get employment with an English firm not dealing in the plaintiffs' specialities, but failed.

Mr. Arnold Goodwin, managing director of Arnold Goodwin and Sons, Ltd., spoke to having manufactured pulley blocks for the plaintiffs in the early nineties. There were, he said, a number of firms who manufactured them. There was no secret process of the patents in connection with their manufacture. They were quite common, though some firms might specialise in details. It was very unusual, and he thought very unfair, to have restrictive covenants in connection with this kind of business. His firm did not think it necessary for their protection.

Evidence was also given by Mr. Wharton, representative engineer of Vaughan & Sons, who said they started making pulley blocks as an invention of his. They were now competing with the plaintiffs in pulley blocks and overhead cranes.

In summing up the case for the defendants, Mr. Romer submitted that this was an attempt by the plaintiffs to obtain a monopoly of something for which they had no patent.

Mr. Walter was heard in reply, and at the conclusion of the arguments his Lordship reserved judgment.

Tramcar Accident Claim.

Judge Reginald Brown, at the Stockport County Court, recently heard an action in which Fred Johns, paint grinder, 2, Haddon Grove, Levenshulme, claimed £50 from the Stockport Corporation for injuries received, and loss of wages, alleged to be due to the negligence of a tram driver. The plaintiff's case was that as he was taking his seat on the top of a Corporation tramcar the car was suddenly pulled up, with the result that he was thrown to the floor and sustained injuries to his shoulder. It was alleged that the car driver was not driving in a proper and skilful way. The defence was that the car was travelling at a reasonable speed, and that the driver was compelled to use the electric brake to avoid a serious collision with a cart. Negligence was denied.

Judge Brown, holding that there was no evidence of negligence, gave judgment for the Corporation.

Workmen's Compensation.

At Oldham County Court on October 15th, sanction was given to an agreement under which Samuel Hincheliffe, electrical engineer, 19, Balfour Street, agreed to pay £150 to Ellen Foster, of 14, Silver Street, Oldham, in settlement of a claim for compensation in respect of the loss of her husband, who received fatal injuries recently whilst working for the respondent.

Armorduct Manufacturing Co., Ltd., *v.* H. Defries & Co.

[*German Companies trading in London.*]

In the City of London Court, on October 15th, before his Honour Judge Atherley-Jones, K.C., the Armorduct Manufacturing Co., Ltd., 6, Farringdon Avenue and Birmingham, sued H. Defries and Co., electrical engineers, 59, New Oxford Street, for £1 10s. 6d., for trade goods supplied. Defries did not dispute owing the money, but said he had paid £20 to the plaintiffs and he objected to pay the balance as the plaintiffs were a German company and alien enemies.

Mr. Liddle, plaintiffs' solicitor, said that the company was registered in London and the Courts had held that they could trade here.

Mr. H. F. Marchant, secretary of the plaintiff company, who said that he was a "Man of Kent," stated that the company was registered eight years ago. The authorised issue was £15,000, the ordinary shares being £5 each and the preference £1 each. Three English shareholders held 380 shares and the other 1,435 were held by Germans. The managing director was a naturalised German.

Judge Atherley-Jones said that the secretary seemed to have fallen amongst Germans. Upon perusing a list of shareholders he found they were practically all Germans.

Mr. Marchant added that the company employed nearly 200 workers in large works at Birmingham and they were all British.

Defendant: This company is what has been called "A Pipe Line of Gold to Germany."

Judge Atherley-Jones was sure no Englishman wanted to behave ruthlessly to German traders whatever might be done by others, and they should observe the ordinary requirements and conditions of international law. In that case if he found for the plaintiffs he would be offering the benefit of the English Courts for the purpose of ministering sustenance to the enemy. The doctrine of the alien enemy had never been expounded with absolute lucidity. While he would be shocked if a judicial person did not give protection to a German in this country against whom, say, a crime was committed if the safety and security of his person were affected, as the internal affairs of the company before him showed that the profits would go to Germany, he must dismiss the action with costs. Defendant had honestly discharged his obligations to his country in raising the question.

Mr. Liddle asked for leave to appeal, as 200 British workers would lose their employment if the company could not get in its debts.

Judge Atherley-Jones agreed.

Frank *v.* Hankow Light and Power Co., Ltd.

By this action, which was tried by Mr. Justice Joyce in the Chancery Division on Monday, October 19th, the Court was asked to decide whether the interest payable on the ordinary shares of the company was cumulative or uncumulative.

From the opening statement of Mr. Stone, who appeared for the plaintiff representing the deferred shareholders, it appeared that the company was formed in 1906, with a capital of £20,100, divided into 2,000 shares of £10 each and 2,000 deferred shares of 1s. each. From 1906 until 1913 the company carried on business with varying success, and no one seemed to have thought it worth while to raise the question at issue, but, with improvement in the company's affairs, the present action was started to enable the company to ascertain its exact position. By the prospectus it was stated that the ordinary shares were to bear a non-cumulative interest of 8 per cent., and that was confirmed by the memorandum and articles. Seven were originally issued to the seven signatories of the memorandum of association. Directors were appointed at a meeting held on January 12th, 1906, and the first meeting of these directors was held on February 2nd of that year. At a meeting on February 9th 333 of the ordinary shares were allotted, a further 235 on February 12th, 60 were allotted on February 19th, 16 on February 22nd, and 2 5 on March 1st. On February 12th the whole of the deferred shares were allotted to the vendors or their nominees. Finding that the applications for ordinary shares were not coming in as quickly as was desired, the directors at a meeting of February 9th resolved that the 8 per cent. interest payable on them should be cumulative instead of non-cumulative. A general meeting was called for February 16th, at which a resolution to the effect was pressed, and such resolution was duly confirmed at a general meeting of March 5th. Counsel, however, contended that the alteration was bad inasmuch that as the articles of association provided that the interest was non-cumulative, and persons had subscribed for shares on that footing, the company had no power to alter it.

Mr. Hughes, K.C., for the company, argued that inasmuch as there was power in the articles for the company to make alterations and also power to the directors to exercise all the powers vested in the company, the alteration was lawfully made at the meeting of directors of February 9th, but even if that were not so an effective resolution was passed at the general meeting of February 16th and confirmed at the meeting of March 5th.

His Lordship held that all the ordinary shares whether issued or not should bear cumulative interest.

OUR LEGAL QUERY COLUMN.

"A.B." writes:—"We have a number of overhead wires running from the works, joining the underground cables to the station. The overhead wires are about a quarter of a mile long and are run on private ground. The private ground is accessible from the highway, there being no fence or wall to keep people from getting on to same. I would be very glad to know how far the Board of Trade rules apply to such overhead wires.

"The overhead wires in question are slightly insulated with compounded braiding. The B.O.T. rules appear to deal with un-insulated conductors, thought it is not stated that this is the case. I take it that the fact of the conductors being insulated does not in any way alter the operation of the rules."

*** It is not quite clear from the statement of facts what is meant by the words "works" and "station" respectively; nor is it stated whether the private ground referred to belongs to the Corporation, who have power to supply electricity, or to private persons.

Assuming that the land over which the wires are suspended belongs to the Corporation, the right to suspend the wires appears to be conferred by the exception in S. 10 (b) of the schedule to the Electric Lighting Clauses Act, 1899. That sub-section provides that: "The undertakers shall not, without the express consent of the Board of Trade, and, where the local authority are not themselves the undertakers, of the local authority also, place any electric line above ground except within premises in the sole occupation or control of the undertakers, and except so much of any service line as is necessarily so placed for the purpose of supply." If the ground over which the wires run belongs to private persons it is clear that the consent of the Board of Trade must be obtained, and the regulations made by them must be complied with. It does not seem that the regulations (which are set out in Will on the Law of Electric Lighting, Traction and Power, 4th Edn., p. 385) make any distinction between covered and uncovered wires. They apply to wires of both kinds.

South Africa.—The office of H.M. Trade Commissioner for South Africa reports that an inquiry has been received there relating to the supply of machinery for making dry cells, and British manufacturers of such plant are requested to forward catalogues, addressed direct to H.M. Trade Commissioner for South Africa, P.O. Box 1,946, Cape Town.

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NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The Keystone Stoker.

A new type of mechanical stoker has been introduced by the Keystone Stoker Co., of 141, Milk Street, Boston, U.S.A. While it somewhat resembles a chain-grate stoker, it differs from the latter in that the grate is built up of disks mounted on bars, which rotate upon their axes as they carry the fuel along. The rotation of the disks has the advantage that clinker is broken up and prevented from sticking, so that the air spaces are kept free, and the disks are constantly presenting fresh surfaces to the fuel, while the heated parts are cooled by contact with the air on their undersides. The fuel bed being in a free state, a bigh draught pressure is not required, and the air-flow through the fuel is uniform, so that holes are not formed through which excess of air can enter.

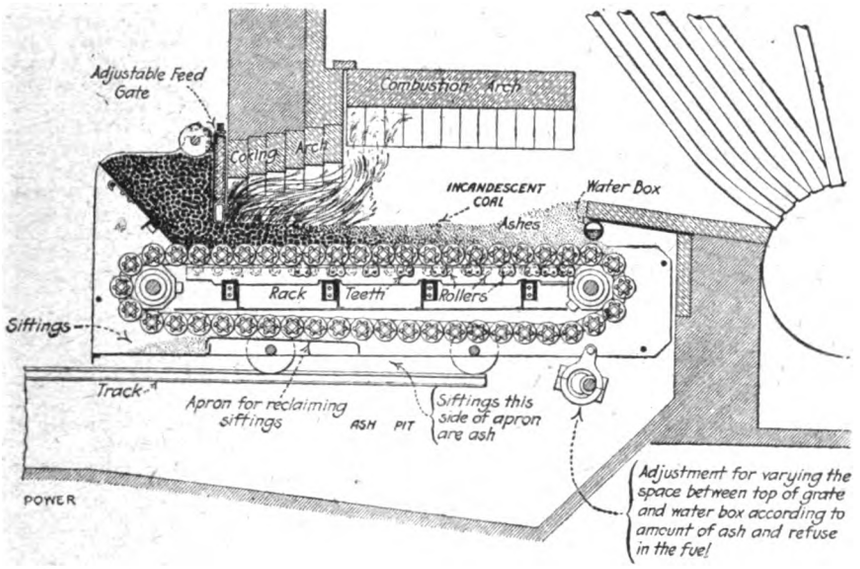

Fig. 1.—Section of Furnace with Keystone Stoker.

A new bar filled with disks can be inserted without stopping the stoker except momentarily. A water-box, not connected with the boiler, protects the bridge wall. A sheet-iron apron under the chain catches small fuel that slips through the crevices, and the chain pushes the siftings forward, depositing them on a plate; ash that falls through beyond this apron are kept separate. The stoker can be raised or lowered at the bridge wall to suit the rate of combustion required whilst in operation by the eccentric shown, and the speed of the grate and supply of fuel are also adjustable. The foregoing particulars are derived from *Power*.

Electric Control Gear for Machine Tools.

The Igranic Electric Co., Ltd., of 147, Queen Victoria Street, E.C., have developed a special range of self-acting controllers for electrically-driven machine tools, comprising simple self-acting starters of a special design for automatic stopping and starting only, self-starters arranged with pre-determined speed adjustment and self-starters with pre-determined speed adjustment and dynamic braking. One of the last mentioned is shown in fig. 2.

No sliding contacts are used, as the plunger of the operating solenoid is arranged to rotate a shaft carrying contact fingers

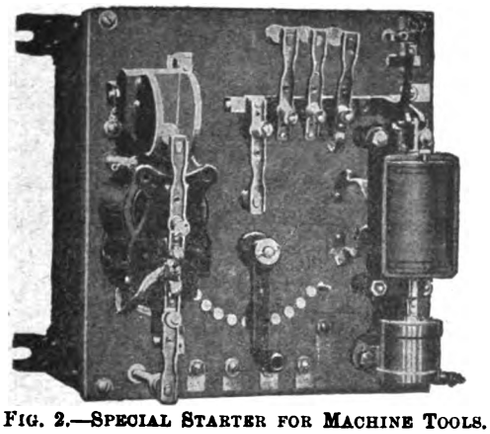

Fig. 2.—Special Starter for Machine Tools.

which have an angular displacement with respect to each other, and which causes the starting resistance to be cut out a step at a time.

The solenoid operated clapper switch which always makes and breaks the main circuit, has a magnetic blow-out, and is fitted with an auxiliary contact for operating the dynamic brake whenever the circuit is opened.

Speed is pre-determined by adjustment of the speed regulating lever at the bottom of the panel. This lever permits of from 5 to 100 per cent. speed variation by shunt field resistance. Similar controllers are made to combine shunt field and series regulating resistance.

The makers claim credit for simplicity in design, and the controllers, they say, are of specially robust construction and quite suitable for rough workshop usage.

The "Plexsim" Heat Projector.

Although the "Plexsim" projector, shown in fig. 3, does not create heat, Messrs. Simplex Conduits, Ltd., of 116, Charing Cross Road, W.C., who are introducing this speciality, claim that it certainly does use every watt put into it to the greatest advantage, and that its heat can be readily projected in a required direction. If the heat beams are directed along the floor, there is no system of electric heating so economical.

Fig. 3.—"Plexsim" Electric Heat Projector.

It will be noticed that the guard is open, so that it does not baffle the heat, and it is possible to dust the reflector without removing the guard. The element is supported at both ends, and cannot sag; the connector-box is strong and well ventilated. The "Plexsim" projector is claimed to be one of the most effective heaters at present on the market, and its price is quite competitive.

WAR ITEMS.

The Imperial Institute and Trade.—The number of inquiries received by the Imperial Institute from manufacturers, merchants, and others in Great Britain and the Colonies, relating principally to sources of supply of raw materials, methods of utilising new products from the Colonies and India, or to new or little known processes and machinery for industrial purposes, has now become so great that the Secretary of State for the Colonies has authorised the formation of a Technical Information Bureau at the Institute for dealing with them. The present is a specially opportune moment for the formation of such a Bureau, since the paralysis of German and Austrian trade and industry opens up opportunities for the development of many industries in this country and in the Colonies which have hitherto been monopolised by Germany. A very important question at the present moment is that of the supply of potash salts, which are essential in certain branches of glass and soap manufacture, and for the preparation of a large number of chemicals and manures. Germany has for many years had a practical monopoly of this industry, owing to her possession of the great potash mines of Stassfurt. The only country which has made any attempt to break this monopoly is the United States. The possible sources of supply of potash to England just now are few, and the Bureau is preparing a statement as to sources of potash, which will include some hitherto untouched for industrial purposes. An equally important matter is that of finding markets in this country for the immense quantities of raw materials from India and the Colonies formerly exported to Germany. Written inquiries for the Technical Information Bureau should be addressed to the Director, Imperial Institute.—*Morning Post*.

Faraday House Men with the Forces.—The number of the *Faraday House Journal* for the Michaelmas Term, which has just appeared, is of special interest by reason of the long list which it gives of past and present students who are serving in the Allied Forces. Photographs of a number of the men are given.

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U.S. Electrical Export Trade.—In view of recent references to the part that the States might or might not play in meeting the demand for electrical manufactures outside America, we may quote from the *Electrical Review and Western Electrician* the following interesting table, showing the state of U.S. electrical export trade for the month before the war. Our contemporary says that as compared with the relatively low total of the electrical shipments in June ($1,450,437), the total in July shows a further slight decrease. The falling off as compared with July of a year ago is very striking, however, all classes of electrical exports but two showing shrinkage. The Government report for July opens a new fiscal year, and at this time an additional class has been included in the detailed electrical figures, namely, meters and other measuring instruments. The number of articles shipped in the four classes for which numbers are reported were as follows in July: Fans, 1,851; arc lamps, 86; carbon lamps, 20,424; metal-filament lamps, 49,583.

Articles.	July, 1914.	July, 1913.
Batteries	$59,714	$44,084
Dynamos or generators	195,983	246,595
Fans	23,629	40,217
Insulated wire and cables	127,697	147,948
Interior wiring supplies, &c. (including fixtures)	45,077	68,695
Lamps—		
Arc	1,672	16,423
Carbon-filament	3,148	22,582
Metal-filament	13,581	80,847
Meters and other measuring instruments	31,685	—
Motors	161,798	501,783
Static transformers	72,448	207,314
Telegraph instruments (including wireless apparatus)	5,340	3 402
Telephones	59,347	77,969
All other	614,351	910,648
Total	$1,415,960	$2,318,509

Canadian General Electric Engineers for the Front.—The *Canadian Manufacturer* states that, on August 6th, Mr. Frederick Nicholls, president of the Canadian General Electric, sent a telegram to Sir R. L. Borden, Premier of Canada, stating that the directors of the company, after full consideration, and having regard to the present serious war situation, "have resolved to submit to your Government an offer to raise, equip and pay the salaries of a company of 25 skilled electrical and mechanical operatives who would be available for service in any part of the Dominion, and be under the control of the Minister of Militia as part of the Canadian forces. Probably their services could best be utilised in the erection, repair and maintenance of wireless telegraph stations, cable stations, bridges, transport vehicles, artillery, &c."

Mr. Borden immediately replied:—"The Government of Canada warmly appreciate patriotic offer of Canadian General Electric Co., and send their sincere thanks. Minister of Militia will communicate with you thereon."

The Corps of Electrical and Mechanical Engineers, under Capt. H. Ritchie, has been divided into three sections, as follows:—

For Quebec.—Messrs. W. J. Swanger, R. W. Nurse, George Monaghan, George Hillier, C. Pink, P. Foster, H. Galvin, of Peterboro, and Colin C. Rous, of Toronto.

For Halifax.—Messrs. H. S. McKean, J. C. Munro, Clarence Henry, E. S. Shill, R. Bethune, A. J. Palmer, of Peterboro, and F. G. Jackson, Edward Crockford, of Toronto.

For Esquimalt.—Messrs. H. Ritchie, Chas. Stewart, H. S. Elliott, W. S. Johnson, H. Williams, J. S. Dunlop, of Peterboro, and A. T. McLean, Harold Bastard, Alex. Hardie, of Toronto.

Engineering Works in Belgium.—We read in the *Machinery Market* that the Institution of Automobile Engineers has been informed by the English manager of the F.N. Co. that M. Galopin, who acted as host to the Institution in their summer meeting in Belgium, has written to say that the factory at Liége is perfectly intact, and that the clerical departments are back at work preparing for next year's programme. Another Liége factory—that of the Société John Cockerill—is still at work executing orders. The Derihon factory, also at Liége, has not been destroyed, but no work is being done. No definite news has been received in regard to the works of Messrs. Dyle & Bacalan, at Louvain, but it is believed that the factory is undamaged, though the offices have been destroyed and the hands dispersed. The Minerva Works at Antwerp were not injured by Zeppelins, though attempts were made upon them. The factory at the time of writing was at work, though some of its energies have been diverted from the manufacture of cars. Engineers will be particularly pleased to learn that Messrs. Greiner, père et fils, are all well, and that the factory of Messrs. Mabille & R. Pelgrims, at Mariemont, though it has been in the thick of the fighting, is undamaged, and is actually at work.

Board of Trade Assistance.—In connection with their trade war campaign the Board of Trade have received a very large number of inquiries for names of sellers or buyers of articles of which the sources of supply or markets have been interfered with by the war. Special arrangements have been made in the Commercial Intelligence Branch of the Board of Trade for dealing with the inquiries, and lists are being prepared and circulated of articles which inquirers desire (*a*) to purchase and (*b*) to sell. The first and second lists were recently published, and the third list, in which these are incorporated, is now ready and may be obtained on application to the branch. Firms interested in any of the goods mentioned, either as buyers or sellers, should communicate with the director of the Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, London, E.C.

Exports Prohibited.—By an Order in Council the export of graphite, suitable for the manufacture of crucibles, to certain countries, and of compasses, and signalling lamps operated by electricity, to all destinations, is prohibited.

Northampton Tramway Managership.—Matters at Northampton relative to the position of Mr. J. Gottschalk, the Corporation tramway manager, who is of German birth, and who did not obtain his naturalisation papers until after the outbreak of the war, have assumed the character of a deadlock. As we hinted last week, there is a probability of municipal elections being fought upon the question of whether he should be retained, as decided by the Council at a special meeting, or discharged. We understand that the Mayor-Elect, Councillor F. C. Parker, has intimated that he will have to reconsider his acceptance of office if elections take place. At the beginning of this week there appeared every likelihood that an agreement would be arrived at between the pro and anti-Gottschalk parties. Those who favour Mr. Gottschalk's retention made a suggestion to the other side that he be suspended during the war, with a payment of £200 a year. With this end in view representatives waited upon the anti-Gottschalk party at a meeting on Monday evening. After they had retired, however, the following resolution was carried, "That Mr. Gottschalk be unconditionally discharged, and that it be left to the Council as to what compensation they think fit to give him." There was a decided feeling at the meeting in favour of a compromise being arrived at. The resolution is to be sent to a meeting of the Tramways Committee, who may possibly suspend Mr. Gottschalk during the war, and thus cut the ground from beneath the feet of the agitators for his dismissal, who have six candidates ready to fight the elections. A retiring Councillor in favour of Mr. Gottschalk's retention said, at a meeting on Monday, that the "town has been practically turned topsy-turvy by the regrettable agitation." The matter is far from a party question, as Unionists, Liberals and Socialists are ranged on either side. One of Mr. Gottschalk's sons who was in the British Army has again volunteered for service.

Not Enemy Vacuum Cleaners.—Messrs. Duncan Watson and Co., of Berners Street, W., wish it to be clearly understood that no part or parts of their electric vacuum cleaners are made in, or imported from, Germany or Austria.

Electricity Works Insurance.—The Shoreditch B.C., on the recommendation of the Electricity Committee, has taken out a policy at Lloyds for the insurance against bombs, riots, or civil commotion, on Whiston Street power station for £30,000, and on Coronet Street power station and refuse destructor for £20,000, the rate being 5s. per cent.

Manchester Tramwaymen at the Front.—There has been a remarkable response from employés of the tramways department of the Manchester Corporation, and Mr. McElroy, the general manager, has prepared and issued a roll of honour. The list of men who have joined the Colours contains the names of 804 employés of the department, representing all grades of the service.

Practical Service.—The British Telephone Supply Co., of 4, Slaney Street, Birmingham, recently fitted up the Military Hospital at Edgbaston, Birmingham, with a private telephone system to the approximate value of £140, and undertook to maintain it so long as required, entirely free of charge; the company also installed a connection for the Belgian Refugee Committee to the value of £14, free of charge. This is a practical form of patriotic service which cannot be too highly commended, and we hope it will induce other branches of the electrical trades to assist where they can, for gifts of this nature are often more valuable than money.

Carbons for Melbourne.—According to a report appearing in the *Melbourne Age* for September 8th, it seems that at a meeting of the Melbourne City Council, endorsement was given to the action of the Electric Supply Committee concerning the tender of Mr. C. W. Webster for the supply of arc lamp carbons. "The Council's London agents, Messrs. M'Ilwraith, M'Eacharn & Co., had cabled to the effect that the contractor had stated that, owing to the enormous advances of raw material, he could only accept the contract at an advance of 10 per cent. on the tender price, £2,261, cash to be paid in full against bills of lading, and subject to a war risk of about £5 per cent. The cable stated that carbons would presently be treated as contraband. The Committee replied requesting the agents to make the best possible arrangements in connection with the contract."

Active Service Allowances.—The Leigh Corporation Finance Committee has passed a resolution to pay certain officials 10s. per week whilst on active service, and at a meeting of the T.C. last week it was moved that this should be referred back. It was stated that a decision had been come to that employés who enlisted should have their pay made up to their wages as received from the Corporation, and, it was argued, that there should be no differentiation between officials and ordinary workmen. There was no seconder, and the minute was passed. It was explained that the officials concerned had no dependents.

The Bradford City Council has decided to pay 10s. per week to the dependents of employés joining the military forces. The decision arose out of a proposition by the Tramways Committee in respect of its workers.

An Electrical Alien.—Of a number of aliens arrested last week at Crewe for internment, one was an Austrian employed by a local electrical firm.

Roll of Honour.—Ernest Hadfield, 30, of Stalybridge, who was a conductor on the Joint Board Tramways, has died in the Manners English Hospital at Mons.

W. Burns, a conductor in the Salford tramways department, has been killed at the front.

Private Richard Wareing, of the Loyal North Lancs. Regiment, who before joining the army was an assistant electrician at Rossall College, near Blackpool, has died from wounds received in action at Vendresse.

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News has been received of the death of Gunner James Bradburn (R.F.A.). Prior to being called up as a Reservist, he was employed as a driver by the Burnley Corporation tramways department.

At the last meeting of the Hackney B.C., the Electricity Committee reported that notification had been received from the Admiralty, that able seaman J. Singer, of H.M.S. *Hogue* (Naval Reservist), who, previously to being mobilised, was employed by the Council as an arc lamp trimmer, had not been reported in the list of survivors up to the present. The Committee recommends that £10 be paid to the widow as death allowance, together with £4 13s. 11d., the amount of the workmen's contributions to the Superannuation Fund.

Personal.—Mr. A. H. Bulton, of the staff of the Bromley (Kent) E.L. and Power Co., has joined the 5th Battalion Royal West Kent Regiment for active service.

Mr. John Bond, of the Royal Naval Division, formerly an employé at the works of the St. Helens Cable Co., has been under fire in the trenches at Antwerp.

BUSINESS NOTES.

Consular Notes.—JAPAN.—The report of Mr. E. F. Crowe, Commercial Attaché to H.M. Embassy in Japan, which has just been issued, not merely deals with last year's trade results, but also makes some interesting deductions therefrom relative to present prospects. Commenting on the increase of 22 per cent. shown in the value of machinery imports (these figures were published in our issue of October 2nd), he says that these returns are, to a certain extent, misleading, because, instead of representing activity in 1913, they should be taken as indications of the optimistic feeling which prevailed as to the future in 1911, inasmuch as a large portion of the machinery arriving last year was ordered 12 months or more previously. At present there is a comparative cessation of new works and of development of existing factories, so that the outlook for the next year or two is not very bright. Although Japan still imports machinery in such large quantities, it is interesting to note that there has been solid development on the part of Japanese machinery makers. In the case of gas plant for lighting and power it has been quite remarkable. They are making suction producers, gas engines, retort furnaces, and are building complete gas works. Practically all the appliances required by gas companies are now made in Japan, including meters, stoves, burners, lamps, glassware, and mantles. Rubber manufacturers have not appeared to benefit by the lower cost of material. The demand for rubber manufactures seems to be more than met by the mills already in existence, and competition in sales has been exceedingly keen. The net results have not been satisfactory in the mechanical branch of the industry, and the smaller concerns have, in several instances, suffered correspondingly. The electrical branch of the industry remains as hitherto the more important of the two branches, but it has shown no noteworthy development during the past year, and manufacturers generally complain that work has been slack owing to the paucity of Government orders. The principal mills in this branch appear to be devoting considerable attention to other methods of insulation, such as paper and lead covering. It is more particularly in this division of the manufacture of insulated wires that progress has been made.

Japan's production of copper increased from about 66,000 to 75,000 tons. Export figures show an advance from 38,868 to 42,345 tons, and the home consumption also grew considerably.

Adverting to the matter of Japan's imports of machinery, the United Kingdom remains well at the head of the list of suppliers, but her share in the trade has not advanced as much as that of Germany, the rates of increase being 19 and 33 per cent. respectively. Germany retained her commanding position in the supply of water turbines, and she was successful in obtaining important orders for some large cranes and two or three big gas engines. This accounts for the important advance shown by Germany, compared with 1912. Taking it all in all, there was no very remarkable change in the United Kingdom's position, or in the character of her trade with Japan, and it is an interesting fact that in spite of the obstacles in the shape of tariffs and bounties the total business done between the two countries goes on growing year by year, and is now more than three times as much as the annual average for the years 1893-95, when the first serious changes were made in the tariffs, and 12 per cent. larger than in 1911, when the second and latest revision took place.

ROUMANIA.—In our Consul-General's report on the trade of Roumania there is good evidence that that country is one to which British manufacturers may usefully direct their attention as soon as ever the European situation permits. Our chief competitors in the Roumanian market are Germany and Austria-Hungary. With these two countries the United Kingdom shares over 70 per cent. of the total import trade, but her own quota shows a slight but steady decrease. France maintains an almost steady position, but both Italy and Belgium are annually contributing a larger proportion of the total imports. Geographical position and cheaper freights will tell, particularly in the case of goods, such as textiles and machinery, which are of high value in relation to their bulk, and it is in these lines that the United Kingdom is losing ground. But the advantage of railway transport is less marked in the case of bulky goods, and here it is that British merchants are increasing their share of the trade. The United States, whose wares a few years ago were rarely seen in Roumania, is coming rapidly to the front. Germany has in the past supplied more than one-half of Roumania's requirements in machinery, Austria-Hungary taking second place, whilst the United Kingdom was over-reached by the United States, and took only the fourth position. Agricultural machinery (reapers) accounts for the United States' advance. Hydraulic machinery came mostly from the United Kingdom and Germany; steam engines almost entirely from Germany and Austria-Hungary; oil engines from Germany, the United Kingdom and Switzerland; portable engines and threshing machines from the United Kingdom, Germany and Austria-Hungary; printing, paper-making and textile machinery practically all from Germany; machine tools from Germany and Austria-Hungary; electrical machinery and apparatus from Germany, Austria-Hungary and France. Our Consul-General has little doubt that British interests have suffered greatly in the past from the lack of proper representation, and British merchants are strongly recommended to follow their rivals' example and send out capable and energetic travellers to study the conditions and needs of the market.

TURKEY.—According to the recently issued report by the British Consul at Constantinople, the total value of steam and oil engines and parts imported into Turkey in 1911-12 was £342,000, the British share was £159,000, an increase of 50 per cent. compared with the previous year. A line in which the Consul thinks the demand should increase is pumps. The total value imported was £28,000, the United Kingdom holding the first place with £7,500. Other items of electrical interest are:—Copper sheets and plates, £269,000 (United Kingdom, £153,000); electrical material, £140,000 (United Kingdom, £20,000).

RUSSIA.—In his report on the foreign commerce of Russia, Mr. Consul Woodhouse notes that amongst the goods in which increasing imports were shown in 1913 were dynamo-electrical machines and electric motors, parts of machinery and apparatus, scientific instruments, motor-cars, manufactures of copper, machinery of cast-iron, iron and steel, and, amongst raw and half-manufactured materials, india-rubber, gutta-percha, iron and lead. The imports of raw and half-manufactured materials in 1913 exceeded the average for the quinquennial period of 1908-12 by 26·6 per cent., and manufactured articles by no less than 47·7 per cent. As regards Great Britain's participation in Russian trade, imports from the United Kingdom into Russia in 1913 proved to be in excess of those in 1912 by 22·3 per cent. Compared with the total import trade of Russia the share falling to the United Kingdom was 31·9 per cent. as against 13·5 per cent. in 1912, whilst Germany's share amounted to 52·7 per cent. as against 50·1 per cent. in 1912.

Bankruptcy Proceedings.—Charles Blake (Bilston Electrical Co.), Bilston.—Trustee (S. W. Page, 30, Lichfield Street, Wolverhampton) released October 5th, 1914.

Herbert James Godfrey, electrical engineer, 23, Lucien Road, Tooting, London; 188, Balham High Road, London.—This debtor attended at the Court House, Wandsworth, on October 15th, for his adjourned public examination on accounts showing liabilities £581, and assets £166. The Official Receiver had no further questions to ask the debtor, and after the latter had read the shorthand notes of his previous examination, and answered the formal questions of the Registrar, he was allowed to pass.

Book Notices.—"The Electron Theory of Matter." By O. W. Richardson. London: Cambridge University Press. Price 18s. net.

"Polyphase Currents." By A. Still. London: Whittaker and Co. Price 6s. net

"Electric Light Fitting." By S. C. Batstone. London: Whittaker & Co. Price 5s. net.

"Board of Education Regulations and Syllabuses for Examinations in Science and Technology, 1915." London: Eyre and Spottiswoode. Price 3d.

"A School Electricity." By C. J. L. Wagstaff. Cambridge: *University Press*. 5s. net.

"Principles of Electrical Measurements." By A. W. Smith. London: Hill Publishing Co., Ltd. 8s. 4d. net.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIII. October. New York: The Society. Price $1.

Catalogues and Lists.—Messrs. Townshend's Art Metal Co, Ltd., Ernest Street, Holloway Head, Birmingham.—Two illustrated folders giving brief particulars and prices of "Calor" electric cooking and heating appliances, and "Calor" red hot electric fires. Both folders are so prepared that traders can have their own names printed on them.

Messrs. Musgrave & Co., Ltd., St. Ann's Ironworks, Belfast.—Illustrated postal card showing their induced draught fan and engine, and tabulating the percentages of heat losses in flue gases.

The Anglo-Colonial Engineering Co., Ltd., 13, City Road, London, E.C.—Sixty-eight-page illustrated catalogue, giving information and tabulated data and prices respecting D.C. and A.C. dynamos and motors, transformers, forge blowers, drills, starters, &c.

The Brompton and Kensington Accessories Co., Ltd., 254-260, Earl's Court Road, London, S.W.—54-page catalogue containing large illustrations of the company's various "Universal" electrical home needs. A description of the "Universal" heating unit and the connecting plug and terminals, which are common to all Universal heating appliances, is given. The "needs," which are priced, and of which the weights and current consumptions are tabulated, comprise coffee percolators and urns, tea pots, samovars, chafing dishes, egg cookers, kettles, portable water heaters, toasters, grills, disk stoves, heating pads, portable luminous radiators, irons, &c. We understand that the sale of these Universal appliances is increasing very rapidly.

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International Time Recording Co., Ltd, 30 32, Farringdon Road, London, E.C.—"In the Balance" is the title of a 24-page illustrated catalogue of the Dey, Bundy, International and Rochester card systems of automatic time-keeping and job-costing.

Messrs. Donovan & Co., 47, Cornwall Street, Birmingham.—Illustrated leaflets giving particulars and prices of insulated lamp-holders and hand-lamps, Barwick starting switches, and "Safuse" distribution boards.

The British Thomson-Houston Co., Ltd., of 77, Upper Thames Street, London, E.C., have prepared a "Mazda" poster stamp, the feature of which is their excellent Union Jack poster design. Contractors and others can have quantities of these stamps for use in their efforts to sell British-made lamps.

The Jackson Electric Stove Co, Ltd., 38, Blandford Street, London, W.—Postcards giving particulars (illustrated) and prices of electric cookers and electric fires.

Sceando Lamp Co., 7, Blackfriars Street, Manchester.—Circular giving prices of "Sceando" drawn wire metal lamps.

British Thomson-Houston Co., Ltd., Rugby.—Price list No. 7,510 A (8 pages) gives illustrated descriptions, with tabulated weights, dimensions, prices, &c., of B.T.H. radiant-electric fires, convectors for A.C. or D.C. circuits, vertical rectangular convectors (non-luminous and semi-luminous); vertical and horizontal cylindrical convectors; and state, study and tramcar-type convectors.

The Magneto Position. — The question of British magnetos for British motor cars continues to attract attention in motoring and motor trade circles. Our contemporary, the *Automobile Engineer*, reports that it has lately been making careful inquiry into the position of affairs in England with regard to the magneto market, "and it is obvious that all the British makers of such machines, taken together, are quite unable to cope with the demand which may be expected immediately upon the exhaustion of the Bosch stock in this country. Great preparations are being made for British manufacture upon a large scale, and there should be no lack of home-produced magnetos in from 12 to 18 months from the present date. At the moment, however, there is a real shortage in supply, and when the touring car demand returns to normal the position may become very difficult. . . . We appeal to manufacturers to give the English magneto a trial."

For Sale.—The Postmaster-General invites tenders for the purchase of certain electrical power plant, now at Head P.O., Glasgow. Swansea Electricity Department has for disposal a Lancashire boiler. Particulars are given in our advertisement pages.

Trade Announcements.—Mr. Duncan Watson has purchased, as a going concern, the old-established West-End electrical contracting business of E. D. Berry, Harrison & Co., of Whitcomb Street, W., including the goodwill, patents, lease, plant and stock-in-trade. Mr. Watson will carry on the business under its old title at 62, Berners Street, W.

Theft.—Robert Richmond, driller, of Lorne Grove, Urmston, charged at Manchester recently with stealing scrap brass and copper and some fitters' tools of the value of £3 4s. 2d., the property of his employers, Messrs. Glover, Ltd., Trafford Park, was sentenced to two months' imprisonment, with hard labour.

Liquidations.—The Pump and Power Co., Ltd.—Particulars of claims must be sent by December 13th to the liquidator, Mr. L. R. Sankey, 5, Coleman Street, E.C.

Wright's Electrical Sales Co., Ltd.—A meeting of creditors will be held on November 20th at West Bar Chambers, Boar Lane, Leeds, to hear an account of the winding up from the liquidator, Mr. A. France.

Plant Required on Loan.—The Dartford U.D.C. wants a 200 to 300-kw. high-speed steam generator set on loan. Particulars appear in our "Official Notices" to-day.

LIGHTING and POWER NOTES.

Aberdeen.—Power Supply.—The Corporation Electricity Committee has agreed to give an extra supply of electricity to Grandholm works at the terms arranged last year. The Donside paper works are also to receive a supply.

Acton.—Annual Report.—The statement of accounts of the Electricity undertaking for the year ended December 31st last shows a profit of £1,314, or 1¼ per cent. upon the capital expended, but until the undertaking can show a profit of 6½ per cent. the Council does not benefit. Last year there was a decrease of ½d. per unit, sold without any corresponding decrease in generation costs.

Australia.—The Leederville Council, W.A., has decided to install a generating plant unless better terms for current can be obtained from the Perth City Council than those already submitted.

North Shore Electricity Scheme.—The Sydney Municipal Council has requested Prof. Gibson, of the Brisbane University, to design two steel towers to carry 33,000-volt transmission lines over the Parramatta River at Five Dock in connection with the supply of energy to the North Shore municipalities.

The Melbourne (Vic.) City Council has agreed to supply the Williamstown Council with electrical energy in bulk at £5 per kw. of maximum demand plus ·65d. per unit. The Melbourne Council will lay a cable at a cost of £1,100 across Fishermen's Bend, and steps will at once be taken to install electricity within the municipality.—*Tenders.*

The Warrnambool (Vic.) Shire Council is having a canvass of the town made with the view of ascertaining the probable consumption of electricity in the event of the Council installing a service.

The Northcote (Vic.) Council has decided to borrow £9,300 for the purpose of extending the electric lighting scheme, &c.

Bradford.—Annual Report.—Additional particulars, just issued, relating to the working of the Corporation electricity undertaking, show that of the 28 million units sold in the year 1913-14, roughly 7½ million were for bulk supply, 5 million for general power and heating, and 11¼ million for traction purposes. The greatest progress was made in bulk supplies, which took, roughly, 2 million units extra, some 445 motors of 6,400 H.P. coming under this heading. The general supply included 2,193 motors of 10,000 H.P. The generating plant installed remained practically stationary at 16,800 kw., and the maximum load at 11,522 kw., represented an increase of about 1,100 kw. Some interesting data regarding the progress of the domestic tariff in the town are given, showing that in 1914 56·5 per cent. of the lighting consumers (633 against 487 on ordinary rates) used the domestic tariff, as against 52·6 in 1913, while the average units used per D.T. consumer increased from 933 to 970. As has previously been mentioned in our columns, a Westinghouse 5,000-kw. turbine set is being obtained in place of the Bergmann set originally ordered: 27 H.T. transformer chambers are now in use, with 42 transformers of from 15 to 312 k v.a. capacity, making a total of 5,914 k.v.a.; and the E.H.T. feeders now reach 53 miles in length. The publicity department and showroom are reported to be increasingly successful, many of the contractors drawing on the latter for stock. A complete electric cooking outfit for 500 persons is being installed at the Central Baths, and it is hoped that the city restaurants will be encouraged to try electric cooking in the future. The half-watt lamp has been substituted for the arc lamp in a number of public lamps.

Brentwood.—E.L. Scheme.—The U.D.C. has appointed two members to represent the Council at a conference to consider an electric supply scheme for the town.

Bromley (Kent).—The E.L. and Power Co. has reduced the price of energy for heating, cooking, and power to 1½d. per unit.

Clun.—E.L. Scheme.—The inauguration of the electric supply took place on October 10th, at the power house, when the chairman of the P.C. switched on the street lighting.

Croydon.—Greater London Supply.—The delegates to the recent L.C.C. conference on the electricity supply of Greater London have reported to the B.C. After Ald. Miller had moved the report, and pointed out that the borough was seriously affected by the scheme, several other speakers criticised the proposals adversely, and an amendment that the report be not received (moved with a view to giving the Council as a whole an opportunity to express its views) was carried by a large majority.

Easebourne (Sussex).—The P.C. has passed a resolution in favour of the use of overhead lines for the supply of electricity to the parish. This will be forwarded to the R.D.C.

Ealing.—The T.C. has decided to give current free for one year, to the value of £40, to a Belgian Refugees' Home established in the borough.

Edinburgh.—Public Lighting Charges.—The Electric Lighting Committee has made a readjustment in the charges for lighting the public lamps in the city. In lieu of the present charge of £7 10s. per lamp, a new rate is to be substituted, £9 16s. 8d. per lamp for those in use all night, and £5 3s. 8d. for those lit only a portion of the night. This means a saving of some £700 per annum.

Flint.—Prov. Order.—By seven votes to six, the T.C. has referred back to a Committee the recommendation to apply to the B. of T. for a prov. order for E.L. The scheme proposed includes overhead mains as a main principle, and the capital outlay is estimated at £6,000. The object of those supporting reference back is to obtain further advice on the whole matter.

Hastings.—Mains Extension.—The L.G.B. has suggested to the T.C., which applied for a loan of £1,185 for the laying of cables on the Brisco Estate, that the expenditure should be met out of the amount in hand for cables. The T.C. has adopted the suggestion, although it was not desired to deplete the previous loan of £5,000 to such a large extent.

Heywood.—Bulk Supply.—The T.C. has accepted the terms of the Bury Corporation for a supply of electricity in bulk. It has also adopted an overhead transmission scheme for this supply.

Application for permission to borrow an additional £710 for the electricity works is to be made.

The Health Committee has acceded to an application for the use of land at Heap Bridge for a sub-station.

(*Continued on page* 563.)

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ELECTRICITY SUPPLY IN BASINGSTOKE.

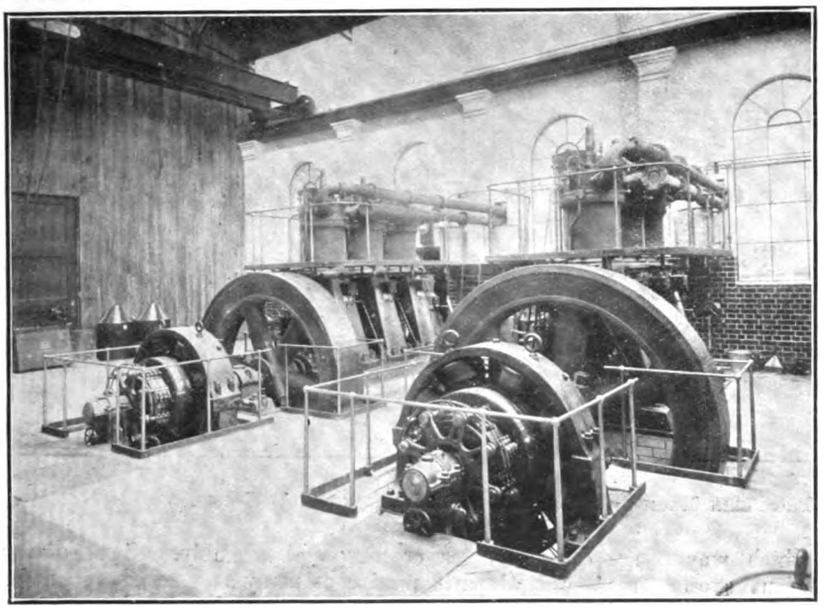
On Thursday afternoon, last week, the old town of Basingstoke was the scene of an interesting little ceremony, when the Corporation's new generating station was opened by the chairman of the Electricity Committee, Councillor Tigwell, and the machinery was officially started by the Mayor, Mr. Cannon.

It was in 1912 that the Town Council finally decided that the borough, which has a population of, roughly, 12,000 inhabitants, would benefit by the introduction of electricity for both lighting and power purposes, for although essentially an agricultural community, the town is an important railway centre, and contains well-known engineering and clothing factories.

The new generating plant, which was jointly designed by the borough surveyor and Mr. J. B. Morgan, resident engineer to the Horsham Council's electrical undertaking, has cost, roughly, £13,000; Mr. George Broadhurst, of Worthing, was appointed in March last to supervise the carrying out of the contracts, and subsequently as electrical engineer to the undertaking.

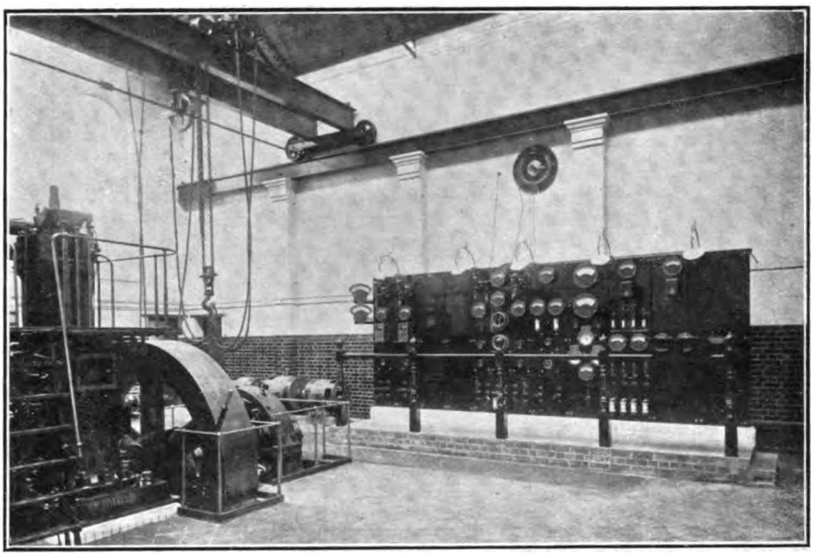
The new station is a brick building, containing a light and airy engine room, with a battery room adjoining and offices, test room, workshop, &c., facing on to Brook Street.

One of the Battery Rooms, Basingstoke.



Diesel Generating Plant, Basingstoke.

In the engine room are installed two 150-H.P. Morley-Güldner Diesel engines, constructed by Messrs. Cole, Marchent & Morley, who have taken over the construction of the Güldner engine in this country—Dr. Güldner being at one time chief engineer and constructor for the Diesel firm.



The Main Switchboard, Basingstoke Electricity Works.

The engines are three-cylinder machines, with an independent two-stage intercooled compressor attached at one end. The cylinders are supported on standards, and each is complete with its own fuel pump.

The cam shaft is carried on the standards, not on the cylinders, and the valves on the heads of the latter are operated by vertical tappet rods.

Each engine is provided with a blast and two starting (compressed air) bottles, the starting bottles being of extra large size, sufficient for starting three times; also with a fuel-feed tank and paraffin tank for starting purposes.

A 200-gallon fuel storage tank in the engine room supplies the engine tanks by gravity, and is itself coupled through a 1½-in. pipe line (fitted with a hand pump) to an outside storage tank with a capacity of 22 tons of oil.

The cooling water for the cylinder jackets, on account of its hardness, is first passed through a Boby water softener and subsequently circulated between the jackets and a Henan & Froude cooler of the helical type, which is operated by a 5-H.P. Phœnix motor. Each engine is direct coupled to a 100-KW. Phœnix dynamo wound for 460-500 volts, the engine speed being 210 R.P.M. The generators are of the interpole type and shunt wound. On test these engines have shown a fuel consumption of ·64 lb. per KW.-hour on full load, ·69 lb. and ·70 lb. respectively on three-quarter and half loads.

This plant operates in conjunction with a 300 ampere-hour Hart battery, the two halves of which are installed on separate floors, and the boxes made large enough for a prospective increase in battery capacity to 500 ampere-hours. A balancer to deal with 100 amperes out-of-balance current and a 42-H.P. motor-driven booster for battery charging—both supplied by the Phœnix Dynamo Co.—are installed in the engine room, the whole plant being controlled from a ten panel main switchboard supplied by Messrs. Cox-Walkers, Ltd.

The board contains the necessary panels for the generators, battery, and balancer, also a middle wire and two feeder panels, together with certain spares; the regulating switches for the battery are mounted on the wall behind the board, at a suitable level for the respective battery connections. The switch spindles are coupled by chain and sprocket wheels and operated from the battery panel.

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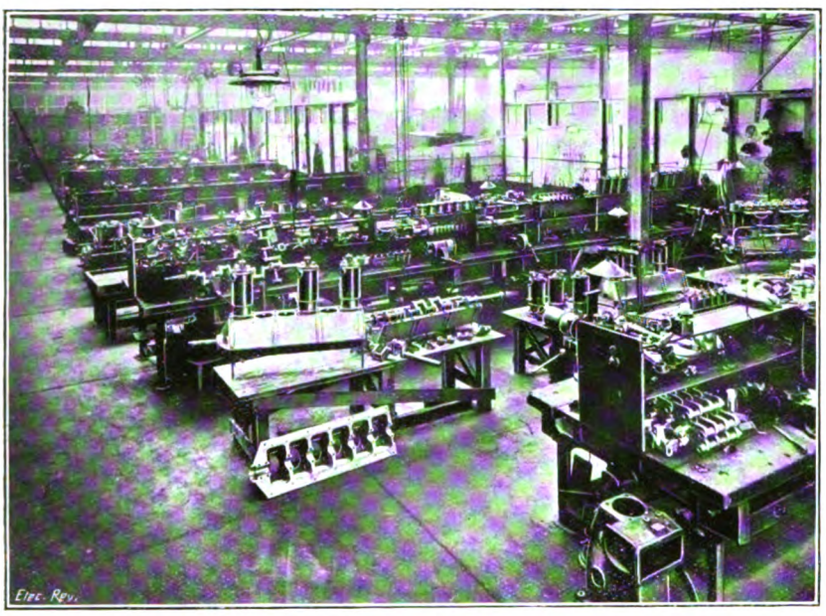
The engine room, which is spanned by a 6-ton Morris hand-travelling crane, contains space for an additional generating set, and a temporary end is provided in view of future extensions.



The General Erecting Shop, Aster Works.

The supply system is the usual three-wire one with 460 volts across the outers, and the initial feeder and distribution system has been carried out by Messrs. Johnson & Phillips.

Two lead-covered triple feeders have been laid to distribution pillars, from which three-core distributors are run to supply the area.

Some 70 street lamps have been converted to metal-filament lighting, and these are supplied through separate cables and controlled at the main switchboard.

The Basingstoke undertaking starts with excellent prospects; a number of consumers have been connected, and one large consumer—the South-Western Railway Co.—has entered into an agreement with the Corporation for the supply of from 50,000 to 80,000 units per annum at the flat rate of 2d. per unit, for station lighting and working the lifts and signal air compressors. In addition, the engineering, clothing, leather and other industries in the town offer considerable scope for the development of a day load.

We understand from Mr. Broadhurst, the borough electrical engineer, who kindly placed himself at our disposal during a recent visit, that active steps are being taken by means of demonstrations, &c., to popularise the use of electricity for lighting and other purposes in the town, which may congratulate itself on having made an auspicious start in the provision of what is practically a necessity of modern life.

THE ASTER ENGINE WORKS.

Through the courtesy of the Aster Engineering Co., Ltd., we were recently enabled to pay a brief visit to the company's works at Wembley, to view the well-known Aster engine in its various constructional stages.

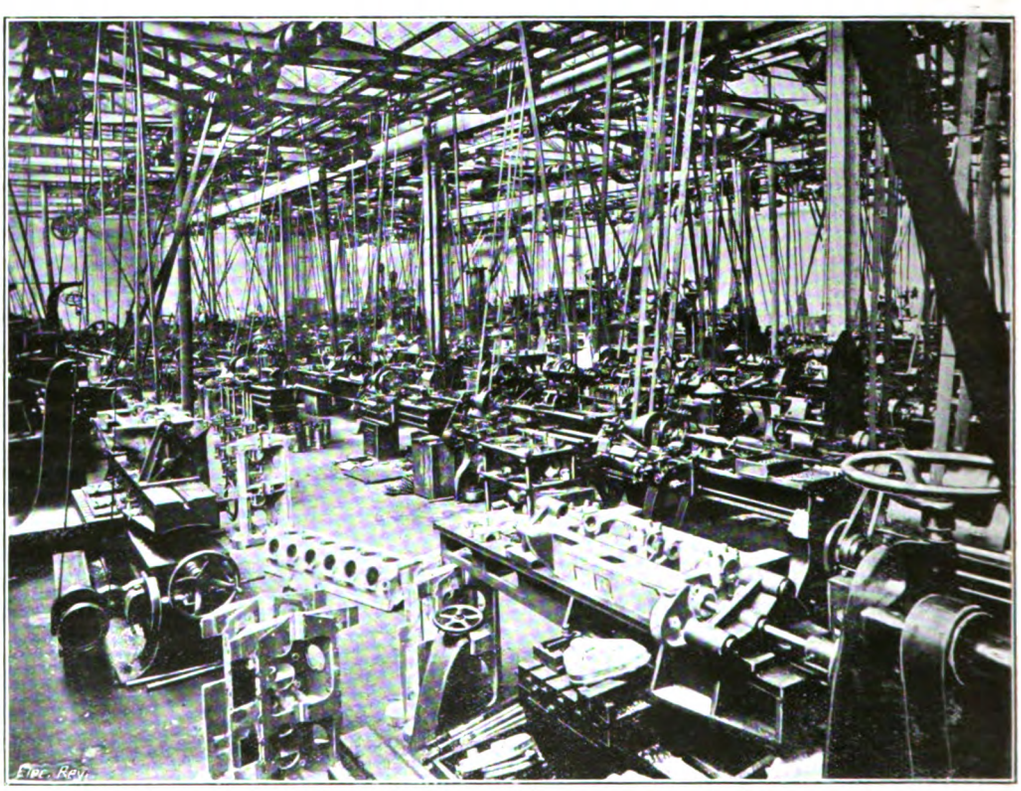
The company specialises in engines for automobile work, aeroplanes, and industrial uses, such as electric lighting, pumping, and marine propulsion, which are designed to run on petrol, paraffin, or heavy oil fuel.

So far as electrical readers are concerned, it may be of interest to record that, on the average, one complete Aster generating set is turned out per day, in addition to the engine units which are supplied direct to dynamo builders.

It is, of course, well known that only by the perfection of the constructional methods employed in the shop, could the modern automobile engine have been brought to its present highly efficient state, and although the petrol and paraffin engine for stationary industrial use, has, by comparison, an easy life, it has without doubt benefited greatly from experience gained in other more strenuous directions.

Some of the interesting features of the shop methods employed at the Aster works may be briefly referred to. One of the most important is the careful supervision given to the work in progress.

All raw materials—castings, forgings, &c.—are carefully tested in the inspection department before being passed to the rough stores; these supply the materials for the machine shops, but after each important operation there the part is returned for inspection before it is finally approved and passed to the finished stores, which



The Main Machine Shop, Aster Engineering Co.'s Works.

are drawn on for erecting and assembly. Some of the more critical parts receive as many as nine inspections in this way.

The machine-shop equipment is quite modern and

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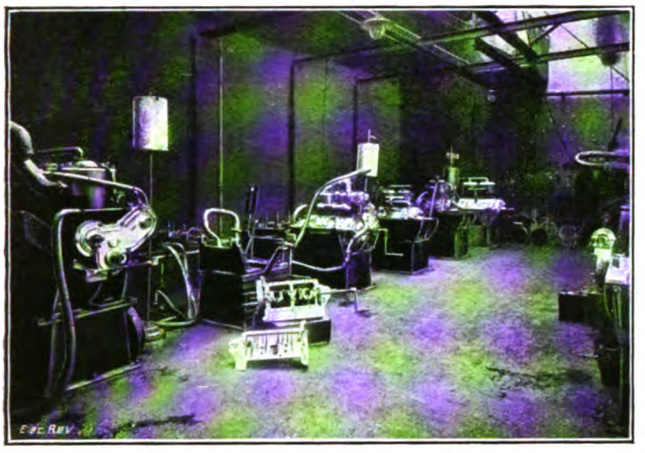
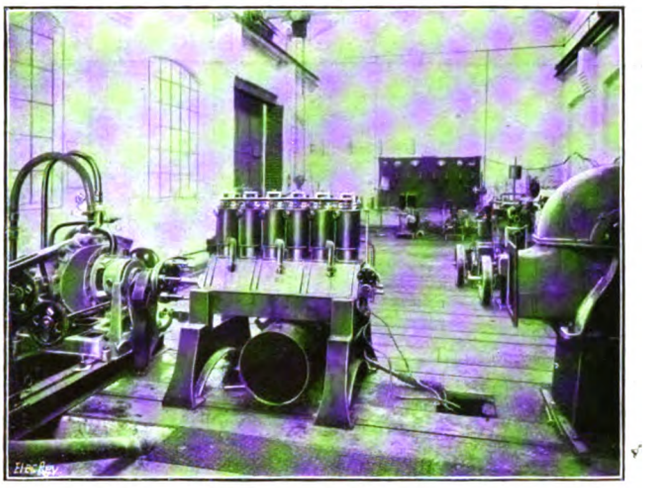
specialised, including a number of labour saving tools by well-known makers, which enables the firm to carry out the operations associated with this department in the minimum of time. The practice adopted in these works conforms with that which experience has proved to be suitable, the only just been completed, and is equipped with Heenan and Froude water dynamometers and the necessary switchboards for testing complete generating sets.





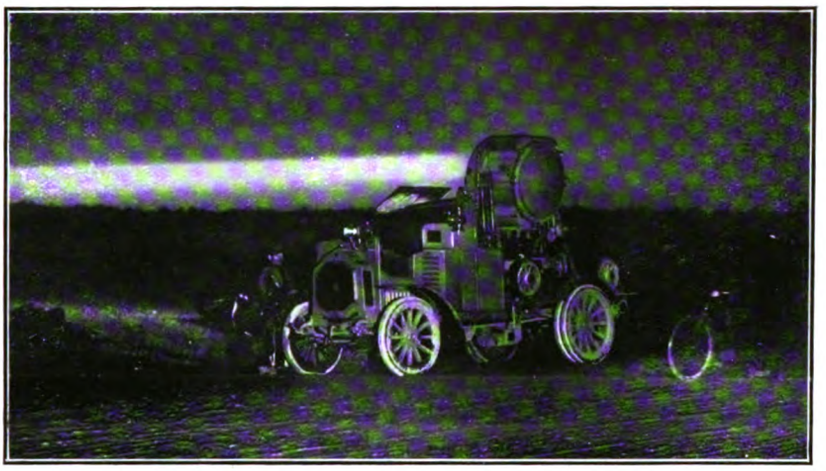
The Old and New Test Shops, Aster Engineering Co.'s Works.

methods in vogue ensuring the greatest accuracy and reliability in the finished product.

As our readers are aware, the Aster engine has achieved a considerable reputation for itself, and it is, no doubt, due in large measure to the care bestowed on its manufacture in the works that it has given such satisfaction to its numerous users.

We illustrate on the previous page the main machine and erecting shops, while on this page will be found views of the old and new test-shops.

The block of buildings also includes an engine house with two gas engines working in conjunction with a producer plant for driving the shops; a smiths' shop in which are also installed muffle furnaces for case-hardening purposes; and the test rooms, one of which has

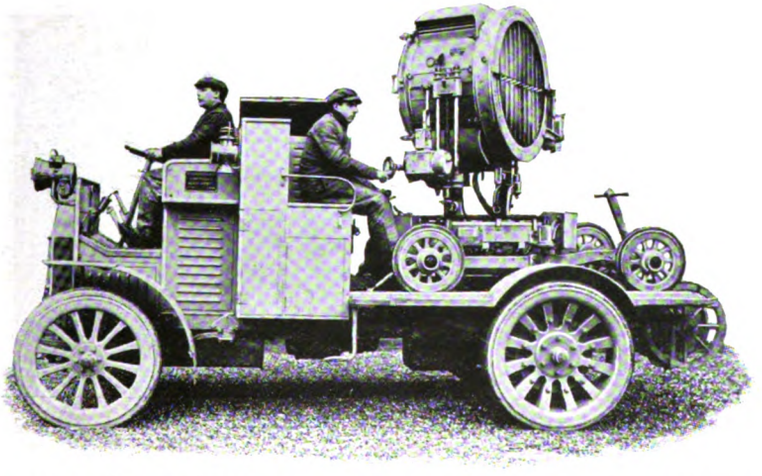


French Military Searchlight in Operation (see page 562).

The erecting and repair shops form a separate block of buildings, and a special or "industrial" shop is set apart for electric and marine sets.

The Aster Co.'s engine products cover a wide range of sizes and types; the smallest single cylinder petrol engine standards are the 3, 5 and 7-H.P. models, with multiple cylinders the outputs range up to the 150-H.P. eight-cylinder model, the largest made by the firm. The engines can be adapted for the use of either petrol or paraffin. Semi-Diesel hot-bulb crude-oil engines for both stationary and marine purposes, in sizes between 7 and 60 H.P., are built, and amongst special work one may mention that they make the celebrated Green aeroplane engine, and portable generating sets for the Post Office, War Office and Admiralty.

In conclusion, our thanks are due to the Aster Engineering Co. for the facilities placed at our disposal on the occasion of our visit to the works.



De-Dion Bouton—Breguet Automobile Searchlight in Marching Order, as used by the French Military Authorities (see page 562).

Science to Aid Industry.—The Council of the Sheffield University has approved the formation of a University Scientific Advisory Committee, in the hope of being able to render service to local manufacturers. It is suggested that the resources of the University shall be available for the purpose, either by directing manufacturers to technical literature bearing upon the difficulties presented by new problems, or by putting manufacturers into communication with suitable expert opinion, on the understanding that no work shall be done by the Committee which could readily be dealt with by local professional experts.—*Sheffield Independent.*

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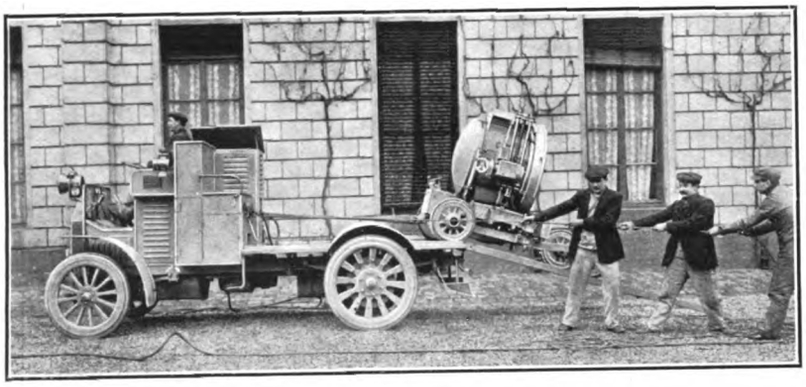
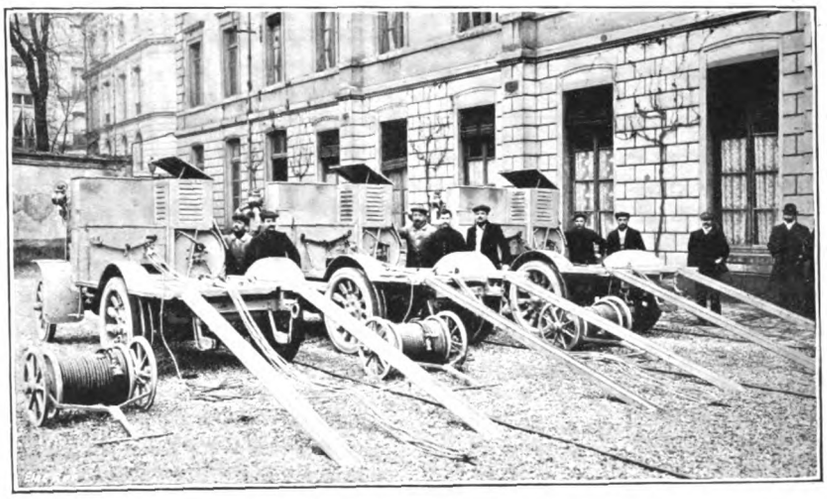
AUTOMOBILE SEARCHLIGHTS FOR THE FRENCH ARMY.

When the complete history of the European war at present in progress comes to be written, one of the outstanding features will be the important part played in it by motor vehicles. Not only are they being employed for the rapid conveyance of soldiers, for the transport of supplies of all kinds, for gun haulage and ambulance work, but they are also being used in many other directions, among those of interest to the electrical engineer being that of automobile searchlight plants. The accompanying illustrations depict a portion of the fleet of 50 such vehicles, which is being used by the French military authorities in the course of their operations against the Germans. The searchlights, which are of the Breguet pattern, are mounted on light, independent, four-wheel trucks, so arranged that they can either be used directly on the wagons on which they are transported, or they can be dismounted from the latter and located at any desired point within a range of about 100 yards of the wagon, which is provided with sloping channels or ramps and blocks and tackle for the purpose. The necessary current for the searchlights is provided by a dynamo located on the wagon at the rear of the driver's seat, and driven off the main engine. When the projectors are used independently of their means of transport, the necessary current is conducted by a cable carried on a reel, which forms part of the equipment. The projectors are mounted on turntables, so that they can be instantly swung round to any desired position; they are also adjustable as to the angle at which the powerful beam of light is projected.



Lowering Searchlight from Motor Transport.

Another interesting machine, of which the French army has a fleet of about 20, is a motor vehicle equipped with wireless telegraph receiving and dispatching apparatus. This can be quickly erected and brought into operation, and has the great advantage that, apart from direct attack, it cannot possibly be interfered with in its function of maintaining communication between widely separated points except, to some extent, by similar apparatus in the hands of the enemy. To the insidious devices of spies and the onslaughts of cavalry patrols its ethereal medium of communication is immune; there is no line to be laid down, no natural obstacle to be overcome—like the beam of the searchlight, the wireless ray instantly flashes through space to the limit of its range. It would be easy to trace other analogies between these two aids to military operations, which, apart from the ordinary telegraphs, appear to be the only types of electrical apparatus which are employed to any important extent in modern warfare. For example, both can be used for signalling, to the eye and ear respectively, and both are deficient in the important quality of secrecy; and both are dependent upon the ether for their operation.



Motor Transports with Searchlights Dismounted, showing Cable Reels, &c.

Dismounted Searchlights Coupled to Generators on Transports.

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LIGHTING and POWER NOTES.

(*Continued from page* 558.)

Great Yarmouth.—Overhead Wires.—The T.C. has applied to the Port and Haven Commission for permission to carry overhead electric cables across the River Yare, in order to supply additional current to Gorleston. The matter is being dealt with by a Committee.

Hindley.—E.L. Scheme.—It was expected that the U.D.C. would be in a position to supply electricity for lighting, heating and power purposes this week.

Hurst.—Proposed E.L.—The electrical engineer at Ashton having written to the D.C. asking whether it would be disposed to consider the question of a public supply of electricity by Ashton, the Clerk to the D.C. has been instructed to inquire into the matter.

Keighley. — Works Extensions. — The T.C. has adopted the recommendation of the Electricity Committee for the purchase of a 25-ton overhead travelling crane, at a cost of £400, and the extension of the engine room at the electricity works at an estimated cost of £1,000.

London.—L.C.C. Electric Supply Scheme.—A number of conferences have already been held at the instance of the L.C.C. in regard to the Greater London electricity scheme. At one held last week various speakers expressed their antagonism to the proposals, and concluded that any such scheme if permitted to be established would be used against the lesser authorities at a future date by the L.C.C., which, it was pointed out, wanted to extend its boundaries; only one representative spoke in support of the proposals. No resolution was put to the meeting, but it was manifest from the discussion that any Bill promoted by the L.C.C. to carry into effect its scheme will meet with strenuous opposition.

Midhurst. — Overhead Wires. — The R.D.C. has rescinded the resolution sanctioning the erection of overhead wires except in Midhurst, and a Committee has been appointed to meet the representatives of the Electric Supply Co., and to discuss the best route for the wires to take and what system should be adopted.

Newport (I. of W.).—On Saturday night an explosion occurred under an electric street lamp, in consequence of which a Territorial bandsman was killed.

New Zealand.—The Christchurch Electricity Committee has notified the Council of the uncertainty of the arrival of insulator and street lamps supplies, which are of foreign manufacture. In the meantime, inquiries are being made as to stocks held in New Zealand and Australia.

Nuneaton.—The T.C. has asked the electrical engineer (Mr. Gibson) to furnish a list of the manufacturers of the goods supplied to the electricity department for the past year to Easter, for the Council to ascertain what foreign material is used, goods from Germany and Austria to be specified.

It has been decided to invite quotations from all firms with which the department has done business in the past for one or two years' supply of cables.

Prestwich.—Polefield Hall Estate is to be lighted by electricity, and the D.C. has decided to provide a special cable.

The Salford Corporation is being asked to fix five electric lamps to the tramway overhead equipment in Bury New Road, as an experiment.

South Africa.—Electric Winding.—The annual report of the Mines Department shows that the number of electric hoists licensed for transport of persons continues to increase. There were 75 induction-motor hoists, of 40,141 H.P., and 16 Ward-Leonard hoists, of 15,755 H.P., in operation at the end of the year.

Swinton and Pendlebury.—Street Lighting.—The U.D.C. has decided to purchase 300 50-C.P. and 100 100-C.P. electric lamps for the lighting of the tramway route.

Todmorden.—Mill Driving.—Recently a portion of Messrs. Fielden Bros.' mill commenced operations with power supplied by the electricity department. New plant has been installed, and H.T. cables run to the mill, where a sub-station has been built and equipped. The H.T. supply will be available throughout the town.

Truro.—E.L. Scheme.—At a meeting of the T.C. on October 13th, it was reported that Dr. Purvis had advised that the tenders sent in for the electricity scheme were within his estimate; the E.L. question has, however, been deferred until after the new Council is constituted on November 1st.

Welshpool. — Street Lighting. — The P.C. has arranged to have the streets lighted by 21 electric lamps, each of 150 C.P., at £30 for the season.

Whitehaven.—In reply to a request for a supply of current to Sandwill Quarries, the T.C., on the advice of the electrical engineer, has replied that it is impracticable to give the supply.

Whitworth.—E.L. Agreement.—The U.D.C. proposes to enter into a 15 years' agreement with the Rochdale Corporation for the supply of electricity.

TRAMWAY and RAILWAY NOTES.

Ayr.—Annual Report.—The annual accounts of the Corporation tramways department show a total revenue for the year of £19,377, being an increase of £3,081. The receipts per car-mile were 9·81d., as against 9·71d. for the previous year. The energy consumed amounted to 421,844 units, or ·94 per car-mile. Working expenses, including power charges, amounted to 5·75d. per car-mile.

Birmingham. — New Tramways. — The Tramways Committee recommends the construction of four lines of tramways and the borrowing of £128,240 to cover the cost of carrying out the work.

Blackpool.—Reduced Traffic.—Ten weeks of war has caused a reduction of £13,600 in the Corporation tramway receipts. When the war broke out the takings were £4,300 up compared with last year. They are now £9,351 down.

Bury.—The extension of the Limefield section is proceeding quickly, and it was intended to commence the new permanent way from Jericho to the borough boundary this week.

Glasgow.—Tramway Insurance, &c.—The T.C. having decided to carry its own third party insurance risks, the Tramways Committee proposes that a sum of £31,000 per annum be set aside to meet such risks, the sum to be paid in four quarterly instalments.

It is proposed that the tramways department present to the 1st Glasgow Battalion H.L.I. (which is composed almost entirely of tramway employés) the necessary equipment and instruments for a fife band.

After having had a lease of the Harbour tunnels for over a year, it is recommended by the tramways department that the T.C. should now seek Parliamentary powers to secure a 10 years' lease or working arrangement for the tunnel, at a rent of £3,000 per annum, the T.C. paying both landlords' and tenants' taxes and maintaining the works. The tunnel is being utilised for the relief of cross-river traffic, and there is a proposal for its electrification for tramway purposes.

Ilford.—At the meeting of the U.D.C. last week, the chairman of the Tramways Committee stated there had been an increase in the takings of about £3,000, as compared with the corresponding period of last year, but in addition to the £950 they paid to Barking as rent, they were paying £860 per year for current to run extra cars, which, with other expenses, amounted to £2,800 per annum, so that there was not such a big surplus as one was led to think. The Tramways Committee has decided to purchase a car from the Barking Council for £650.

The Electricity Committee has decided to make a charge of $1\frac{1}{16}$d. per unit for current supplied for traction purposes during the year ending March 31st next.

Leeds.—Half-Year's Statement.—The working of the tramways undertaking from April 1st to September 30th has resulted in a net surplus of £45,465. The total receipts—£224,185—show an increase of £1,343, and the number of passengers carried increased from 47,996,569 to 48,543,198.

Manchester.—Relief Works.—At the request of the Distress Committee, the Parks Committee has promised to consider the question of constructing a light railway to surround Heaton Park.

Mexico. — According to the *Financial Times*, it is confirmed that the Government has taken forcible possession of the property of the Mexico Tramways Co. and is working same. It is stated that no political trouble underlies this incident.

New Zealand.—The installation of electric tramways, supply of cars and equipment of sub-station for the New Plymouth Borough Council is to be carried out by Messrs. Greenshields & Co., of Wellington, at a cost of £19,926. The work is to be completed in 14 months.

Rawtenstall.—At a recent meeting of the T.C., Ald. Coupe explained the increased cost of running the cars as being due to the fact that a large number of cars had been changed from regenerative to series-parallel control.

Southampton.—Motor-'Buses.—The Tramways Committee has deferred the question of purchasing 'buses for the present. The report of the deputation which inquired into the question favoured the Thornycroft and Tilling-Stevens vehicles.

South African Railway Electrification.—In his official report for the year 1913, Mr. W. W. Hoy, general manager of the railways, &c., discusses the proposed electrification of certain sections of the South African Railways, and emphasises the advantage that would arise from the electrification of the Wynberg line in the Cape Peninsula. He avers that as an engineering proposition, the electrification of certain sections of the railways in South Africa is not open to doubt, and that the points remaining to be considered are:—(*a*) Capital cost; (*b*) working expenditure; (*c*) choice of system; and (*d*) section of line to be electrified. Mr. Hoy suggests that the Administration should secure the most eminent advice obtainable, and that a consulting electrical engineer who is acquainted with the subject should visit South Africa and study the local problems and conditions on the spot and report.

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TELEGRAPH and TELEPHONE NOTES.

Australia.—A test case has been decided with regard to the compensation payable by the Federal Government in respect of private telephone lines, of which the Postmaster-General has resumed possession. The payment was assessed by the arbitrator, Mr. A. B. Shand, at £60, and the Government was ordered to pay the costs of the reference and award.

German Telephones.—It is reported that the Russian military authorities are taking over the private telephones from Reval westwards and the lines to the neighbouring islands. These lines were originally put up by Germans, and the descendants of these concessionaires are under suspicion.—*Standard.*

Honolulu.—The Marconi Wireless Telegraph Co. states that the service to Honolulu has not been closed, as reported by the United States Government, and that the commercial service is being carried on as usual.

Telegrams in Code.—The Government proposes to allow the use of a limited number of authorised codes for telegraphic traffic between the United Kingdom on the one hand and countries outside Europe on the other. A further announcement will be made as to the date on which the concession will come into force, and the conditions under which it will be allowed.

Telephone Spy.—A correspondent of the *Daily Call* states that near Insterberg news has been leaking through to the Germans from an unknown source. There were no telegraph or telephone wires available, and the conclusion was arrived at that the Germans were using special subterranean cables installed prior to the outbreak of hostilities. In several instances this assumption was subsequently justified. In the village of Margraboff, the teacher of the local school was found to be using a telephone, which was placed in a hat-box lying on a heap of clothing in a wardrobe. From this hat-box the telephone wires went underground in the direction of the places where the German troops were stationed, and through the medium of these wires the teacher could establish communication with the Germans, and give them very useful information. When it was discovered that the teacher possessed a "telephonic exchange," the first thing done was to telephone to the Germans false news as to positions, strength, movements, &c. Then the wires were cut, and the owner of the telephone was brought before a court-martial, with the usual sequel.

Wireless Apparatus.—By an Order in Council issued last week, it is prescribed that no person shall, without the written permission of the Postmaster-General, buy, sell, or have in his possession or under his control any apparatus for the transmission of messages by wireless telegraphy, or any apparatus intended to be so used; nor shall he sell any such apparatus to any person who has not obtained such permission.

Wireless Apparatus Seized.—The police recently removed a wireless telegraph installation from the residence of Prof. Arthur Schuster, at Wargrave, in consequence of which the daily Press published particulars of the career of the owner, who is the Secretary of the Royal Society, and the brother of Sir Felix Schuster, governor of the Union of London and Smith's bank, and was formerly Professor of Physics at Manchester University. It is hardly necessary for us to say that to suspect Prof. Schuster of any act unfriendly to this country would be to court the ridicule of those who are acquainted with his record of honourable service to the nation. He installed the apparatus in June last under licence from the Postmaster-General, for the purpose of receiving the time signals from the Eiffel Tower, and when war was declared, in the absence of Prof. Schuster, the installation was dismantled by Post Office officials and packed up in a sealed box, which was removed on October 14th. Prof. Schuster's only son is an officer in the Yeomanry.

In a letter to the *Times* of October 19th, Sir Joseph Larmor, whilst emphasising the danger of secret wireless telegraphic communication, points out that it is almost impossible to prevent the unauthorised reception of wireless messages, but easy to detect the sending of messages; he approves of the surveillance even of Fellows of the Royal Society, but refers to the attack on its secretary as likely to make us appear ridiculous to neutral nations.

Wireless Charge.—On October 14th, Morgan A. Watzdorf pleaded guilty at the Central Criminal Court to a charge of establishing a wireless telegraphic apparatus at his home, in 1913, without a licence. Particulars of this and other charges have already been published in this column. It was stated that the prisoner, wishing to become a wireless operator on board ship, applied in 1912, 1913 and 1914 for a licence, but it was refused on the ground that he was under age. In August, as he had not complied with a notice to take the apparatus down, the Post Office removed it. Mr. Justice Rowlatt sentenced him to a fortnight's imprisonment in the second division, and ordered the apparatus to be forfeited, saying there was nothing to show that he contemplated being useful to the enemy.—*Times.*

Wireless Spying.—Letters in recent issues of the *Times* indicate the possibility of wireless transmission from an aerial wholly indoors to a station over 150 miles distant, and the possible use of a telephone wire as an aerial for the reception of wireless messages. It is also possible for telephone subscribers to communicate with one another telegraphically over a telephone line without the knowledge of the exchange operators.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—November 25th. Victorian Railways. 25 battery signal machines for operating signals. Contract 27,479. Contractors' Room, Railway Offices, Spencer Street.

December 2nd. Victorian Railways. 1,376 steel disk wheels complete for electric cars; steel disk wheel centres and steel tires for electric motor-cars; 1,376 steel disk wheels for electric motor-cars. Three separate contracts. Particulars from Contractors' Room, Railway Offices, Spencer Street.

December 9th. Victorian Railways. 110 tons of block tin. Contract 27,436. Contractors' Room, Spencer Street.

December 16th. Victorian Railways. Rubber-covered copper wire. Contract 27,705. Contractors' Room, Spencer Street.

December 16th. Victorian Railways. 100 neutral track relays for electrical circuits. Contract 27,712. Contractors' Room, Spencer Street.

December 28th. Victorian Railways. Three 50-kw. static transformers. Contract 27,727. Contractors' Room, Spencer Street.

Adelaide.—November 11th. Portable desiccating plant, petrol motor driven, for Postmaster-General. See "Official Notices" October 9th.

December 9th. Telephone instruments and parts, for the Postmaster-General. See "Official Notices" to-day.

Perth.—November 18th. 249 accumulators and power board, for Postmaster-General. See "Official Notices" October 16th.

Brisbane.—November 18th. Instruments and parts. See "Official Notices" October 9th.

December 15th. Switchboard, common battery, automatic or semi-automatic, for the Postmaster-General. See "Official Notices" October 9th.

Sydney.—December 9th. P.M.G. The time for tenders for various telegraph instruments and measuring instruments has been extended to December 9th.

November 23rd.—The City Council has extended the time for the receipt of tenders for wet air filters from October 26th to November 23rd.

December 21st. City Council. Motor-generators and switchgear suitable for electric vehicle battery charging. Specifications, 10s. 6d., from City Electrical Engineer.

Beckenham.—October 26th. U.D.C. Twelve months' supply of Midland small coal for the electricity works. See "Official Notices" October 16th.

Birmingham.—October 26th. Electric light installation, Western Road House and Dudley Road Infirmary, for the B. of G. Messrs. Edwards & Shaw, engineers, 105, Colmore Row, Birmingham (returnable deposit of £5).

Blackpool.—Corporation. 24 cast-iron distribution pillars, H.T. and L.T. cables, earthenware conduit. See "Official Notices" October 9th.

November 19th. Corporation. Water-tube boiler, mechanical stokers, economiser, steel chimney, cold-storage hopper, one 1,500-kw. turbo-alternator, surface condenser and auxiliaries. See "Official Notices" to-day.

Canary Islands.—Tenders have just been invited by the municipal authorities of Icod (Canary Islands) for the concession for the electric lighting of the town during a period of 21 years.

Cardiff.—October 26th. Wiring and fittings at the County Police Station, Canton, Cardiff, for the Standing Joint Committee of the Glamorgan Quarter Sessions and County Council. Specifications and form of tender from the County Hall.

Connah's Quay.—November 6th. U.D.C. (Contract 2) Gas engines, suction gas plant, pipework, cooling tank, dynamos, booster, switchboard, connections and storage battery. (3) Overhead and underground mains, services and public lighting. See "Official Notices" October 16th.

Dublin.—November 5th. G.N. Railway Co. (Ireland). Twelve months' supply of stores, including a number of electrical items. See "Official Notices" October 16th.

November 9th. Dublin United Tramways Co. Twelve months' supply of stores, including car fittings, electric supplies, &c. See "Official Notices" to-day.

Finchley.—October 26th. U.D.C. 1,000 tons of Warwickshire D.S. small nuts or peas, for the Electricity Works. Forms of tender from Mr. E. Calvert, Electrical Engineer, Squire's Lane.

The Education Secretary has been instructed to obtain special terms for the usual supplies of lamps.

Hawarden (Flint).—November 11th. R.D.C. Gas engines, suction gas plants and dynamos, switchboard, balancers and boosters, storage battery, underground mains. See "Official Notices" to-day.

Heywood.—Tenders are to be invited for converting plant in connection with the bulk supply scheme.

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London.—October 28th. L.C.C. Installations, 160 wiring points, 200 lights, at Victoria School, Hammersmith; 126 wiring points, 170 lights, at Woolmore Street School, Poplar. See "Official Notices" October 9th.

October 27th. 20,245 yards of grooved trolley wire. Particulars to be obtained from Chief Offices, L.C.C. Tramways, 62, Finsbury Pavement, E.C.

November 4th. Installation, 235 wiring points, 290 lights, at Senior Street Elementary School, Paddington. See "Official Notices" to-day.

HAMMERSMITH.—November 4th. H.T. and L.T. underground electric supply cables, for the B.C. See "Official Notices" to-day.

New Zealand.—GISBORNE.—December 5th. Borough Council. Direct-current meters for electric lighting. (Deposit £25, to Town Clerk.) Specifications, &c., may be seen at Board of Trade Commercial Intelligence Department in London.

South Africa.—November 2nd. S.A. Railways Administration. 14,080 incandescent lamps and 39,150 train-lighting lamps—all tungsten drawn-wire. Secretary to Tender Board, S.A.R. Headquarters, Johannesburg; and S.A. High Commissioner in London, 32, Victoria Street, S.W.

Spain.—Tenders have just been invited for the concession for the working of the telephone exchange in the town of Valls (province of Tarragona) during a period of 20 years.

The Spanish Government Department has issued a new list of materials required by it, which may have to be obtained from abroad, and for which foreign competition will be admissible. This list includes: Metal-working machinery; wood-working machinery; leather cutting and stamping machinery; constructional material for air service; high-tension and special steel of all kinds, in bars, sheets, &c.; steel boiler plates; dynamos and accessories for the lighting of railway carriages. Some further information may be seen at the Commercial Intelligence Branch of the Board of Trade.

November 12th. The municipal authorities of Talvera de la Reina are inviting tenders for the concession for the electric lighting of the town during a period of four years.

Swinton.—The Lighting Committee is to purchase a tower ladder for use in connection with the electric street lighting, at £22. It has also been decided to purchase 300 electric lamps of 50 C.P., and 100 of 100 C.P. for the lighting of the tramway route.

Tunbridge Wells.—November 7th. Corporation. 12 months' supply of H.T. and L.T. cables. See "Official Notices" October 9th.

York.—October 23rd. North-Eastern Railway. Twelve or six months' supply of telegraph apparatus, telegraph wire and line stores. See "Official Notices" October 16th.

October 23rd. North-Eastern Railway Co. Six or twelve months' supply of arc lamp carbons, wires and cables, electric light fittings, arc lamp globes, &c. Forms of tender from Mr. E. H. Clark, Stores Superintendent, Gateshead.

November 9th. Construction of about 1½ miles of light railway, excluding overhead electrical equipment, for the T.C. Mr. F. W. Spurr, City Engineer (returnable deposit of £5).

Wakefield.—December 4th. Yorkshire (W.R.) Electric Tramways Co., Ltd. Twelve months' supply of electric lamps, fittings, insulating materials, &c. Schedules can be obtained from the Central Offices, Belle Isle, after November 9th.

CLOSED.

Australia.—The following tenders have been accepted:

P.M.G.'s Department, Victoria:—
1,250 earth plates, £455.—J. Bartram & Son.
30,000 dry cells, 3 by 3, £2,937; 250 dry cells, Obach, £18 15s.—A. J. Sage and Co.
P.M.G.'s Department, South Australia:—
20 tons of H.D. copper wire, £1,514; 20 tons of bronze wire, £1,787.—British Insulated & Helsby Cables, Ltd.
N.S.W. Public Works Department:—
Two 5-H.P. motors.—Australian G.E. Co.
Low-tension switchboard at abattoirs, £1,158.—Australian G.E. Co.
Queensland Public Works Department:—
Electric goods lift at Brisbane, £276.—Norman Bell & Co.
P.M.G.'s Department, Sydney:—
Installation of electrically-controlled clocks at Newcastle, N.S.W., £89.—W. G. Watson & Co. —*Tenders.*

Brighton.—The Guardians have accepted the tender of Mr. H. J. Galliers, at £150, for electrical supplies for the next three months.

Chesterfield.—The Corporation Electricity Committee has decided to obtain a 1,500-KW. rotary converter and transformer, with the necessary controlling switchgear, at a cost of £2,200, and a 1,200-KW. transformer and switchgear, at a cost of £282, both from the British Westinghouse Electric and Manufacturing Co., Ltd. A high-tension cable, at £725 approximate, is to be ordered from the B.I. and Helsby Cables, Ltd.

Glasgow.—The T.C. Electricity Committee has accepted the following tenders:—

Babcock & Wilcox, Ltd.—Coal-conveying plant at the new generating station to be erected at Dalmarnock, £12,234.
The Edison Battery Co.—Providing three electrical vehicles at a cumulative price of £2,446.

The Committee on Tramways, Works and Stores recommends the acceptance of the offer of Messrs. James Thompson & Son for the supply of vulcanising plant and a lathe for a garage.

Government Contracts.—The following tenders have been accepted during the past month by the following Government Departments:—

H.M. OFFICE OF WORKS.

Extension of electric wiring at public offices, Westminster.—The Alpha Manufacturing Co.
Incandescent electric lamps (supply for one year).—British Drawn Wire Lamp Co., Ltd.; British Thomson-Houston Co., Ltd.; Edison & Swan U.E.L. Co., Ltd.; Siemens Bros. Dynamo Works, Ltd.

POST OFFICE.

Cables, Canterbury-Dumpton Gap.—Johnson & Phillips.
Power cables, Fordrough Lane Factory, Birmingham.—W. T. Henley's Telegraph Works Co., Ltd.
Laying lines of self-aligning ducts.—London-Chelmsford-Colchester: Section II, W. Dobson; Section III, R. J. May. London-Sevenoaks: Sections II and IV, G. J. Anderson; Section I, W. Iles. Birmingham-Sheffield: Section V, H. Ashby; Sections VI and VII, Callender's Cable and Construction Co., Ltd.; Section II, W. Dobson; Section IV, Bower Bros. London Road-Bromley section: W. Griffiths & Co., Ltd. Southport-Ormskirk section: W. Pollett & Co., Ltd. Edinburgh-Forth Bridge section: Casey & Darragh. Glasgow-Kilmarnock section: J. & D. Meek, Ltd.
Telephone exchange equipment.—Whitehaven: Peel-Conner Telephone Works. Woking: Automatic Telephone Mfg. Co. Dover: Western Electric Co. Belfast (extension): Western Electric Co.
Protective apparatus.—British L. M. Ericsson Mfg. Co., Ltd.
Telephonic apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; General Electric Co., Ltd.; Western Electric Co.
Electric light cables.—India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.
Submarine cables.—W. T. Henley's Telegraph Works Co., Ltd.; I.-R., G.-P. & Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.; Telegraph Construction & Maintenance Co., Ltd.
Telephone cable.—Callender's Cable & Construction Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; London Electric Wire Co. & Smiths, Ltd.
Arc lamp carbons.—General Electric Co., Ltd.
Dessicators.—Lacy, Hulbert & Co.
Joint-box guards.—W. Rogers & Sons.
Insulators.—Taylor, Tunnicliff & Co., Ltd.
Ironwork.—Bullers, Ltd.; Highfield Foundry Co., Ltd.
Protectors.—A. C. Jeffrey; E. Sellers & Son.
Felt rings.—Bullers, Ltd.
Solder.—E. Austin & Sons.
Insulator spindles.—T. W. Leuch, Ltd.
Steel tubes.—Stewart & Lloyds, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.
Galvanised-iron wire.—Johnson & Nephew, Ltd.; Rylands Bros., Ltd.; F. Smith & Co., Wire Manufacturers, Ltd.
Vulcanised wire.—C. Macintosh & Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Single-phase alternators.—British Westinghouse Elec. & Mfg. Co., Ltd.
Telephone cable.—Western Electric Co., Ltd.
Motor and starter.—British Thomson-Houston Co., Ltd.
Light tramway.—Montania Engineering Co., Ltd.

INDIA OFFICE STORE DEPARTMENT.

Accumulators.—Tudor Accumulator Co.
Cable.—T. Bolton & Sons, Ltd.
Converters.—Lancashire Dynamo & Motor Co., Ltd.
Dynamo parts.—J. Stone & Co., Ltd.
Engines.—Lancashire Dynamo & Motor Co., Ltd.
Instruments, &c.—Siemens Bros. & Co., Ltd.
Motors.—Lancashire Dynamo & Motor Co., Ltd.; Laurence, Scott & Co.
Wire.—British Insulated & Helsby Cables, Ltd.; Elliott's Metal Co.; Shropshire Iron Co.; R. Johnson & Nephew.

Hornsey.—The B.C. has accepted the tender of the Western Electric Co. for cable.

London.—LEWISHAM.—The B.C. Libraries Committee has accepted the tender of Messrs. Haycraft & Son, Ltd., at £51, for the installation of electric light at the Brockley Branch Library, which is now lighted by gas.

L.C.C.—The Fire Brigade Committee recommends that the tender of Messrs. Mossay & Co., Ltd., for the supply of an electrically-driven chassis to carry a turntable ladder, be cancelled, as the company proposed sub-letting to the Hansa Lloyd Works A.G., of Bremen, the construction of the chassis (without batteries), and in consequence of the war this cannot be carried into effect.

The Committee reports the acceptance of the tender of Messrs. W. A. Stevens, Ltd., for two petrol-electric chassis to carry Magirus ladders, at £762 each.

The Alpha Manufacturing Co., of Balham, has received the contract for electric light and power wiring, &c., for the extension of Government offices at Westminster, for H.M. Office of Works, and that for the electric lighting of the Vernon Square Elementary School, Finsbury, for the L.C.C.

Malvern.—The U.D.C. has accepted the tender of the South Wales and Cannock Chase Coal and Coke Co. for a year's supply of coal to the electricity works.

Rugby.—The Joint Hospital Board has received the following tenders for the electric light installation at Harborough Magna Hospital:—

Mr. S. P. Marsh, Rugby	(accepted)	£250
Rawlings Bros., London		250
Linnell & Son, Rugby		271
Burberry & Co., Coventry		293

The tender of Mr. Denyer, Brinklow, for the erection of the electric light engine-house and the water supply tank, at £199, has also been accepted.

Southampton.—The Education Committee has received the following tenders for the installation of electric light at the Foundry Lane School:—

H. M. Ashton, Ltd.	(accepted)	£195	F. W. Cook & Co.	£267
H. C. Taplin & Sons		197	W. Dibben & Sons	277
E. D. Wishart & Co.		224	A. E. Wells & Co.	296
Geo. Vivian & Sons		235	A. Burkett	3 7
I. Groves & Co.		239	A. Smethurst & Co.	121
Proctor & Jarrard		260	A. Kingman & Co.	Informal

Stockport.—The Board of Guardians has accepted the tender of Mr. Richard Bardsley for "Mazda" metallic-filament lamps.

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FORTHCOMING EVENTS.

Physical Society of London.—Friday, October 23rd. At Imperial College of Science, South Kensington. Presidential address on "Ionization," by Sir J. J. Thomson, F.R.S.

Greenock Electrical Society.—Thursday, October 29th. At 7.45 p.m. At 21, West Stewart Street. Paper on "The Manufacture of Electric Cables," by Mr. R. A. D. Macalister.

Institution of Electrical Engineers.—Thursday, October 29th. At 8 p.m. At Victoria Embankment, W.C. Inaugural address by the President.

Institution of Mechanical Engineers.—Friday, October 30th. At 8 p.m. At Storey's Gate, S.W. "Thomas Hawksley" Lecture.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, October 30th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General meeting.

'Graduates' Section').—Saturday, October 31st. At 7.15 p.m. At Bolbec Hall. Address by Mr. E. L. Champness.

Institution of Municipal Engineers.—Saturday, October 31st. Eastern and North-Eastern District meeting, Lincoln. At 11.45 a.m. At Guildhall. Business meeting; luncheon. Afterwards visits to various undertakings, including, at 2.45 p.m., electricity works and tramway undertaking.

NOTES.

Royal Mint Report.—The Deputy Master, Sir Thomas Elliott, in his Annual Report states that during 1913 over 185 million coins were produced, this figure being upwards of 14 million more than in 1912, the previous highest total. Of this number 150 million were for Imperial issues and 35 million for Colonial requirements. The Imperial coinage was made up of 30½ million gold, 32½ million silver, and 87 million bronze pieces. The bronze figure exceeded that of the previous year by 10 million, and is the highest on record. The year's operations resulted in a net profit of £870,945, as against £1,243,576 in 1912, the decrease being due, principally, to the reduced demand for silver coin during the period under review.

The memorandum of Mr. Rigg, Superintendent of the Operative Department, shows that in 1913 nickel bronze bars were melted for the first time since the adoption of coal gas furnaces in the melting houses (see ELEC. REV., November 12th, 1912, p. 704, and October 24th, 1913, p. 666). And this has made possible a more complete comparison as to the cost of melting under the original coke-fired furnaces and the gas system which has replaced them. The melting costs (fuel, crucibles and wages) per ton of bars in 1909—the last year entirely under the old *régime*—was 82·06s., and the corresponding figure for 1913, 59·62s.

During the year changes in the power and lighting plant of the Mint were of a minor character. The number of motors in use has risen from 99 to 102, and their gross H.P. from 834¾ to 877. High candle-power incandescent lamps have replaced arc lamps in the cutting and weighing rooms, and the total number of arc, flame and silica lamps is now 64, as compared with 71 in 1912. In official premises the number of incandescent lamps has risen from 995 to 1,151, whilst in private residences there are 121—89 less than in 1912—the decrease being due to the vacation of No. 1 residence. The average monthly output of the Mint generators was 34,302 B. of T. units—an increase of 4,244 over the previous year's average.

In the Inland Revenue Department, in connection with the preparation of postage-stamp plates and dies for post-cards and wrappers, 1 copper, 137 nickel, and 186 steel-faced electros were grown. In this department, also, at the request of the Department of Ancient Monuments and Historic Buildings, a series of electrotypes of the inscriptions on the walls and in the cells of the Tower of London was made. They number 268 in all, and vary from 3¼ in. × 3¼ in. in size, to one very long one measuring 35 in. × 24 in. Master-plates have been secured from all the moulds, and it is intended to deposit two replicas from each mould.

A new feature of the present Mint Report is the inclusion of memoranda by the superintendents and assayers of the Branch Mints, in addition to the usual reports of the deputy masters.

In the memorandum of Mr. A. Ventris, superintendent at the Perth branch, reference is made to the recently installed Root's blower, coupled direct to a 20-H.P. motor, which provides the air pressure of 1¾ lb. required for the new group of 13 gas furnace burners, and for the 17 remaining furnaces in which coke fuel is used. In this branch also a 30-H.P. motor-driven breaking down mill, with 14-in. rolls (erected in 1911), has considerably expedited the operation of rolling.

In the Canadian Branch Mint at Ottawa, Mr. Cleave, the superintendent, states that a Hoskins electric furnace has been installed for the heat treatment of dies, collars, &c. It is operated from the ordinary power circuit at 220 volts D.C., the consumption being 4 units per hour. As the price per unit for power is 2 cents, the cost of the electricity supply for the furnace is 8 cents per hour. The temperature is regulated by a multi-step circular rheostat, the full current being used to heat up from cold and the necessary resistance thrown in when the pyrometer shows that the required temperature has been reached. The furnace has been in constant use since April, 1913, and is still as efficient as when first installed. The heating element has a guaranteed life of 1,000 hours, provided the temperature is not raised above 1,800° F. In connection with the hardening and annealing furnace, a small electric testing furnace has been set up. Sample pieces from the different makes of steel used are heated in this, and in each case the decalescent and recalescent points are observed. In this way when treating steel of uncertain composition the danger of overheating is obviated.

In the assay office at this branch also experiments have been carried out during 1913 by the assessor, Mr. Pearson, and the assistant-assessor, Mr. Entwistle, on electrolytic refining, to determine the effect of (1) substituting silver strips and hooks for those of gold, and (2) of dispensing with the heating of the electrolyte. It was found that the silver strips and hooks became rapidly covered with an exceedingly thin coating of silver chloride, which increases the internal resistance. This drawback may perhaps be overcome if they are plated with gold. The silver hooks have one advantage over gold in that, if they accidentally dip into the electrolyte, they do not dissolve, whereas gold hooks under the same conditions dissolve in a few moments.

It was found also that with the hot electrolyte the fineness of the gold deposited was 998·9 at the highest and 998·3 at the lowest; with the cold electrolyte the corresponding figures were 998·2 and 996·8, the greater part of the balance being silver in each case. The gold from the hot cell (998·3) contained 1·5 silver per 1,000, and that from the cold cell (996·8) 2·5 per 1,000. In addition, gold from the hot electrolyte contained a distinct trace of lead (less than 0·1 per 1,000), traces of copper, iron, arsenic and distinct traces of platinum. That from the cold electrolyte had no trace of lead, but traces of copper, iron and nickel, and a distinct trace of platinum, though less than that from the hot liquid. Analysis was made also of the slime from each type of cell.

Another series of experiments was carried out during the year to determine the rate of production and cost of electrolytic gold chloride from impure gold anodes containing 92·2 per cent gold, 6·6 per cent. silver, and 1·2 per cent. base (chiefly lead). An average current of 83·4 amperes, at 2·41 volts per cell, will give, with two cells, 40 litres of acid gold chloride containing 393 oz. of gold in solution in 34 hours. The mean cost for power (with generator set having an efficiency of only 33 per cent.) was 0·23 cent. per oz. of gold in solution, or 0·979 cent. per oz. including acid.

Fatalities.—On Friday a boy, aged six years, named Harold Ashcroft (son of a Reservist at the Front) was killed on the Lancashire and Yorkshire Railway at Aintree, while trespassing on the railway line, where he was found insensible on the live rail. He was taken to hospital, but death had taken place almost immediately.

At Sheffield on Saturday an inquest was held on the body of James Brinnen, commercial clerk, of Sheffield, who had dropped dead on the previous day at the Electric Light Generating Station Club, Neepsend, Sheffield, while standing near his desk. Verdict: "Death from heart failure."

Private David Cameron, of the 3rd Northumberland Fusiliers, was killed on the 14th inst. on the North-Eastern Railway, at Backworth, near Newcastle-on-Tyne. He was crossing the line when he stepped on a live electric rail.

Electricity in Toxicology.—It is reported from New York that by being placed in an electric oven at a temperature of 250° to 300°, David R. Beach, a broker, was cured of accidental poisoning by bichloride of mercury.

London County Council and Electrical Trades List of Rates of Wages and Hours of Labour.—The General Purposes Committee, on Tuesday last, submitted the following revised list of rates of wages and hours of labour paid and observed by the Council in accordance with its standing orders in works of construction, repair or maintenance of buildings or electrical engineering work, which the Council may resolve to carry out without the intervention of a contractor within a radius of 20 miles from Charing Cross. Contractors for works in the nature of construction, repair, &c., to be executed within a radius of 20 miles from Charing Cross, or on a site partly within and partly outside the radius, are required to pay wages at rates not less, and to observe hours of labour not greater, than the rates and hours set out in this list.

* Wiremen	9½d. per hour.
Jointers...	9d. "
Labourers	6½d. "
Armature winders	9½d. "
Armature winder helpers or labourers ...	6½d. "
Transformer winders	8d. "
Magnet winders	7d. "

Fifty-four hours per week. Overtime:—First 2 hours, time and a quarter; second 2 hours, time and a half; after 4 hours until starting time next day, double time.

Plumber jointers	1s. per hour.

Fifty-six hours per week. Overtime:—First 2 hours, time and a quarter; second 2 hours, time and a half; after 4 hours until starting time next day and Sundays, double time.

Electric derrick drivers	10½d. per hour.
Drivers of (electric) travelling cranes and overhead travellers	9d. "

Hours and rates for overtime as arranged.

* Electrical wiremen when employed with the building trades or on buildings are, in accordance with the agreement of August, 1914, between the Electrical Trades Union and the London Electrical Masters' Association, to be paid 10½d. an hour, the hours of labour, &c., also to be in accordance with that agreement.

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Late Correspondence.—The following letters have come to hand just as we go to press :—

CARBONS.

"Some few weeks ago, letters appeared in your columns making inquiries as to whether all the carbons sold by the General Electric Co., Ltd., were of English manufacture, and in due course a reply appeared from the secretary of that company. He stated that if one of two conditions were complied with, he was empowered by his directors to answer the various points raised by your correspondent.

"I am in a position to assure the secretary of the General Electric Co., Ltd., that the questions raised are of the greatest interest to numerous readers of your journal, from the lowly contractor to the mighty consultant, and further, the very fact that your correspondent's questions have been evaded, has stimulated a still greater interest in the electrical trade. In view of the General Electric Co.'s manifesto concerning the carbon industry which appeared in your columns, I claim that the trade has a right to insist that the two letters on this subject be freely answered.

"IN TENEBRIS."

[We think that our anonymous correspondent has overlooked the fact that the firm named offered to answer the questions put by "Inquirer," if he would make his name public instead of hiding behind a *nom de plume*.—EDS. ELEC. REV.]

WHO CAN HELP?

"Will any of your readers, who may be in a position to do so, offer to assist a young Belgian who has been compelled to quit his own country and is desirous of obtaining temporary employment of any kind in England?

"I have been asked by the Belgian Consul in Dover to do anything I can for him, but, unfortunately, I cannot employ him here. He is apparently well educated, of good presence, and is training for central station duties, but speaks very little English. Possibly, however, his knowledge of French may prove useful to many. I shall be pleased to put him into communication with anyone who may be able to help him.

"L. W. WOODMAN,
"*Borough Electrical Engineer.*
"Electricity Works, Dover.
"*October 21st*, 1914."

Lead Poisoning.—In the course of a lecture on "The Industrial Diseases of Greater Manchester," delivered at the Manchester University on October 8th, Dr. L. S. Reynolds (Professor of Clinical Medicine), said that lead poisoning was by far the commonest and most serious of all the industrial diseases of the district. The number of occupations in which lead poisoning might occur was very great, and included makers of electrical appliances, especially accumulators.

Three facts about lead poisoning were worthy of mention. The first was that extremely small doses, frequently repeated, were sufficient to produce symptoms—for instance, as little as one-hundredth part of a grain per gallon in drinking water. The second was that, as in the case of alcohol, young people were very susceptible to the poison. And the third fact was that when a person came in contact with lead at all, the smaller the quantity handled the greater were the chances of poisoning. The last point was important. A person working in a trade well known as liable to cause lead poisoning was educated to take precautions. On the other hand, a fitter of steel machinery, for instance, was never warned of the danger. He was supposed to be working only with steel. As a matter of fact, nearly every fitter used red lead for various purposes, yet he was seldom careful to wash his hands after using it.

Institution and Lecture Notes. — INSTITUTE OF MARINE ENGINEERS.—At a meeting on October 12th, a paper by Mr. R. Kilburn Scott, on "Gyroscopic Compasses, with particular reference to the 'Sea Star' type," was discussed. After briefly describing the Anschutz and Sperry compasses, the author said that the errors peculiar to these compasses, for which allowances had to be made, were those due to latitude, change of latitude at constant speed, change of speed, rolling and pitching, slowness of gyroscope and those produced by steering. These errors, he said, could be traced to one feature which both the compasses had in common, viz., that they were pendular; that was to say, they depended upon the force of gravity to be effective.

The "Sea Star" type, designed by Capt. V. H. Rozic and the author, is so arranged that the righting momentum does not depend on gravity for its magnitude, but is always determined by the amount of deflecting momentum that has to be counteracted. The means to this end are forcible and automatic. Another feature is that the gyro-wheel is so mounted that it is non-pendular about its horizontal axis, and therefore is not subject to ballistic effects. One object in view is to dispense with correction tables and mechanical correctors; another, to devise an instrument that could be made small and cheaply so as to be of use on merchant vessels, aeroplanes, &c. The "Sea Star" differs from the Anschutz and Sperry types in that the direction of rotation of the gyro-wheel is clockwise when looking at the north-pointing end of the gyro-wheel spindle. The other two run counter-clockwise. Owing to the direction of rotation of the "Sea Star" gyro-wheel being opposite to the rotation of the earth, the gyro-wheel is in a state of permanent unstable equilibrium and, therefore, as soon as it has been deflected in the slightest degree, there is a strong tendency to increase the deviation and the motor is immediately started to correct it. There is thus a very great sensitiveness when in the meridian, and this sensitiveness allows the "Sea Star" type to be built in small sizes, for the kinetic energy of the wheel is of lesser importance than with other compasses.

THE INSTITUTION OF ELECTRICAL ENGINEERS.—The programme for the Session now commencing includes :—

1914.—October 29th.—Inaugural Address by the President (Sir John Snell).
November 12th.—"Cables." By Mr. C. J. Beaver.
" 26th.—"Power Plant Testing." By Mr. W. M. Selvey.
December 10th.—"Automatic Switchgear for Alternating-Current Systems." By Mr. E. B. Wedmore.
1915.—January 14th.—"The Shape of the Pressure Wave in Electrical Machinery." By Dr. S. P. Smith and Mr. R. S. H. Boulding.
" 28th.—The Sixth Kelvin Lecture: "Lord Kelvin's Work on Gyrostatics." By Prof. A. Gray, F.R.S.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—The opening meeting of the West of Scotland Branch was held on Saturday evening at Glasgow. Mr. A. B. Muirhead, Lenzie, the new President, delivered his presidential address, in the course of which he dealt with the things that mattered in the maintenance and repair of electrical plant, and the regulations for the use of electricity in mines. He said that colliery electrical plant required very different treatment in its maintenance and repair from that which was customary in the case of mechanical plant. It had been said that mechanical plant cost little to maintain, whereas the maintenance of electrical plant was a serious item; investigation, however, often revealed the fact that the basis of comparison was unsound. Hitherto it had been the custom to carry on ordinary mechanical repairs at the colliery, and it was amazing how little was known of the actual cost of this work for time and material. The outlays appeared in a general way against the colliery stores and colliery wages bill. On the other hand, an electrical repair was sent out to the manufacturer, and his bill passed through the office and attracted notice because it was a concrete item. Moreover, the singling out of the cost of repairs on electrical plant ignored the greater economy and higher efficiency of electrically-operated plant. If they looked back on the state of the industry as it existed prior to 1904, and took into consideration the enormous development in the use of electricity since that year, they were compelled to acknowledge the high standard of engineering shown in the modern plant as specified, to some extent, in the regulations.

In the course of the proceedings, prizes were presented to Mr. J. P. C. Kivlen, United Collieries, and Mr. J. A. Kerr, now in South Africa, for papers read by them, and it was announced that this session special prizes would be presented to working colliery electricians for practical contributions.

GREENOCK ELECTRICAL SOCIETY.—On October 18th Mr. J. H. Parker read a paper on "Alternating Current."

WIRELESS IN WARFARE.—A free public introductory lecture was given at University College, London, on October 14th by Prof. J. A. Fleming, on "Wireless Telegraphy in War."

Electrical Business Openings Abroad.—Some fuller information respecting the following matters will be found in the current issue of the Board of Trade *Journal* :—

Spain.—A Cadiz firm wants names and addresses of British manufacturers of metal-filament lamps, electric light fittings, and other electric light material. Large imports from Germany hitherto. Firms should communicate direct with British Vice-Consulate, Cadiz.

Italy.—A Milan firm desires to get into touch with British manufacturers of iron stampings for laminations, electric lamps, arc lamp carbons, and carbon brushes. An agent wishes to represent British manufacturers of electrical material. In both cases write to British Consulate, Milan.

France.—Manufacturers of British electric hand-drilling machines are asked for by the British Chamber of Commerce in Paris.

Canada.—A Montreal agent wants to represent British manufacturers of insulating material and general electrical specialities, particularly cast-iron street-lighting standards. H.M. Trade Commissioner for Canada, 3, Beaver Hill Square, Montreal.

South Africa.—English agent formerly representing prominent German competitor in South African electrical trade wants to communicate with British makers of electrical machinery and supplies who are not already represented there. H.M. Trade Commissioner for South Africa, P.O. Box 1,346, Cape Town.

Royal Engineers Old Comrades' Association.—This Association was formed in 1912 to foster *esprit de corps* amongst all ranks, serving and retired, of the Royal Engineers, to promote recruiting, and to assist deserving members on leaving the corps to obtain employment, besides relieving necessitous cases. Full particulars can be obtained from the secretary, Mr. J. McB. Robbins, Horse Guards, Whitehall, S.W. The Association numbers 6,000 subscribing members, and in 12 months has found permanent employment for 200 ex-Royal Engineers.

Appointments Vacant.—Skilled mechanic (£2), for Salford electricity department; assistant electrical engineer (temporary, during war), 35s., for Fareham U.D.C.; charge engineer (35s.), for Wakefield electricity department; two junior assistants (£1), also jointer, for Kilmarnock Electricity Department. Particulars are given in our advertisement pages.

Inquiries.—Makers of pocket lamp batteries marked "British-made T.E.C.," and "Argentana" wire, are asked for.

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Metropolitan Association of Electric Tramway Managers.—A meeting of the members of this Association was held on Friday last at the Municipal and County Club, Whitehall Court, Whitehall, S.W., when the following were present:—Messrs. Ullman (East Ham), chairman; Schofield (Leyton), vice-chairman; Bruce (L.C.C.), Coveney (Erith), Harvey (Ilford), Moffet (West Ham), Goodyer (Croydon), hon. secretary; Mason (South Metropolitan), Mackinnon (London United), Hammond (Metropolitan Electric), Birkett (Southend-on-Sea), and C. Mittelhausen. Letters stating inability to attend were received from Messrs. Fell (L.C.C.), Stokes (Bexley), and Murray (Walthamstow). Messrs. Ullman and Schofield were re-elected chairman and vice-chairman respectively, and Mr. Goodyer was re-elected hon. secretary. Various matters of interest were discussed.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—At St. James's Church, Ashton-under-Lyne, on October 14th, the marriage took place of MR. S. E. B. BUCKLEY, mains superintendent to the Stalybridge, Hyde, Dukinfield and Mossley Joint Tramways and Electricity Board, to Miss Annie Hampson, of Ashton. The presents included a canteen of cutlery from the generating station staff at Stalybridge.

The marriage took place at Tewkesbury Abbey on October 12th of MR. JOHN ATKINS, manager of the Ledbury electricity works, and Miss Ethel Mallett, only daughter of Mr. Alfred Mallett, of Tewkesbury.

MR. GILLITT, works superintendent, has been appointed to take charge of the E.L. station of Whitehaven T.C. during the absence of the electrical engineer, who has been attached to the Royal Naval Division for active service, at a salary of £3 10s. per week. The Council will keep open the engineer's position, and maintain his salary, having regard to his remuneration from the Government.

MR. G. H. BROWNE, Chief Assistant Engineer and Deputy Manager of the Ilkeston Corporation Tramways and Electricity Department, has been appointed engineer and manager (*pro. tem.*) during the absence of Mr. L. C. F. Bellamy with the Royal Naval Division, his salary being raised to £170 per annum.

General.—MR. H. HAYES has resigned his position with the Leigh Corporation electricity department, and has entered the business of his brother, Mr. Frank Hayes, tramways and public works contractor, at 68, Victoria Street, Liverpool.

MR. W. H. BLYTHE, of Plane Street, Bacup, who has been employed by Messrs. Ferranti, of Hollinwood, has taken up a new appointment at the British Westinghouse Works, Trafford Park. He has also been appointed evening assistant to the head of the electrical engineering department at the Manchester School of Technology.

COUNCILLOR W. M. WIGGINS, chairman of the Middleton Electricity Committee, has accepted the Mayoralty of the borough for 1914-15.

NEW COMPANIES REGISTERED.

W. Sanders & Co., Ltd. (138,005).—This company was registered on October 17th, with a capital of £1,000 in £1 shares, to carry on the business of electricians, mechanical engineers and manufacturers, workers and dealers in electricity, motive power and light, &c. The subscribers (with one share each) are:—W. Sanders, 63, Fernley Road, Sparkhill, Birmingham, manufacturer; H. Butcher, Ashurst, Rosemary Hill Road, Streetley, Staffs., merchant. Private company. The number of directors is not to be less than two or more than five; the first are W. Sanders and H. Butcher; qualification, 50 shares. Registered office, 7, Oxford Street, Birmingham.

Stanley J. Watson Magneto Co., Ltd. (137,973).—This company was registered on October 14th, with a capital of £100 in £1 shares, to carry on in the United Kingdom or elsewhere the business of agents for, dealers in, and manufacturers of magnetos and electrical and other appliances used in connection with engines, machines and motors, &c. The subscribers are:—S. J. Watson, 1, Marchmont Gardens, Richmond, Surrey, electrical engineer, 15 shares; F. J. Young, 2, Clare Street, Bristol, insurance broker, 10 shares. Private company. The number of directors is not to be less than two or more than five; the first are S. J. Watson (permanent) and F. J. Young; qualification, 50 shares; remuneration as fixed by the company. Registered office, 43, Berners Street, W.

Small Electric Motors, Ltd. (138,006).—This company was registered on October 17th, with a capital of £10,000 in £1 shares (7,500 preference), to take over as a going concern, and carry on, a branch of the business recently carried on by F. W. Potter & Co., of Phipp Street, Great Eastern Street, E.C., so far as regards the manufacture of electric motors, to carry on the business of general, electrical, mechanical and chemical engineers, makers of and dealers in electric motors, generators and transformers, commutators, shafts and spindles, slip-rings, bush-gear, magnet cases, burners, armatures, motors, magnetos, resistances, &c., and to adopt an agreement with H. P. Meares. The subscribers are:—F. E. Adams, 43, Boston Avenue, Southend-on-Sea, director, 100 shares; A. E. Newbould, 199, Piccadilly, W., director, 1 share; H. F. Joseph, Phipp Street Works, Shoreditch, E.C., electrical engineer, 1 share; W. H. Harris, 38, Bloomsbury Square, W.C., solicitor, 1 share; G. H. McNeil, 74, Harvist Road, Kilburn, N.W., accountant, 1 share; F. Stretton, 147, Nelson Road, Hornsey, N., clerk, 1 share; W. Berner, 58, Wrentham Avenue, Brondesborough Park, N.W., shorthand writer, 1 share. Minimum cash subscription, 1,010 shares. The number of directors is not to be less than three or more than seven; the first are F. E. Adams, R. Grierson, H. F. Joel, jun., and Capt. H. P. Meares, qualification, £100; remuneration, £50 each per annum. Solicitors, Ford, Lloyd & Co., 88, Bloomsbury Square, W.C.

British Bachelet Flying Train Syndicate, Ltd. (137,939).—This company was registered on October 12th, with a capital of £10,000 in 1s. shares, to enter into an agreement with C. Vane, and to carry on the business of proprietors and builders of railways, tramways and rolling stock, mechanical manufacturers and suppliers of balloons, flying machines and other contrivances for aerial navigation, electrical and general engineers, electricians, &c. The subscribers (with 50 shares each) are:—H. G. Clark, 53, Oaklands Road, Hanwell, W., clerk; E. W. Church, 85, Duriston Road, Upper Clapton, N.E. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; remuneration, 10 per cent of the net profits available for distribution, divisible. Registered office, 166, Piccadilly, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Stratford-on-Avon Electricity Co., Ltd.—Particulars of £3,000 second debentures, created April 21st, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Electro-Flex Steel Co., Ltd.—Particulars of £15,000 first debentures, created September 29th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £7,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Manaos Tramways and Light Co., Ltd. (101,081).—Capital, £300,000 in £1 shares. Return dated September 9th, 1914. All shares taken up. £100 paid. £299,900 considered as paid. Mortgages and charges: £296,800.

Foote & Milne, Ltd.—Mortgage dated October 9th, 1914, to secure £10,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: London County and Westminster Bank, Ltd., 41, Lothbury, E.C.

CITY NOTES.

British Electric Traction Co., Ltd.

THE following circular has been issued, under date October 15th, to the preference and ordinary stockholders and the holders of income certificates:—

PROPOSED SCHEME OF REDUCTION OF CAPITAL.

With the letter from the chairman, which was addressed to the stockholders on July 2nd last, a form of question and reply was sent, and stockholders were asked to state before October 1st whether or not they were in favour of the directors' proposals.

I am now directed to inform you that 1,589 replies were received before August 4th last, and 348 have been received since.

The replies show that a large majority of each class of stockholder, and of the income certificate holders, who have expressed their views are in favour of the scheme. The directors are of opinion that but for the intervening state of war a much larger number of replies would have been received, which probably would have increased the majority in favour of their proposals.

Under the existing conditions, however, the directors consider that the wisest course is to defer any further action in regard to the scheme for the present.

THOMAS BOWER, *Acting Secretary.*

Ferranti, Ltd.

THE directors report that for the year ended June 30th, 1914, the profit on trading was £47,257, and, after crediting discounts, interest, and transfer fees, and deducting general establishment charges, repairs and renewals, legal expenses, income-tax, bad debts, directors' and trustees' fees, there remains a balance of £19,776. Interest on first mortgage debenture stocks absorbs £4,700; interest on five-year notes, £2,052; interest on bank loans, £1,426; and there is put to depreciation reserve account £10,000, leaving £1,598 plus £452 brought forward, making £2,050, which is to be carried forward. The results for the year show a falling off as compared with the previous year, but this is due in a considerable measure to the discontinuance of large switchgear work and the building up of new business in switchgear details. There has also been a falling off in export business due to monetary conditions ruling in certain countries. During the year £6,000 first mortgage debentures have been redeemed, and the loans against five-year notes and second mortgage debentures have been reduced. The directors refer to the great loss sustained by the company through the death of Mr. A. Bruce Anderson, managing director.

Montreal Light, Heat and Power Co.—The directors have declared a dividend of 2½ per cent. on the paid-up capital stock, being at the rate of 10 per cent. per annum, for the quarter ended October 31st.

Parsons Marine Steam Turbine Co., Ltd.—The report for the year to June 30th last states that during the past year the works were fully occupied in the construction of machinery for war and mercantile marine vessels, and the orders on hand will keep them fully employed during the current year. The directors recommend a dividend of 10 per cent. (including the interim distribution) and a bonus of 10 per cent., both free of tax, carrying forward £19,768.

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Dick, Kerr & Co., Ltd.

Mr. Claud T. Cayley (Chairman) presided on October 14th, at the Cannon Street Hotel, E.C., over the annual meeting.

The Chairman, in moving the adoption of the report (Elec. Rev. p. 505), congratulated the shareholders on the figures therein contained. They had gradually improved, so far as profits earned were concerned, from two years ago. Then the profit was down to about £3,000. In the next year it was £30,000, and now it was nearly £45,000. He could not promise them that it was going to continue at the same rate, but at all events they must rest assured that the directors and staff would do all that could be done. In considering the accounts, he would like them to bear in mind that they indicated the position of the company's finances as at 30th June last, and that, as pointed out by the auditors in their report, no provision had been made for whatever effects the present state of war might have on the assets. It was satisfactory to see that the item "Capital expenditure at the works, including goodwill and patents," showed a reduction of about £14,000, as compared with last year; the depreciation having been maintained as in previous years, this reduction indicated that less expenditure than usual had been incurred in extensions to plant. The sum representing the value of the "Stocks in hand and works in progress" showed a slight increase over what was already last year considered high-water mark, and it was gratifying to know that they started the present financial year with a considerable amount of orders in hand. On the other side of the balance sheet, he need only mention the elimination of the item shown last year as "loan from bankers," the directors having taken an opportunity which presented itself of obtaining the necessary financial accommodation in another way. This was the explanation of the "Contingent Liability, No. 4." No doubt they were anxious to know what the prospects were for the immediate future, and what permanent effects were to be anticipated as the result of the war. To intelligently understand the position it was, he thought, necessary to emphasise what he fancied few of them realised, namely, the ramifications of the company's business. Most people to-day considered Dick, Kerr & Co. as being solely an electrical manufacturing concern, but those who had been shareholders since the earlier days of the company would recollect that at one time they were primarily a contracting firm, and that it was only some fifteen years ago that they found it necessary to become manufacturers of electrical apparatus so as to enable them to carry out advantageously the large contracts then in hand for tramway construction. As the importance of the contracting department declined with the diminution of the demand for new tramway construction, the manufacturing department increased in importance. Now, owing to the policy adopted some years ago of extending the contracting department in other directions, they had reached a condition of having two distinct sections, approximately equal in importance, and which in future could be expected to materially assist each other. As instances of the class of work dealt with by the contracting department, he would mention the construction of a railway 90 kilometres in length for the Government of Portugese East Africa, which had just been completed, and a contract lately entered into with the Metropolitan Water Board for the construction of a very large reservoir representing some six years' work. In the other section, which he would designate as the electrical manufacturing department, he would instance the contracts now in hand with the London and South Western Railway Company for the complete equipment of the generating station for the supply of current for their suburban electrification scheme, and with the Lancashire and Yorkshire Railway Company for the supply of the machinery and apparatus for the complete electrification of their Manchester suburban lines. These two sections represented the main business of the company. But there was a third department, namely, the general supply, or, as they would call it, the merchant business. This department was chiefly concerned with the supply to customers of such general engineering machinery and electrical supplies as they themselves manufactured, and also such as their experience of this class of work enabled them to obtain from other sources to the advantage and satisfaction of their clients. He had entered into these details for the purpose of explaining that their ramifications were such that, while undoubtedly some departments would be detrimentally affected by the war, others might be expected to derive certain advantages. It was to be assumed that for some time to come the construction of public works both in this and in foreign countries, would be deferred, but so far as their contracting department was concerned, the Metropolitan Water Board contract should fill the breach to some extent. Concerning the prospects of British manufacturers of electrical machinery, there was much being said in the public press regarding the benefits to be reaped owing to the removal of German competition, but it must be borne in mind that the elimination of Germany as a competitor did not necessarily signify the entire absence of competition. It was far from his intention to attempt to enter the arena of political economy, but it appeared to him that to whatever extent Germany might be crippled financially for the time being, she would make stupendous efforts to regain her lost markets. The German manufacturers, as they well knew, possessed the advantage of having their home markets to themselves, and with their home demand as a profitable nucleus they were enabled to compete for business abroad on a more favourable basis than could the manufacturers of a country where it had to be all grist that came to their mill. But another factor, of no less importance, was the financial assistance which German manufacturers had been receiving from their banking institutions. What an immense advantage such assistance denoted could only be fully realised by those directly connected with the management of manufactories turning out large and expensive classes of machinery, where the acceptance of an order of any size involved the locking up of capital from the time the raw and half-finished material was purchased till the machines were completed and delivered, a period usually extending over many months. Hence it was surprising, but nevertheless gratifying, to find that British manufacturers had, to some extent at all events, been able to put up a fight considering the limited resources at their disposal. Taking all the indications, as they presented themselves at the moment, into consideration, the directors were of the opinion that they would have to tide over a lean year or two before they could hope to see the dawn of an increased demand for the heavy class of machinery in which they specialised. In their merchant business they looked for, and indeed were already experiencing, an increased turnover. Certain classes of apparatus in which they had specialised were of the nature required for camp and transport equipment. As regarded their electrical supplies department, he might instance the steady growing demand for their metallic filament lamps, the sale of which had been greatly retarded in the past due to keen continental competition. Summing up, therefore, while no one was in a position to prophesy what the future had in store for them, particularly at a time when Europe was in the throes of an upheaval such as the world had never before witnessed, he had no hesitation in telling them that the company's organisation was such as to inspire confidence in its ability to hold its own, especially if the preference shareholders, at the meeting which was about to be held, would place them in a position to take full advantage of future possibilities.

Mr. R. H. Prestwich seconded the motion, and it was carried without discussion.

The Chairman and Mr. T. D. Lingard were re-elected directors.

Mr. Hoyle proposed a vote of thanks to the Board and the staff.

Mr. Fox, in seconding the motion, said that in the engineering world they had watched the gradual recovery of the company to its premier position. They had not lost sight of the fact that in the electrical world the company, as regarded both its capital and constitution, was the premier electrical company of the country.

The motion was carried, and the Chairman, in reply, said the Board owed a great debt of gratitude to the managing director, Mr. Rutherford, for the extremely able manner in which during the past few years he had managed the affairs of the company.

A meeting of the preference shareholders was then held, and the Chairman proposed a resolution to the effect that the borrowing powers of the company be increased by the issue of second debentures, but that the total issue of first and second debentures should not exceed £650,000. He said it did not follow that the directors would issue the debentures, but they asked for power to do so.

Mr. Gamlin pressed for more information, as it seemed rather a large order to ask for such powers when no ordinary dividend was being paid and when they had used up the whole of the reserves.

The Chairman said it was not correct to say they had used up their reserves. They had simply transferred it from one column to another. The issue of second debentures would not affect the preference shareholders. When they entered into a large contract they saw to it that they made enough profit to pay interest on the money which had to be borrowed. They would only issue what debentures were necessary, and it would mean getting rid of other obligations.

A shareholder said it was quite legitimate to issue debentures to carry out contracts they expected to get. Apparently the Board asked for powers to issue £236,000 second debentures, and it would be interesting to know what rate of interest they proposed to pay.

The Chairman said that obviously at present they could not make any issue, and consequently they had not seriously considered the rate of interest. What they could do, however, if they had a large contract, was to use the debentures as collateral security and borrow from the bank.

The resolution was seconded by Mr. Prestwich and carried.

Spanish and General Wireless Trust, Ltd.—A financial daily states that the accounts for the 12 months to June 30th show a loss of £1,068, reducing a credit balance brought down to £3,586.

Electric Welding Co.—The *Financial Times* states that the report of this company says that as soon as the balance of the capital has been collected, the directors propose to submit suggestions for the liquidation of the company.

Anglo-Portuguese Telephone Co., Ltd.—The directors have declared an interim dividend of 3 per cent., less income-tax.

Brazilian Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent. on the issued ordinary capital stock.

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Norwich Electric Tramways Co.—The directors report that the results for the year to June 30th were as follows:—Total receipts, £39,120; total expenditure, £28,044; net profit, £11,076, plus £140 brought forward, making £11,217. The directors recommend that £2,500 be placed to reserve fund account, £7,920 to the payment of 3 per cent. dividend, and £797 to be carried forward.—*Financier.*

Yates & Thom, Ltd.—The directors' report for the year to August 8th last, states (says the *Financial Times*) that the net profit, after providing for depreciation of plant and machinery, interest on mortgage debenture stock, and £2,000 to write down investments, is £14,520 which, with £6,928 brought forward, makes £21,448. The directors recommend a dividend for the year on ordinary shares at 2½ per cent., less tax, transferring to reserve fund £4,000 and carrying forward £8,428.

La Plata Electric Tramways, Ltd.—The report (according to the *Financier*) states that the result of the working for the half-year to June 30th shows receipts £29,699, expenses £22,098, profit for half-year £7,601, plus £330 brought forward. After allowing for debenture stock and other interest, but without any further contribution for reserves or renewals fund, there would remain a balance of £5,212.

Brisbane Electric Tramways Investment Co., Ltd.—The directors have decided to postpone the payment of the final call of £2 on the new ordinary shares from October 15th to November 16th. It has been decided to pay the usual interim dividend of 4s. per share on the ordinary shares on December 1st.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended August 28th, 1914, amounted to 1,387,301, compared with 1,267,735 units in the corresponding four weeks of 1913.

Anglo-American Telegraph Co., Ltd.—Interim dividend for the quarter ended September 30th, 1914, of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income-tax, payable on October 31st.

STOCKS AND SHARES.

Tuesday Evening.

From the Stock Exchange point of view, the news which has come through since last week has been of the mixed variety, with the pleasant side uppermost. Monday's dispatches from General French, with the steady progress made by the Allies and the Naval engagement in which four German destroyers were sunk, put more heart into Stock Exchange quotations than was in them just previously. It is a little curious to notice how the fortunes of war are reflected in tendency rather than in prices; good news brings along buyers of Consols, Canadian Pacifics, a few oil shares and foreign bonds; whereas, when the contrast is provided, business shrinks to nothing at all, so that firms of brokers with large *clientèles* may go for a couple of days without doing a solitary transaction. Efforts are being directed towards reopening the Stock Exchange in time for a settlement on November 18th, but, pending some announcement of Government guarantee to bankers in respect of Stock Exchange loans, it is difficult to see how the markets can be restarted without grave danger to prices, and therefore to public peace of mind.

The success of the London and South-Western Railway issue has already been noted here. The price rose at one time to 2¼ premium above the issue price of 99¼, but some of the allottees found the premium too great an attraction not to be secured; and, on a little selling, the price backed to 101½, to rally again to 102½. At this the return per cent. is £4 10s., if the issue is repaid in five years, or £4 15s. per cent. if it runs for its allotted span, till 1924. Other Home Railway stocks are distinctly dull. Metropolitans have gone back to 30½, Districts to 18½. Underground Electric "A" shares keep firm at 6s., on the assumption that the London General Omnibus Company must be doing extraordinarily well in consequence of the war, and is likely to continue its present prosperity.

The chairman of the Underground Electric Railways Company is Sir Edgar Speyer, whose recent retirement from his well-known firm of Messrs. Speyer Brothers is a formality brought about by reason of the war. The firm has occupied such a prominent position in the financial world connected with London's tubes and trams, that rumour was disposed to link Sir Edgar's retirement with the dulness of Metropolitans and Districts, though, in point of fact, the two things had no connection.

Home Railways, as a whole, have given way principally because of the uncertainty that has arisen with regard to the next dividend-payment possibilities. The official announcement that the Government would make up to the railways such amount of traffic as they might lose in connection with movements of troops, has not been followed by any statement as to the policy which the companies themselves will pursue with regard to the next dividends. Therefore, the hyper-cautious are hinting at the possibility of substantial reductions, as to which it may be pointed out that the pessimists are taking time by the forelock, inasmuch as the railway world has only just lately completed the first half of the second six months of the year. The Home Railway market is in a tender condition, and it takes little to bring about such cessation of buying orders as is immediately reflected in falling prices.

The melancholy appearance presented by London streets after dark is about as bad an advertisement as could be devised for the shares of the Metropolitan electric supply companies. Ingenuity strives to probe what may be the reasons at the back of the official mind for plunging London into more than semi-darkness, when to the plain man in the street there seems so little obvious need for it. Electric lighting shares have not given way, simply because there is no active market in them.

Amongst the few things which have changed hands within the last few days are Chelseas, done at 4⅛, Metropolitan Ordinary at three guineas, City of London Preference at 12¾, and County Preference at 11⅛. The River Plate Electricity Supply Company has put forward proposals for the raising of fresh capital, in the shape of new 6 per cent. Preference stock; and a meeting has been called to give effect to this.

The London County Council, at its first meeting after the summer recess, adopted without debate a recommendation that notice should be given by public advertisement of the Council's intention to consider at the meeting on November 10th the proposal that it should take the necessary measures for promoting Parliamentary legislation dealing with the establishment of a new electricity undertaking for the County of London and certain adjoining districts. The prophetic is always a dangerous *rôle*, otherwise we should feel tempted to guess that the coming proposals are not likely to differ greatly in principle from those advocated in one or two previous schemes.

The British Electric Traction Company announces that it has received substantial support for its scheme of re-organising the capital, but that, having regard to the present state of affairs, the directors deem it advisable to take no steps just now. Consequently the matter is shelved for a while. Since the Stock Exchange closed there have been few dealings in the company's securities; prices are merely nominal.

The Brazilian Traction Company has aroused some criticism, as well as pleasure, by announcing the usual quarterly dividend of 1½ per cent. on its Common shares. The declaration had the effect, anyway, of raising the price from 45 to 47, at which it now stands. The criticism was directed to the obvious fact that, at a time like this, exceptional steps for strengthening the financial position of any company would be fully justified, and that the distribution of this 1½ per cent. did not err on the side of austerity.

It may be pointed out that the bargain-hunter has a fine chance, at the time of writing, in a small scrap of Sao Paulo Tramway, Light and Power First Mortgage bond, which is offered at 83, and could probably be picked up nearer 80. On July 30th the price was 99, and the security at the back of the bond is covered many times.

This week's new issue in the electrical department is $500,000 1st Mortgage Sinking Fund 5 per cent. Gold Bonds, offered by the Pennsylvania Water and Power Company at 88 per cent., plus accrued interest. The price, when the House closed, of the existing issue of bonds was 95½ middle; and the company's report, issued from New York on September 30th, showed the business to be advancing by leaps and bounds. The present issue is required for reimbursement of the company's treasure for moneys expended out of income on an extension line to Baltimore. At the end of October there should be a total installed capacity of 111,000 H.P. The actual price in London works out to 92½ for people who pay up at once, and £92 10s. 9d. for those who elect to pay by instalments.

In the Telegraph market, the tendency has been for people to pick up some of the Preference issues, such, for example, as Globe Telegraph and Trust Preference, wanted at 12¼ or rather more; Anglo-American Telegraph 6 per cent. Preferred, for which prospective buyers are bidding 100, and several others of the same kind. Eastern Telegraph Ordinary stock is quiet at 125. Eastern Extension shares are 11½, and have changed hands on the basis of this figure within the past day or two. New York Telephone bonds are firm at 95, which includes the interest due on November 1st. Marconis dipped to 30s., but rallied again to 1⅛. Canadian Marconis are duller at 4s. 6d., Americans at 9s.

The improvement in Manufacturing varieties still continues. Edison & Swan partly-paid are a shilling up at 5s. 6d., and the full-paid are ⅛ to the good at 1⅛, while business was done the other day in the company's 4 per cent. Debenture stock at 59. British Westinghouse Preference changed hands at 30s. 3d. For other shares of this class there is a steady demand, without causing much alteration, however, in the prices.

Of the foreign traction stocks, Anglo-Argentine 4½ per cent. Debenture at 95½ looks dear in comparison with the company's 5 per cent. Debenture stock, which can be picked up at a little below 90. Adelaide Electric 5 per cent. Debenture—indicated here the other day as cheap at 102½—is now ½ higher, investors absorbing the security day by day. Consolidated Company of Baltimore Debenture stock has been done at 100½ *ex* dividend, which is a good price for it.

Armament shares have experienced a certain weakness, there being pressure to sell from provincial centres where, apparently, money was wanted. Vickers fell to 33s., Armstrongs to 37s. 6d., B.S.A. to 52s. 6d. But rallies have since taken place, and the respective prices at the moment are 33s. 10½d., 38s. 6d. and 53s. 6d. The Rubber market calls for no particular attention. The material has gone up a trifle, though not sufficiently to bring about any change in prices of shares. This market, with the rest, was favourably affected by the more satisfactory character of the news received last Sunday and Monday.

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EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING SEPTEMBER, 1914.

We publish herewith the September returns of electrical export and import business, which, it will be noticed, show a considerable recovery over the August figures.

In the export section the September total amounted to £287,751, a figure which, while it compares badly with the half million per month average before the war, yet represents a satisfactory increase on the total of £238,621 recorded for August.

The imports total for September amounted to £111,174, also representing a comparatively large increase as compared with August (£87,031), while the re-exports at £9,116 were about £1,000 less than in August.

While the machinery exports remained practically stationary as compared with the previous month, considerable improvement is shown in almost every other export section, and, although business is on a reduced scale, it is being maintained all over the world.

The electrical imports, which, for various reasons, are of interest at the present time, show an increase in value of £24,000 on the month, for although German business with us has vanished, our trans-Atlantic cousins and other neutral countries have increased their supplies to this country.

Particularly does this apply to Holland, which supplies the only notable example of a great increase on pre-war trade, and which sent us some £9,500 worth of electrical material in September, almost entirely comprising lamps and lamp parts.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	211	...	26	200	...	246	1,780	24	13	42	130	...	2,672
Germany	...	...	...	...	...	...	...	...	...	...	...	...	...
Netherlands, Java and Dutch Indies ...	332	...	253	...	...	...	193	686	...	24	110	...	1,598
Belgium	...	...	...	...	...	...	180	...	47	...	150	5,202	5,579
France	16	...	7	...	...	...	559	...	...	...	210	20	812
Portugal	1,211	92	15	86	...	...	333	100	...	8	519	46	2,410
Spain, Canary Isles and Spanish N. Africa...	453	210	45	...	...	20	1,060	48	10	...	50	562	2,458
Switzerland, Italy and Austria-Hungary ...	23	...	91	...	...	50	2,869	...	101	164	...	1,919	5,217
Greece, Roumania, Turkey and Bulgaria ...	24	...	29	35	...	...	...	...	...	...	...	132	220
Channel Isles, Gibraltar, Malta and Cyprus...	147	232	42	16	...	32	71	37	14	...	14	75	680
U.S.A., Philippines and Cuba	118	160	494	12	...	63	995	...	46	...	...	120	2,008
Canada and Newfoundland	447	1,28	477	831	...	130	10,796	3	2,500	2	6	513	16,988
British West Indies and British Guiana ...	112	14	117	147	...	...	279	...	3,606	...	189	154	4,615
Mexico and Central America	...	...	...	...	...	...	26	...	34	...	...	...	60
Peru and Uruguay	116	...	244	7	...	...	222	...	...	6	661	167	1 423
Chile	364	...	15	74	...	30	385	2	10	2	132	306	1,320
Brazil	163	473	632	266	...	20	1,944	1,090	237	...	72	481	5,378
Argentina	7,650	1,161	4,109	225	325	75	14,610	758	335	61	1,417	1,128	31,254
Colombia, Venezuela, Ecuador and Bolivia...	103	...	...	...	...	29	10	...	...	...	...	...	142
Egypt, Tunis and Morocco	432	347	167	44	...	5	1,274	431	25	21	259	966	3,971
British West Africa	198	38	12	105	...	...	80	5	13	...	92	96	639
Rhodesia, O.R.C. and Transvaal	1,407	3,890	901	1,588	51	240	1,526	5	83	...	27	67	9,785
Cape of Good Hope	686	1,177	749	655	182	217	4,526	832	314	110	42	281	9,801
Natal	733	9,402	193	165	...	379	1,155	495	61	33	151	...	12,767
Zanzibar, Brit. E. Africa, Mauritius & Aden	274	11	54	52	...	30	...	54	13	...	144	261	893
Azores, Madeira and Portuguese Africa ...	4,537	1,239	124	59	...	205	...	41	...	...	...	54	6,259
French African Colonies and Madagascar...	...	...	...	...	...	...	...	...	...	...	...	...	...
China and Siam	562	430	363	...	...	1,309	1,752	296	26	...	140	439	5,317
Japan and Korea	134	...	5	...	...	851	5,384	298	1,301	...	...	...	7,973
India	2,821	10,135	6,076	1,350	84	691	20,586	3,712	1,794	51	2,116	938	50,354
Ceylon	223	351	171	135	87	25	3	118	59	...	120	40	1,332
Straits Settlements, Fed. Malay States and Sarawak	354	1,016	259	82	...	278	1,227	295	343	...	1,181	540	5,575
Hong Kong	680	4,437	161	...	...	18	634	481	21	...	130	17	6,579
West Australia	685	3 353	90	599	35	847	...	480	1,359	27	12	58	7,545
South Australia	238	744	97	273	...	4	854	...	31	...	247	35	2,523
Victoria	1,346	8,795	1,295	987	51	1,466	2,950	107	473	119	1,727	7,125	26,441
New South Wales	1,636	9,699	1,247	2,308	100	336	7,430	1,055	2,233	2	1,690	3,301	31,037
Queensland	653	36	110	91	16	23	64	384	34	...	1,279	...	2,690
Tasmania	43	...	43	134	...	116	341	...	...	...	...	...	677
New Zealand and Fiji Islands	1,814	1,163	1 785	438	155	469	2,961	304	551	19	143	957	10,759
Total, £	30,346	59,885	20,498	10,964	1,086	8,234	89,050	12,141	15,687	691	13,160	26,000	287,751

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	260	...	105	6	188	...	3,185	...	901	1,603	1,181	7,429
Germany	...	...	...	...	...	...	...	...	...	...	...	...
Holland...	15	...	...	3,908	5,367	...	95	20	...	...	19	9,424
Belgium	...	51	...	...	...	...	1,800	...	...	156	16,693	18,700
France	13	...	60	...	89	8	1,904	...	...	956	220	3 250
Switzerland	162	208	...	...	70	2,814	...	...	...	320	...	3.574
Italy	...	2,854	...	...	...	...	1,248	...	...	...	...	4,102
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...	...
United States	5,792	376	237	...	200	97	11,906	43,246	1,143	319	125	63,441
Total, £	6 242	3,489	402	3,914	5,914	2,919	20,138	43,266	2,044	3,354	18,238	109,920

Additional imports: Spain: carbons, £1,213. Canada: electrical goods, £41.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above... ...	1,974	954	...	805	121	...	3,025	...	148	19	2,075	9,116

TOTAL EXPORTS: £287,751 TOTAL RE-EXPORTS: £9,116 TOTAL IMPORTS: £111,174

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

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LARGE INDUCTION MOTORS: SOME FEATURES OF MECHANICAL DESIGN.

By G. MOORES, B.Sc. Eng.

(*Continued from page* 517.)

Shafts.—The provision of a shaft of ample strength and rigidity is, of course, a vital necessity in the design of a large motor, and we find in practice that the proportions of a shaft are usually dependent not on the stresses due to twisting and bending, but on the maximum permissible deflection, which latter is generally determined by the size of the air-gap of the machine. When the shaft is deflected, or when the rotor for any other reason is displaced from the true centre of the bore of the stator, there comes into play an unbalanced magnetic pull which tends to increase the displacement, and therefore the deflection of the shaft. This magnetic pull may act downwards in the same direction as the weight of the rotor, hence it must be allowed for in calculating the shaft deflection.

There are several approximate methods of determining the amount of this deflection, based upon the assumption of a parallel shaft of equivalent diameter, but as this assumption frequently introduces considerable error, it is often necessary to calculate the deflection by some more accurate method. An example from actual practice is given here of a graphical method of doing this which is as convenient and gives as great a degree of accuracy as any. The case is one of a 2,000-H.P. motor running at a speed of 490 R.P.M. The weight of the rotor was 11,000 lb., and the unbalanced magnetic pull calculated for a deflection of 0·01 in. was 13,000 lb. The weight of the collector was 500 lb., and the weight of the shaft is allowed for in the loads shown.

The shaft is first drawn to scale, and the bending moment curve, fig. 28 (*c*), is obtained as follows:—Drop ordinates as shown from centres of loads and centres of bearings, fig. (*a*). Draw the vertical load line, fig. (*e*), with divisions proportional to the various loads. Choose any pole distant H from the load line, and join up the various points on the load line to this pole. Then by drawing lines parallel to these, complete the polygon fig. (*c*). Note that the resultant line of this polygon is parallel to the dotted line in fig. (*e*), which latter dotted line divides the load line proportionally to the loads on the bearings.

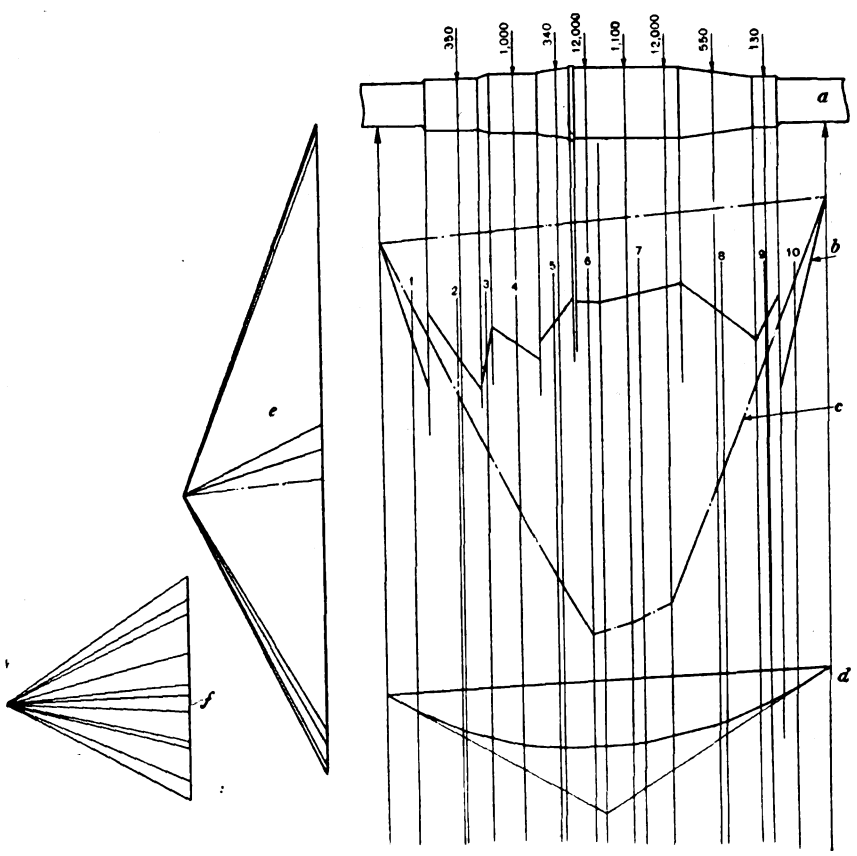

FIG. 28.

Let scale of shaft length be "h" inches per inch, and scale of loads be "d" lb. per inch. Then the bending moment at any point on the shaft = x d h H inch lb., where x is the depth of the diagram in inches vertically below the point considered.

To construct the deflection curve the procedure is as follows:—From each shaft shoulder, and from as many points between the shoulders as necessary, drop ordinates as shown in the figure. Let depth of B M. diagram at any one of these ordinates be a inches. Divide each value of a by D^4, where D is the diameter of the shaft at each ordinate considered. We now require a curve whose ordinates are proportional to these values a/D^4. As these values are unworkably small, multiply by some convenient number approximately equal to D^4 (taking a rough average value of D)—in the present case 10^4 was chosen. Then on the ordinates last drawn mark off lengths $b = a/D^4 \times 10^4$.

By joining up the various points, complete now the several figures 1 to 10 fig. (*b*). Then from the centres of gravity of these figures drop ordinates as shown through fig. (*d*). Compute the area of each figure in fig. (*b*), and by reducing to some suitable scale "l" sq. inches per inch, construct a load line—fig. (*f*)—reckoning the areas as loads. Take a pole distant M from this load line, and join up as shown. Complete the polygon, fig. (*d*), in a similar manner to the B.M. diagram.

Now this polygon is the deflection diagram, and the depths at various points are proportional to the deflections at these points. With scales as given above, the scale of the deflection diagram will be $\frac{M\,H\,h^3\,l\,d}{E\,\frac{\pi}{64}\,10^4}$ inches per inch.

If lines are drawn in fig. (*d*) parallel to the two outside lines in the load diagram, then these lines will intersect at a point vertically below the maximum depth of the deflection diagram. Then by measuring this depth and dividing by the above scale, the maximum deflection of the shaft will be obtained. In the present example the scales used were (in the original which is here reduced) h = 0·1 in. d = 2,000 lb. H = 3 in. l = 4 sq. in. M = 4 in. The scale of the deflection diagram was, therefore, 148·5, and its depth measuri 1·39 in., the actual deflection w 1·39/148·5 = ·0094 in.

As an instance of the degree of accuracy obtainable in the construction of these figures, it may be mentioned that two persons recently drew the figures for a particular case, using different scales and different positions of ordinates, and their results differed by less than 2 per cent.

Shafts for large high-speed motors are frequently specially constructed to provide air passages through the punchings which are mounted directly on the shaft. Sometimes such shafts are swelled out at the centre, and large slots, like key-ways, are milled along the centre portion. These slots allow air to obtain access to ventilating spaces which are provided in the rotor. In the rotor previously illustrated of the British Thomson-Houston high-speed motor, the shaft is milled down at the centre to a triangular shape for the same purpose.

Stator Windings.

It will be assumed, unless otherwise stated in dealing with this subject, that stators have half-closed slots, as open slots

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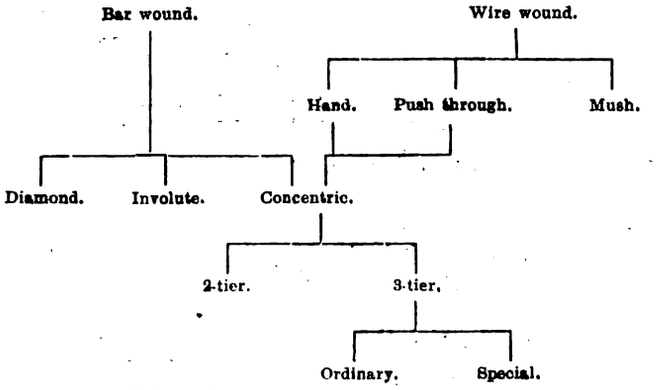
are rarely met with in large induction motors. Stator windings for three-phase machines may be classified as shown below :—



The slots may be either "bar" or "wire" wound ; in the former case the bars must be pushed through the slots from one end, and in the latter case there is a choice of three methods :—(1) Threading the wire through from one end of the slot by hand, one turn at a time, *i.e.*, hand-winding ; (2) forming coils, usually termed "mush" coils, roughly on a mould, and inserting them in the slot by

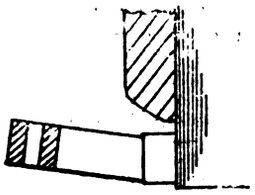


Fig. 29.

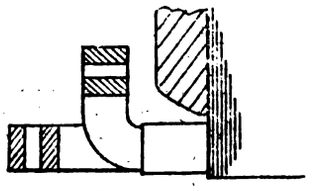


Fig. 30.

slipping one wire at a time through the slot opening, which must be larger than the diameter of the wire ; (3) forming what are known as "push-through" coils on a mould. This last type of coil is formed with its individual turns disconnected and their ends straightened out ; the complete coil is pushed through the slots from one end

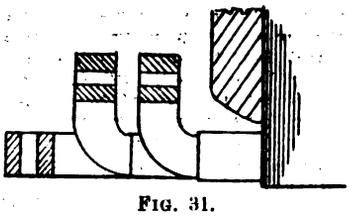


Fig. 31.

of the machine, and its disconnected ends are then bent over and connected to one another so as to put the turns in series, or parallel, or as may be required.

The end connections of a stator winding—that is, the portion of the coils outside the slots—are made in various

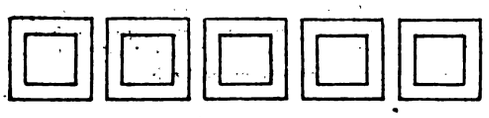


Fig. 32.—Single-tier Diagram

shapes, the chief being the "concentric" type, the "diamond" or "barrel" type, and the "involute" or "butterfly" type.

Bar-wound machines may be made with any of these

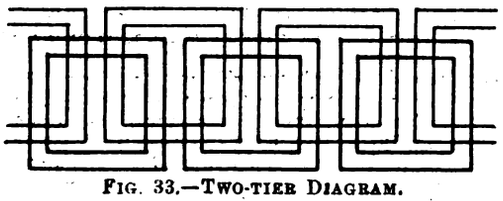


Fig. 33.—Two-tier Diagram.

three types of end-connections. Of wire-wound machines, those that are hand-wound are nearly always of the concentric type, as also are practically all push-through coils.

Concentric windings for single-phase are wound "single tier" or "single plane" (fig. 29), for two-phase they are two tier, and for three-phase either two tier (fig. 30) or

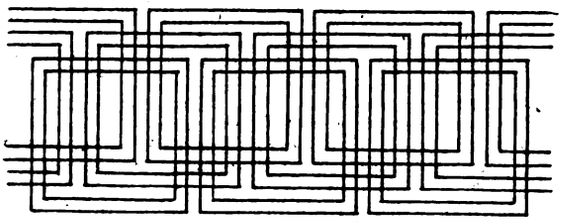


Fig. 34.—Three-tier Diagram, Ordinary.

three tier (fig. 31). Further, three-tier windings may be either ordinary, or specially arranged to be suitable for a

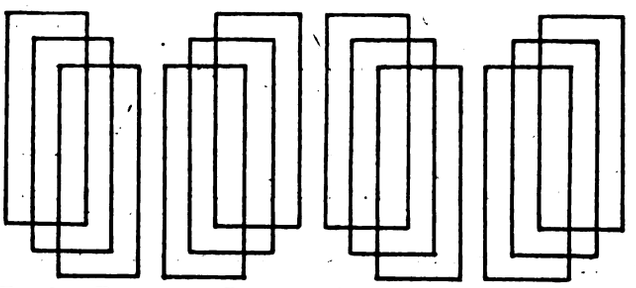


Fig. 35.—Three-tier Diagram ; Special—For Split Stator.

split stator frame so that no coils will have to be interfered with when one part of the stator is removed. Diagrams of these four types of concentric windings are given in figs. 32 to 35.

(*To be concluded.*)

ELECTRIC BRASS MELTING.

By G. H. CLAMER and CARL HERING.

(*Abstract of paper presented at the Annual Meeting of the* American Institute of Metals, *September*, 1914, *at Chicago, Ill.*)

The purpose of this paper is to describe some recent researches and developments in the field of commercial brass melting, with a special type of furnace. The advantages which electrical furnaces have over combustion furnaces for commercial brass melting are well known. These researches were made with the Hering furnace, a new type of electric furnace which promised to be especially well adapted to brass melting.

It is the opinion of the writers, which is also shared by many others, that the direct arc furnace will never be likely to be a commercial success for melting brass. In the direct heating resistance furnaces with which the present researches were made, the heat is set free directly in the metal itself by passing the current through the liquid metal. There is therefore no transmission of heat, hence no loss of time or temperature, and there need be no excessive temperatures. The electric energy in the metal is set free as heat instantaneously and with a perfect efficiency, the only losses being after the heat has got into the metal and in leading the current into the metal, both of which losses are subject to control.

In the type of furnace used in these researches the heat is set free as such in a small portion of the liquid metal in heating holes at the bottom of the hearth, and then by means of a pressure produced by a recently discovered and peculiar electromagnetic force known as the "pinch effect," this heated metal is "squirted" with considerable force into the main bath, whereby its heat is carried very quickly into the bath and is there distributed, and whereby the metal is at the same time very thoroughly stirred, making it uniform. The cold metal is melted by immersion in this hot bath, as in all covered crucible melting. Cold metal, when immersed in superheated liquid metal and wetted by it, takes up heat remarkably rapidly, and anything that increases the speed of melting lowers the stand-by losses, hence poking the cold metal down into the hot bath is an advantage. This "pinch pressure" operates like a valveless pump, forcibly expelling the freshly-heated metal from the heating holes or channels, called resisters, and sucking in the cooler liquid metal from the bath.

This peculiar and heretofore unknown electromagnetic force, which is of considerable magnitude, was noticed by one of the authors some years ago, in a resistance steel furnace with open channels, and proved to be fatal to that furnace, as it kept breaking or pinching off the column of liquid by crushing it ; it is the first mechanical force internal to a conductor known to the electric art, all the other forces being external. In the present type this force was applied to circumferentially closed channels of liquid

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metal submerged beneath the bath, so that rupture could no longer take place; the force tending to crush the conducting column of liquid metal was thereby made to "squirt" it out of the heating holes, whereby the absolutely essential rapid circulation in these heaters is produced. This type of furnace is sometimes referred to as the "pinch effect furnace," as this peculiar force is the underlying and essential feature of it.

Such a furnace heats the liquid metal from the bottom, which is the correct way to heat any liquid, and of course the most rapid way; for this reason, and the fact that the electrical energy is converted into heat instantaneously (that is, without involving the slower transmission by radiation or conduction), the heating can be done very rapidly, depending on how much electric power one is willing to use.

Due to this rapid heating the losses of heat are reduced, because the time during which the metal is kept hot is shortened. If a ton of metal per hour is melted and poured in 500-lb. lots every 15 minutes in a small furnace, the continuous stand-by losses through the walls and the top will be only those from 500 lb., while if melted and poured in ton lots every hour these losses will be several times as great.

The ideal method therefore is to melt and pour as quickly as possible, hence in as small lots as the particular conditions of the foundry require, though this of course need not be carried to extremes. It is thought, however, that for small castings at least, a high-power tilting brass furnace of this type could be constructed small enough to be transported to the moulds, pouring directly into them, thereby saving the process of pouring with a ladle, with its labour cost, and the cost of the superheat necessarily involved in indirect pouring.

In general this furnace consists of a shell lined so as to form a hearth. At the bottom of this hearth there are several cylindrical holes, usually inclined, extending into the lining and closed at their outer ends by the metallic electrodes, usually made of the same metal as that to be melted, or of graphite. The electric current, led into the furnace by means of these electrodes, passes through the columns of liquid metal in these holes, and it is here that the electric energy is converted into heat and the freshly heated metal is squirted out into that in the hearth. These heating holes are technically called the resisters, as it is the electric resistance of the metal in these holes which causes the electric energy to be converted into heat. The electrodes lead out to the outside of the furnace, where they are attached to transformers in which the kind of current required by this furnace is generated. These transformers are preferably secured mechanically to the shell; hence the heating can continue while the furnace is tilting for pouring.

In starting from the cold state this furnace must first be primed with a small charge of liquid metal, enough to fill the holes and the bottom of the hearth, so that the circuit for the current is established. A few fragments of zinc, tin or aluminium inserted in the bottoms of the holes ensure the union of the liquid priming metal with the electrodes at the first start from the cold. During regular pouring, enough liquid is retained to maintain this electric circuit.

On shutting down the furnace, it is tilted or drained so far that the heating holes are also emptied of their metal except for a short stump at the bottom. In some cases the charges in the furnace were allowed to freeze, and it was afterwards started up again by melting the solid charge with the current; but at present this is not recommended as a general rule except when the metal in the furnace is not hot short, as hot short metal is apt to break the electric circuit by cracking in the resisters when the furnace cools or is heated up. A blast fuel flame is desirable for starting up a furnace with a frozen charge.

An electric furnace has its best efficiency when run continuously day and night; this is also better for the lining, which may become strained by repeated heating and cooling. The cost of electric energy is also generally less per KW.-hour for continuous than for intermittent supply. When this continuous running is not practicable, this furnace may be kept hot overnight with about 20 per cent. of its normal input. A large body of metal in a well-heated and well-insulated furnace will keep liquid in the bottom for a number of hours without any current.

In its present form this brass furnace requires very little attendance while running normally, and it is at its best when run at a uniform rate of melting. One operator can well attend to several furnaces or undertake some other duties. It requires intelligent care when starting from the cold to establish good electrical contact with the fluid priming charge; this starting is easily learned, but must be done conscientiously; after first starting no particular care is required.

The chief attention required during normal running is not to waste electric energy or endanger the lining or the electrodes by unnecessarily high temperatures, as the heat accumulates rapidly after the metal is all melted; its temperature had best be determined by the use of pyrometers, which is convenient in this type of furnace.

Any degree of superheat can be obtained, depending only on the money one is willing to spend for this superheat. One need merely keep the melted metal in the furnace with the full current on. Owing to the higher cost of electric heat, it is, of course, desirable to require as little superheating as possible. The ideal method would be to cast directly from the furnace into the moulds, by bringing the moulds to the furnace, say, on a sort of suspended carrousel or by floating them on a canal. Every degree of superheat saved adds to the efficiency of the furnace and to the daily output of a given furnace.

There is no danger at all of "burning" or oxidising the metal, as the air can be entirely excluded and the atmosphere may even be made reducing with charcoal. Sulphur fumes are of course absent. The zinc loss is practically negligible, as the furnace is normally sealed, being opened only for charging and pouring.

The regular and continuous upward motion of the metal squirted from the heating holes brings all the molten metal repeatedly to the top, where all suspended matter is released and then floats. Hence there takes place a kind of mechanical refining of the metal.

The loss of brass in the ashes in the ordinary fuel melting processes, is, of course, entirely avoided. This, together with the practically negligible loss of zinc as fumes, means a saving in the metal, and the value of the metal thus saved goes well toward paying for the current.

The wearing away of the walls of the heating holes was at first expected to be an important matter, but this wear seems to be either negligible or entirely absent even in steel furnaces, in which the temperatures are much higher; the latter become coated with a black layer which seems to replace itself as fast as it wears away. In brass furnaces, when care is taken not to let any slag get into the holes on emptying the furnace completely before a shut-down, the walls of these holes remain clean and smooth, and are entirely unattacked.

The cost of relining, which takes the place of the cost of the crucibles in fuel furnaces, will not be great, being no doubt considerably less than the cost of the crucibles. In the improved type, with the heating holes coming in from the side instead of from the bottom, the relining is a simple matter.

The flow of metal in the heating holes is downward at their circumference and upward in the centre; the outward velocity is by far the greater; the flow is steady and not intermittent.

A large amount of heat can be carried out of these holes effectively by the rapidly flowing metal; it exceeds that of a row of electric arcs in those holes. At present about 25 to 50 KW. are converted into heat in each hole (or, roughly, about 90,000 to 200,000 B.T.U., or 20,000 to 45,000 kg. cal. per hour) with the probability that this can be considerably increased. The correct proportioning of these holes and the current is of great importance. These proportions are quite different for brass and for steel. The furnace must be especially designed for each metal, though variations in the compositions of brasses and bronzes can be taken care of in the same furnace by regulation of the electric current.

Even copper with its very low resistance can be melted commercially in these furnaces without requiring unpractical proportions. The higher the electrical resistivity of a metal the better the proportions become.

The rapid flowing of the metal in the heating holes, which is the basis of this type of furnace, is a phenomenon based on the use of a large current, hence these furnaces must be operated with low voltages and great amperage. For this reason the currents are best converted by transformers attached directly to the furnace, as long leads for such large currents would be expensive and troublesome.

Our researches have shown, however, that the currents may be much smaller than was at first supposed. Our brass furnace is running with about half the current originally intended and double the voltage. This is due to the development of an unexpectedly high counter-electromotive force, which is a very favourable feature, as it improves the proportions of the furnaces, by enabling lower currents to be used. The energy represented by this counter-electromotive force is also converted into useful heat.

Under normal conditions the current is perfectly steady, hence these furnaces become a very desirable "load" for central stations, and may for this reason be granted lower rates, especially as the current need not be cut off during pouring, and because the furnace could easily be cut out of circuit (except for a small current to keep it hot) during the time of the so-called "peak" loads, during which the charges for current are necessarily somewhat higher.

Should the ammeter needles start to oscillate it means that the columns of liquid metal in the holes are parting either because the level of the liquid metal above the holes is too low, or in the case of zinc alloys, that the temperature is unnecessarily high, causing some zinc to volatilise and form bubbles in the heating holes. In either case the addition of some cold metal will at once stop it. The operator soon learns how to avoid both.

Any of the usual alternating currents used for lighting or power can be adapted to this furnace, as they are always transformed at the furnace to the required voltage and current. Single-phase, two-phase or three-phase currents can be used without any complications, there being then two, four or three heating holes; three-phase current is probably the best, and is the kind most generally available. Any frequency may be used, although, of course, the lower the frequency the better.

The power factor of this furnace, even with 60 cycles, was found to be in the eighties and nineties, and even this small reduction from 100 per cent. was no doubt largely, if not all, in the transformers, and could be avoided by a better design of the transformers. In a steel furnace with a frequency of 25, the power factor was practically 100 per cent.

As the top and all but one side are free from all electric appliances, the slag or skimming doors, spout, feeding hopper, roof, &c., may be located and constructed as the owner prefers. The furnace may readily be made to tilt around the spout or lip as a centre, thereby facilitating casting directly into moulds, which saves considerable expensive superheating and labour.

This type of furnace is applicable to quite small as well as to quite large sizes.

In melting many tons of light, curly and oily brass chips with much mechanically mixed iron, we cast in the form of clean ingots nearly 8 lb. per KW.-hour delivered to the furnace transformers.

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equal to about 12·5 KW.-hours per 100 lb. poured; a considerable portion of this energy went into the dross and was lost through the open hopper, through which the cold charge had to be "poked." Moreover, the transformers were not working properly and were wasting much heat, and in this particular furnace there were four electrodes (for a two-phase current), instead of only three (for a three-phase current), which latter would be more general, hence the electrode losses were greater than they would be normally; and the electrodes had been proportioned for a much larger current, hence were unnecessarily wasteful in heat loss.

Short runs, with clean ingot charges, indicated that, even with these easily-avoidable excesses in the losses, 10 lb. per KW.-hour could be obtained in this furnace, hence, in better designs, even better efficiencies than this can reasonably be expected. But this figure depends largely on the amount of superheat required by the particular foundryman.

The economy of the electric melting could be greatly increased by preheating the charge with a fuel flame, preferably in an auxiliary furnace, to only such a temperature at which no oxidation takes place. Nearly half the melting heat could thus be introduced into the metal whereby the economy of the electric heating could be nearly doubled. Such low temperature heat is more cheaply produced by fuel, while the high temperature heat is introduced into the metal more cheaply electrically, hence this combination of both gives the best total economy.

Comparative costs with fuel furnaces can be only crude because the data concerning them differ so very greatly in different foundries. But taking what appear to be fair general averages largely from the recent Bulletin 73 of the Bureau of Mines compiled by Dr. H. W. Gillett, the following rough comparisons can be made:—

He concludes that the average loss of metal in fuel furnaces is about 2·5 per cent. per melt; it is probably greater in most foundries. We will assume this low figure and allow ½ per cent. for the electric furnace. Limiting this comparison to only the fuel or current, the crucibles and the loss of metal, gives the following per 100 lb., assuming $4 per gross ton for the coke, and the average value of the metal as 10 cents per pound, based on the present low metal value; ordinarily it averages about 50 per cent. higher:—

	Cents.
Tilting, forced draught, coke, furnaces:	
Coke, 20 lb.	3·6
Metal loss, 2·5 lb.	25
Crucibles	6
Total	34·6
Open flame, tilting, oil furnaces:	
Oil, 3 gal. at 4 cents	12
Metal loss, 3 lb.	30
Relining	1·2
Total (to which should be added the cost of the compressed air blast)	43·2
Electric furnace:	
Power at 1 cent per KW.-hr. and 10 lb. per KW.-hr....	10
Metal loss, ½ lb.	5
Relining	1·2
Total	17·2
Power at 1·5 cents per KW.-hr., and 8 lb. per KW.-hr.	18·8
Metal loss, ½ lb.	5
Relining	1·2
Total	25·0

The labour cost for charging, pouring and attending to the operation of the furnace may be the same, but the costs of starting the fires and for the handling of the coal and ashes, are absent in the oil and electric furnaces, and should, therefore, be added to costs for the coke furnaces. In the wrought brass industry there is a saving of labour with the electric furnace due to larger ingots, which would no doubt be a much greater item than the difference in cost of melting.

In the above tabulated data, taking as an average 38 cents per 100 lb. for coke furnaces and 20 for the electric, the saving in a plant melting 20 tons per day would be nearly $22,000 per year of 300 days; or for oil furnaces at 43·2 and electric at 20 cents, the saving would be nearly $28,000 per year, which should be credited to the first cost of the electric furnace.

In estimating the cost of melting it is important to consider not only the items tabulated above, but also the cleanliness of this "boiled" metal, the avoidance of oxidation or of the formation of sulphides, the possible uniformity of temperature, the production of any desired superheat, the possibility of casting directly into the moulds with its saving of labour, the comfort of the labourers, the economy of floor space, the increase of output by running day and night, the absence of handling of coke, ashes, oil, compressed air, &c., the saving of time in starting fires, &c., all of which have a money value also which may in some cases be even a large factor than the mere cost of the power alone. On the other side of the account is the cost of the furnace, the cooling water, its attendance (one man who could easily attend to several furnaces), and the relining; under normal running conditions there is nothing about the furnace which is consumed or wears out except the lining; the electrodes are not consumed. This furnace gives the owners of a foundry increased opportunities to carry out what is known as scientific management, or, in other words, to get the best returns per dollar invested in the plant and in its operation.

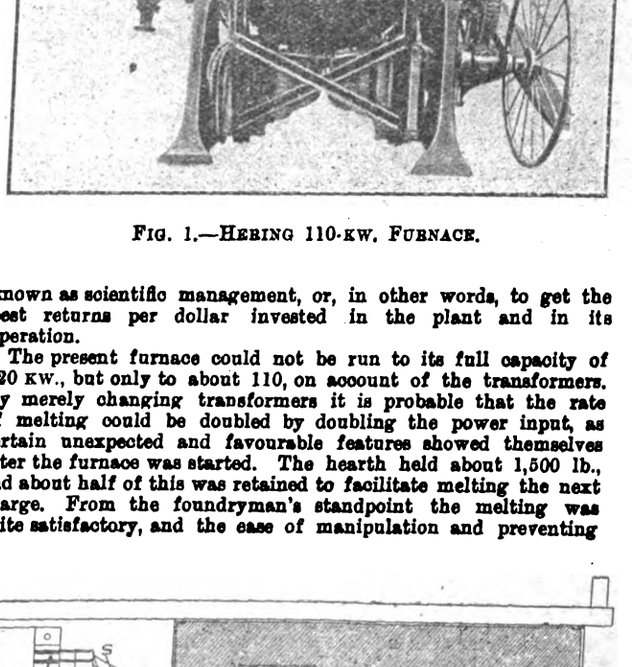
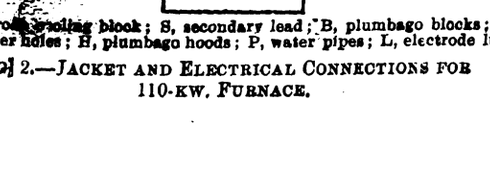


Fig. 1.—Hering 110-kw. Furnace.

The present furnace could not be run to its full capacity of 120 KW., but only to about 110, on account of the transformers. By merely changing transformers it is probable that the rate of melting could be doubled by doubling the power input, as certain unexpected and favourable features showed themselves after the furnace was started. The hearth held about 1,500 lb., and about half of this was retained to facilitate melting the next charge. From the foundryman's standpoint the melting was quite satisfactory, and the ease of manipulation and preventing



E, electrode cooling block; S, secondary lead; B, plumbago blocks; R, resister holes; H, plumbago hoods; P, water pipes; L, electrode lugs.

Fig. 2.—Jacket and Electrical Connections for 110-kw. Furnace.

T, transformer; S, secondaries; R, resisters; TR, trunnion; O, crucible; SP, spout; WB, water block; E, electrode.

Fig. 3.—Jacket and Electrical Connections for 150-kw. Three-phase Furnace.

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loss of metal leaves little to be desired. When closed there was no sensible radiant heat from the outside.

The development of this type of furnace involved many difficulties largely because it was an entirely new and somewhat radical departure from existing practice, hence no precedents existed. All the data for constructing it had to be found out experimentally, and each trial furnace had to be run to destruction to bring out its weak points. Our scrap heap contained probably about 50 furnaces.

The electrodes, which are of metal, are necessarily liquid at their hot ends and solid at the cold ends, hence must be carefully designed and proportioned, so that on the one hand they do not melt back too far, and on the other hand do not carry off too much of the heat. The earlier troubles with the lining were overcome after finding suitable materials and tamping them especially compact with a pneumatic rammer. In brass furnaces the possible troubles due to cracks in the lining around the heating holes and electrodes, whereby electrical short circuits might occur by the metal entering the cracks, were completely overcome by enclosing these parts of the furnace with hoods made of the tough plumbago used for making crucibles.

The outside of the 110-KW. furnace is shown in fig. 1. It is a two-phase furnace. The two transformers are seen underneath; they tilt with the furnace. For each transformer there are two vertical heating holes, thus making each transformer independent of the other. A three-phase furnace with three transformers, three electrodes and three heating holes, would be better. Fig. 2 is an outline and diagrammatic vertical cross-section in which B are the heating holes or resisters. In a later and better design the hearth, electrodes and heating holes are arranged as in fig. 3, which makes the relining and repairs of the heating holes easier than when they are at the bottom, as they are in figs. 1 and 2. This improved form also permits of turning around the spout as a centre, which is considered by many to be an important advantage, and which does not exist in the form in fig. 1.

The furnace shown in fig. 1 has been criticised for being so large outside; but thick walls economise heat, which is more important in electric than in fuel furnaces, as the cost per unit of heat is greater. Bricks are cheaper than kilowatts, hence the first investment in thicker walls was more economical than to suffer the continued losses of expensive kilowatts.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

20,540. "Electrical heating apparatus." R. H. Best & H. H. Cressall. October 5th.

20,549. "High-voltage insulated cable." C. J. Beaver & E. A. Claremont. October 5th.

20,551. "Magnetic separation." S. Bruck. October 5th. (Addition to 11,898/11. Convention date, October 4th, 1913, Germany.) (Complete.)

20,552. "Magnetic separators." S. Bruck. October 5th. (Addition to 11,898/11. Convention date, October 3rd, 1913, Germany.) (Complete.)

20,556. "Switch for testing telegraph lines." E. D. Gledall. October 5th. (Complete.)

20,557. "Electric current transmission systems." British Thomson-Houston Co. (General Electric Co., United States.). October 5th.

20,563. "Electric switches of the tumbler type." A. S. Blackman & S. R. Windle. October 5th.

20,580. Electric Lamp Holders. J. H. Collie. October 6th.

20,587. "Instrument for testing low-tension magnetos as used on internal combustion engines." E. J. Davis. October 6th.

20,595. "Fluorescent screen localiser with combination of stereoscopic photographic attachment for use with the X-rays for localising bullets and other purposes." T. Clark. October 6th.

20,603. "Attachment to prevent theft of electric lamps or globes." H. Maddick. October 6th. (Convention date, February 19th, 1914. Australia.) (Complete.)

20,633. "Accumulator cells made of ebonite or the like." E. S. Seymour and St. Helen's Cable & Rubber Co., Ltd. October 7th.

20,636. "Telegraphic gun." H. A. Whincup & H. Whitaker. October 7th

20,646. "Electricity meters." Simplex Conduits, Ltd., & L. M. Waterhouse. October 7th.

20,650. "Apparatus for generating high-tension electricity." J. E. James, J. B. Wilkie, A. Kenyon & W. Torrance. October 7th.

20,671. "Electrodes for secondary batteries." A. Connell & H. S. Hoine. October 7th.

20,687. "Means for rendering air-, damp-, and water-tight the junction of electric wires or cables with boxes or casings containing electric apparatus and the like." A. Holmes & T. H. Brierley. October 8th.

20,695. "Electric fuse or cut-out boxes having multiple ways." C. F. Parkinson, A. H. Railing & C. C. Garrard. October 8th. (Complete.)

20,714. "Apparatus for bleaching by electrolysis." J. F. Webb & Sir William W. Williams. October 8th.

20,728. "Electrical heating-elements." G. H. Collins & H. F. Collins. October 8th.

20,718. "Electric arc lamps." F. Proctor. October 8th.

20,776. "Electrical igniting-apparatus for internal combustion engines." F. E. Wilson & W. A. Shepherd. October 9th.

20,782. "Electric machines." E. Marelli. October 9th. (Convention date, October 25th, 1913. Italy.) (Complete.)

20,783. "Electric machines." E. Marelli. October 9th. (Convention date, May 6th, 1914, Italy.) (Complete.)

20,784. "Electric machines." E. Marelli. October 9th. (Convention date, March 21st, 1914. Italy.) (Complete.)

20,786. "Methods and apparatus for the determination of the complex energy delivered by alternating currents." R. Arno. October 9th. (Addition to 9,580/10.) (Complete.)

20,790. "Electric heaters." C. R. Belling. October 9th.

20,796. "Electric switches." F. B. Holt & H. Smith. October 9th. (Divided application on 25,833/13. May 11th, 1914.) (Complete.)

20,803. "Coin-freed apparatus for testing manual strength of pull and electric circuit endurance." W. Keast. October 10th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

13,157. Railway Block Telegraph Indicators. A. T. Blackhall & C. M. Jacobs. June 6th.

19,125. Telegraphy. F. G. Creed, and Creed, Bille, & Co. August 22nd.

21,029. Electric Glow Lamps. C. O. Bastian. September 17th.

21,191. Illuminators or Reflectors applicable to Electric and other Advertising Signs and the like. H. Goulton. September 19th.

21,472. Magneto-electric Machines. F. L. Hollister. September 23rd.

21,921. Telephone Exchange Apparatus. D. H. Kennedy & J. W. Turner. September 29th.

21,997. Electrically-heated Hot Air Syringes used in the Practice of Dental Surgery. G. F. Gadd & Western Dental Manufacturing Co. September 30th.

22,146. System and Apparatus for High-speed Telegraphy. J. Gell. October 1st.

22,402. Electric Cooking Ovens. B. Thomas & E. Thomas. October 4th.

23,492. Electrical Cut-outs or Fuses. L. A. Waller & E. D. Rodway. October 17th.

24,560. Electrolytic Apparatus. J. T. Niblett. October 29th.

25,144. Production of Alkali Metal Alloys by the Electrolysis of Alkali Hydroxide in the Molten State and in the obtainment therefrom of Alkali Metals and Alkali Metal Compounds. E. A. Ashcroft. November 4th.

25,477. Electrical Switches or Circuit-breakers. B. Holt & H. Smith. November 7th.

26,623. Voltage Regulators for Electric Generators. A. H. Olmstead. November 19th.

30,017. Electric Bells. H. C. Tudor. December 31st.

1914.

231. Suspenders for Electric Cables and the like. P. Huntington. January 5th.

719. Sparking-plugs for Internal-combustion Engines. F. H. Bluemel & Bluemel Bros., Ltd. January 10th.

5,346. Electric Diaphragm Horns or Alarms. W. W. Dean. March 2nd. (March 15th, 1913.)

5,693. Electric Contact Devices for Arc Lamps, Variable Resistances, and the like. A. T. Dowdell. March 6th.

10,473. Electric Diaphragm Alarms. Thomas Crosbee & Sons, Ltd., and T. S. Rogers. April 28th.

12,983. Electrically-operated Lock for Railway Carriage and other Doors. J. W. Wollers, A. McCaw, & A. Wollers. May 27th.

The Electric Vehicle Committee.—A meeting of this Committee was held on October 2nd, when the final design for the standard sign for charging stations and garages was approved; it may be made up either as an illuminated sign or as an enamelled iron plate sign. The Committee inspected a sample standard charging plug and receptacle submitted to it by Messrs. Reyrolle and Co., and, having approved of it, ordered it to be submitted to the Engineering Standards Committee.

With reference to the specification for this plug, published in the Electrical Review, pages 447 and 448, the Committee decided to amend slightly the wording referring to the handle of the plug in which is embodied the cable gripping device, and to make it read that the handle can be made of malleable cast-iron. It was also decided to give the option of making the outer shell of the plug or receptacle from galvanised steel or bronze tubing.

The secretary reported that the contributions to the working fund received to date totalled £129, and there were still some promised contributions to be received.

The Committee has already fixed the standard range of charging voltage as from 85 to 120 volts, and it was decided to make it clear that this voltage was suitable for 44 lead plate cells as a maximum.

In view of the experience that a gong was not sufficient for clearing a way for the electric vehicle in crowded streets, the opinion was expressed that a loud electrically-operated horn was the best type of signal.

It was decided to invite Mr. Percy Still, the engineer and manager of the Chelsea Electric Supply Co., to become a member of the Committee.

Fans v. Fire.—The use of electric fans as an adjunct by a fire department in putting out a blaze appears to be novel. In Boston not long ago a fire broke out in the basement of a building occupied by a wholesale paint and chemical concern. The fumes and smoke became so thick that it was impossible for the firemen to enter the basement or direct a jet with any effectiveness, when someone thought of electric fans. Half-a-dozen of the ordinary 16-in. size were requisitioned by the fire chief, and their breeze was directed down the stairway. After the rear basement windows had been broken to allow of the escape of the smoke and fumes, the fans gradually cleared the basement, so that the firemen could work quickly and effectively in extinguishing the flames.

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Vol. LXXV.] CONTENTS: October 30, 1914. [No. 1,927.

	Page
The Practical Training of Engineers	577
South American Trade	578
The Lead Position	579
U.S.A. Safety Rules for the Operation of Electrical Equipment and Lines	580
The Other War	581
The Electrical Trades and the War	582
New Electrical Devices, Fittings and Plant (*illus.*)	583
Legal	584
War Items	585
Business Notes	587
Notes	592
City Notes	596
Stocks and Shares	599
Market Quotations	600
Large Induction Motors: Some Features of Mechanical Design, by G. Moores (*illus.*) (*concluded*)	601
High-Speed Electric Passenger Locomotive (*illus.*)	604
The British Empire—and our Work in it, by F. Bailey	604
A Transmission System Suitable for Heavy Internal Combustion Locomotives, by H. J. Thomson (*illus.*)	605
Correspondence—	
Street Lighting in Chicago	607
The Trade War	607
War on German and Austrian Trade	607
Commutator Bars	607
Armorduct *v.* Defries	607
Trade Statistics of Newfoundland	608
New Patents Applied For, 1914	608
Abstracts of Published Specifications	608
Contractors' Column	Advertisement page xviii

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THE PRACTICAL TRAINING OF ENGINEERS.

THE Institution of Civil Engineers has rendered signal service to the engineering industry generally by keeping in view not only the practical side of the engineer's training, but also his general and technical education. From time to time inquiries and conferences have been held under the auspices of the Council, and we have before us a report of the Special Committee appointed by the Council in 1912 to consider the Practical Training of Engineers, this report having been adopted by the Council on July 7th this year. As far back as 1868 an exhaustive inquiry was made by the Institution into the conditions and systems of education in the United Kingdom, and in foreign countries; the results of this inquiry were published in the year 1870. Again, in 1891 another statement was published dealing very fully with the facilities afforded at that time by the engineering schools of universities and colleges within the British Dominions. In the year 1903 the subject was again discussed at an engineering conference of the Institution, and also at the meetings of the Institution of Mechanical Engineers, the Institution of Naval Architects, the North-East Coast Institute of Engineers and Shipbuilders, and other important engineering societies outside London. Very wide differences of opinion were manifested as to the best methods of training engineers, but there was a consensus of opinion throughout the industry that the time had arrived for a thorough investigation of the subject by some body representative of all branches of engineering, whose conclusions would command the attention of all who were interested in the education and training of engineers. This general desire found expression in a letter addressed by the President of the Institution of Mechanical Engineers in May, 1903, to the President of the Institution of Civil Engineers, in which it was stated that the Council of the former considered it desirable that a Committee of the Institution of Civil Engineers should be appointed by the Council to consider and report upon the whole subject of engineering education. The immediate outcome of this letter was the formation of a Committee, which included representatives from practically all the leading engineering societies in the country. The Institution of Electrical Engineers was, on that occasion, represented by the late Mr. R. K. Gray. As a result definite recommendations were made in a report presented by the Committee in 1906, with respect not only to engineering training but also to preparatory education.

It is one of the stock complaints of technical teachers that the youths who come to them for technical instruction are generally so imperfectly grounded in mathematics and other elementary subjects that a considerable amount of time which could more profitably be devoted to specific technical subjects has to be allocated to the teaching of the elements of general education. Without going into much detail, we may summarise the recommendations of the Committee referred to as follows:—It was considered that the standard of education for a boy intended for the engineering profession should be equivalent to that required by the Institution Studentship Examinations, and that his specialised training should not commence until about the age of 17 years. It was desirable also that a leaving examination should be held generally by secondary schools, the standard being equivalent, say, to a matricu-

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lation examination of the Universities and Colleges. Advanced history and geography, and essay and précis writing should be included in the ordinary school curriculum, and an introduction to English literature should form part of the English subjects taught. Whilst Latin was considered desirable, Greek was not necessary; but Latin should be discontinued during the last two years of attendance at school. French and German should be taught colloquially, and instruction in mathematics should be given by methods differing considerably from those usually adopted, which appeared to treat the subject merely as a mental exercise. It was particularly urged that the instruction in practical arithmetic should be carried further than had been generally the case hitherto, particularly with the object of encouraging the use of contracted methods, and operations in mental arithmetic. A general knowledge of elementary physics and chemistry should be acquired, and special attention should be given to drawing, including geometrical drawing with orthographic projection, curve drawing, freehand drawing and practical mensuration. Handicrafts such as carpentry or turning, or elementary field surveying, might be encouraged as a recreation, but not as a school exercise.

On the subject of engineering training, the recommendations of the Committee were briefly as follows:—The practical training should be divided into two parts whenever possible, the preliminary stage to consist of at least one year spent in mechanical engineering workshops. [It is important to note this, because there is a wide divergence of opinion as to whether the workshop training should precede or succeed technical college training.] The alternation of college study and practical training, that is to say, the sandwich system, was only feasible when (as in Scotch Universities) the college vacation practically occupied half the year. It was further recommended that at least three to four years should be spent in practical training, including the above-mentioned preliminary workshop course, and that as regards the technical training, facilities for post-graduate work by engineering students should be considerably increased with a view to the encouragement of special research work. Whilst this inquiry was proceeding an inquiry was also conducted by the Association of Technical Institutions as to the co-operation of employers in the technical training of their apprentices, and a comprehensive report was issued in 1905, in which the work at the leading technical institutions and polytechnics was described, and also the nature of the apprenticeship systems in vogue in many of the large engineering works.

These two reports have had an appreciable influence in concentrating attention on the allied subjects of engineering training and the apprenticeship system, and there has been a real attempt in the meantime to take advantage of the various recommendations which were made with a view not only to improving the methods of general and technical education, but also to bringing about some kind of co-operation between employers and technical institutes. The question of apprenticeship is a two-sided one, as it deals, first, with the rank and file, whose ultimate object is to become skilled artisans, and, secondly, with those more highly-educated youths who hope to become professional engineers. It is with the latter that the Institution of Civil Engineers, and, in fact, all the learned engineering societies, are chiefly concerned.

Following up its previous work, the Institution of Civil Engineers held a Conference on the Education and Training of Engineers in June, 1911, under the presidency of Mr. Alexander Siemens, the then president of the Institution of Civil Engineers. This Conference was divided into three sections, dealing with—(1) General Education; (2) Scientific Training; and (3) Practical Training.

Whilst no definite resolution was adopted by the Conference, the trend of opinion was to the effect that the Council of the Institution should use its influence to secure a continuity of study between those public schools where the elements of science are taught and the Universities and Technical Colleges. This would mean that the course of education at the one would begin where that at the other left off, so that a pupil leaving a public school and entering a University or Technical College would not have to start from the beginning and go over most of the ground he had already covered, but would be able to take up at once a specialised course of engineering study.

With a view to facilitate the above it was the view of the Conference that a close connection between the masters who taught science in public schools and the Institution of Civil Engineers was desirable, and that the Council of the Institution should endeavour to induce the Universities and Technical Colleges to adopt such courses of study, say six months during the winter, that the "sandwich" system could be adopted if desired, a system which is not possible with the "terms" now customary. It was also suggested that the Council should endeavour to produce some co-ordination between the colleges and engineering employers so that properly qualified students might be able to get practical training for a period of, say, 24 to 36 months on the sandwich or some other system when vacancies occurred in the works of such employers.

As an outcome of the suggestions of the 1911 Conference a special Committee was appointed by the Council of the Institution of Civil Engineers in 1912 to consider the following questions:—

1. Whether any steps can be taken to define more clearly the conditions of the practical training in the various branches of the engineering profession required by the by-laws.

2. Whether any steps can be taken to establish some co-ordination between engineering colleges and engineers and other employers, so that the practical training of well-educated students may be facilitated.

It will be appreciated that in appointing a Committee of Inquiry the Council took note of the suggestions of the 1911 Conference, and, moreover, gave to the Committee an additional subject for consideration, namely, the question as to the kind of practical training which adequately meets the conditions contemplated by the by-laws. The expression "training" is defined as "opportunities of observing and acquiring some experience of the varied operations incident to the particular branch of engineering pursued, which opportunities should be suitable to the needs of young engineers whose aim is the design and direction of engineering work."

The kind of regular training contemplated by the by-laws is a regular pupilage or apprenticeship by those who do not receive systematic collegiate technical education; or, a full three-year course in good engineering colleges with a shorter period of practical training. But the conditions of apprenticeship are not what they were when the by-laws were formulated, and many youths pass through a works without any written indentures at all. In fact it is shown by the replies to the specific questions put to employers by the Committee that 25 per cent. of the employers do not take pupils or apprentices at all, whilst 25 per cent. of those who are called apprentices are not bound by any indentures or legal agreement.

The period of practical training (which here means either "workshop" training or time served with a consulting engineer) ranges from two to five years, depending upon the nature and extent of the technical training previously received. It is the absence of a written agreement or indentures of apprenticeship, or even a certificate from the employer that a regular course of workshop training has been gone through, which makes it so difficult to form a judgment as to the qualifications of candidates presenting themselves for admission to the Institution.

The report covers over 60 pages of printed matter, and contains so much that is of general interest to engineers that we propose to deal with the evidence presented to, and the conclusions arrived at by, the Committee in a future issue.

South American Trade.

The *Engineering Record* of August 22nd, falling into line with other United States journals, asks "Who will supply South America's needs?" and quotes the views of a number of men said to be thoroughly familiar with South American conditions. Our contemporary says:—"American exporters can accomplish now, literally (*sic*) in a few days, what they could not have done in 50 or 100 years had not this Continental conflict showed the way."

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To this, in London, the obvious reply is: "We don't think." And the difficulties that our cousins are going to meet are not ignored by the authorities who contribute to the above-mentioned symposium.

The Argentine Ambassador, for example, points out that it will be necessary for the American manufacturer to change his business methods; he cannot obtain trade by postal circulars—travelling salesmen familiar with the country are indispensable, and tenders should be delivered in person, not through the post. Banking facilities are being arranged, and it is for Americans to supply the ships. Mr. M. A. Oudin, manager of the foreign department of the General Electric Co., U.S.A., draws attention to the economic depression in South America, which has been intensified by the war, and the lessening of the purchasing power of S.A. countries by the partial closing of European markets to their products. The essential elements in the exploitation of manufactures abroad, he says, are representation, price, and quality. "What America is especially weak in abroad is personal representation. The splendid machinery used by England in her foreign trade has been built up during a century. . . . What we need most abroad is American business houses. Until our small manufacturer can sell his goods through such concerns established abroad his business is bound to be more or less intermittent. . . . In the beginning American manufacturers should make up their minds to spend a large amount in investigations of foreign markets. They should expect no return for the first year or two."

Another authority says that all the efforts of the American manufacturers can avail nothing unless they can create a merchant marine quickly, and this point is further emphasised by Dr. E. L. Corthell, a consulting engineer of wide experience in South America, who shows that neither of the countries concerned possesses the necessary deep-sea shipping. The latter also warns his fellow-countrymen that to capture S.A. trade will be no easy task, while another engineer, Mr. Fred. Lavis, takes a very moderate view of the chances of the United States, which has no capital to lend, and will itself be hampered by the loss of European loans.

Mr. Lavis recognises that England will be able to continue manufacturing without great interruption, and that South American countries will limit their purchases to urgent needs.

Since writing the above, it has been brought to our knowledge that the publishers of the *Engineering Record*, and other well-known journals, have set on foot inquiries in South America with a view to ascertaining the requirements of that country, and bringing United States manufacturers into touch with purchasers who formerly obtained their supplies from European sources. One of their circular letters, which we have before us, states that "under ordinary conditions, we would send men to South America to secure first-hand the information that we must have to carry out our plan. The exigency of the situation, however, demands more immediate results than would be obtained in this manner. We have concluded, therefore, to ask for assistance in a limited way from a few men, like yourself, who are acquainted with conditions both in the United States and in South America." The letter goes on to ask for the names and addresses of men who are interested in the electrical industry, and for particulars of the immediate and probable needs for electrical machinery and supplies in the neighbourhood of the addressee. It is clear, therefore, that the United States electrical manufacturers are at the foot of the ladder; they do not know what is wanted by South America, nor are they acquainted with the local conditions, or the men in charge of industrial enterprises. We, on the other hand, are well established there. In Argentina alone we have invested 500 million pounds, and our total exports to that country in 1912, which showed an increase of nearly 10 per cent. over the previous year, were almost equal in value to those of Germany and the United States combined. A British Chamber of Commerce has been established in Buenos Ayres (643, Calle Sarmiento), to which British inquiries can be addressed, and our interests are otherwise well represented.

We think our electrical manufacturers need not have a moment's uneasiness with regard to the future of their trade with South America; the odds are all in their favour. Even if the United States were able to secure half of Germany's trade with that continent, the other half would be a prize well worth our capture, but so great are the difficulties in the way, that our only present rival will find the task a very arduous one, which, moreover, far from being mastered in a few days, will take years to accomplish. We are there already; and if our campaign is well conducted, and the purchasing power of South American countries improves, the diversion of the trade to our workshops ought to prove an easy process. But it will not merely "happen"; energetic and sustained action is necessary on our part, and no time should be lost in commencing the attack.

The Lead Position.

The lead market has become rather quieter with less pressure of inquiry from Russia. Russian buying has been of the greatest assistance to the market for some weeks, and the time when shipments to our great northern ally are rendered impossible because of the stoppage of navigation in the Arctic port of Archangel (which is the enforced destination of the goods being sent into the country through the practical closing of the Baltic by Germany) is awaited with some anxiety. It is much feared that the cessation of shipments of lead to Russia would have a bad influence upon selling prices of lead, but this remains to be seen. The restriction of production at the mines and smelters in Spain, and particularly in Australia, is bound to be of prime importance upon the position sooner or later, but it is doubtful whether output or consumption has suffered the more severely since war broke out. In Australia there has been some resumption of work at properties which had been stopped entirely, and the directors of the Zinc Corporation have now intimated officially that an arrangement has been made with the Broken Hill Prop. Co., to smelt a reduced tonnage of leady concentrates from the corporation's lead mill. It is estimated that this will enable the corporation to keep the lead mill running half-time, and operations on this basis will be resumed on November 2nd. The arrangement appears to have been dictated not by reason of any belief that the world wants the lead thus to be produced, but to give employment to labour on the spot. Meantime, there has been a steady and regular quantity of lead coming forward from overseas, and America is quite a ready seller. There is no doubt that in the United States financial conditions have been, and still are, difficult, and that the desire to turn lead into gold exists in full measure. This is not to be wondered at, but equally so the downward tendency of prices during the past six weeks contains nothing which need cause surprise. The general home trade is very poor, though here and there the rollers report that they are doing a trifle more than they were in sheets and pipes, but there is a great deal of leeway to be picked up, and the complete restoration of industrial activity is far ahead at present. The situation of lead in common with that of most metals, and many other commodities, hangs largely upon the developments in France and Belgium. If it so happened that the Allied forces could wrest a decisive victory from their foes, then all business here would improve, for the market is really dependent to an abnormal extent upon sentiment. Hence it is that the progress of the military operations is being watched with tense anxiety. That we and our Allies can possibly fail in the end is not a matter for speculation, for we all know that Germany is doomed, but we want a definite lead now, before trade and finance will begin to take the forward path again. The main consumptive demand comes still from Government contractors, and the mere peace uses of the metal occupy a secondary position. There cannot be any alteration in this respect until the war news frees some of the clogged wheels of trade. So far as supplies are concerned the American position is uncomfortable, but there is an idea in well-informed channels that prices across the Atlantic are near the bottom, and that the reduction there has really been partly forced to compel producers to restrict.

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U.S.A. SAFETY RULES FOR THE OPERATION OF ELECTRICAL EQUIPMENT AND LINES.*

The growth of Compensation Laws in the United States has emphasised the necessity for the adoption of safety rules for the electrical industry as well as for other industries. As each State makes its own laws, there is no legislation corresponding to our Factory Acts or Electric Lighting Acts, and there are no Government Departments equivalent to our Home Office or Board of Trade to make or enforce safety regulations throughout the States as a whole. As regards the electrical industry, only one State has at present adopted any safety rules.

Under a special authorisation by Congress, the National Bureau of Standards has recently been conducting an investigation of life and property hazards and a study of safe operating practices and safe methods of working in regard to electrical equipment and lines.

The necessity for such an investigation is evident from the fact that in the year 1913 there were no fewer than 450 fatal electrical accidents. The inquiry has been very thoroughly carried out by the engineers of the National Bureau. Several of the States have independently formed commissions to inquire into the subject. The Bureau of Standards has conferred with these commissions, and has consulted both company officials and employés. Analysis of the available electrical accident data has shown a large proportion of accidents to be preventable by the observance of definite operating precautions. Both practice and results have been found to vary widely in different localities, and hence local opinion and custom are not a sufficient guide for commissions and companies desirous of securing adequate protection. Rules having their source entirely in local experience or in casual exchange of experiences are liable to be open to the objection that precautions are prescribed to prevent a particular class of accident only after such an accident has occurred. They may thus permit the occurrence of accidents which might be avoided by the observance of rules proceeding from a broader study and experience. Thousands of the smaller companies, in the absence of sufficient data and experience to prepare rules, have no printed rules in effect.

After careful comparison and analysis of existing sets of rules, the Bureau of Standards has drawn up and now offers for criticism and discussion a code of rules which it is suggested should be adopted generally throughout the States. It is pointed out that each rule has been subjected to careful scrutiny, and that the needs of the class of workers to which any rule is addressed have been kept constantly in mind and the workers of this class freely consulted. The resulting code of rules deals entirely with the question of safeguarding operation; it does not include the equally important aspect of the subject—the construction and protection of the apparatus and conductors which have to be operated. At first sight this may appear to be putting the cart before the horse. Investigation of electrical accidents in this country, as shown in the annual reports of the Chief Inspector of Factories, shows that at least as many accidents are due to the absence of proper protection of apparatus and conductors or to faulty design as to neglect of proper care in working. It is obvious, however, that the more dangerous the apparatus and arrangement of conductors, the more necessity there will be for safety rules as to their operation.

It is some years since the writer of this article visited the States, but at that time it was very evident, and it is even now admitted by Americans, that the matter of protection of apparatus and conductors with a view to safeguarding the attendants and other persons employed has been very much neglected, and the standard of safety is generally very much lower than in this country. In Canada also it is no better. As an example, the writer recently received from a young electrical engineer of his acquaintance who had gone to Canada, a letter giving an account of some of his experiences. He had obtained work with an electricity supply company in a fairly large town. On the second day he was there a man was killed by electric shock, but of this he gave no details. He himself received a bad shock a few days later from an unearthed switchbox. The description of the conditions under which he was working at the time of writing shows an amazing disregard for safety on the part of the company. His job consisted of cutting up and tapping metal conduit at a bench placed in a room used as a workshop at the back of a 10,000-volt switchboard with bare and entirely unprotected conductors within six feet of the vice at which he had to work! No amount of "operating" rules could be of any use for ensuring safety when such conditions as this are permitted. The actual use of a high-tension switchboard chamber as a workshop, as in this case, may be of exceptional occurrence, but reports from engineers visiting both the States and Canada show that unnecessary exposure of conductors and apparatus is very much more general than in this country. Whilst having no desire to minimise the value of carefully considered operating rules, it appears to the writer that the value of such rules in reducing the number of accidents must be largely discounted if at the same time there are no regulations in reference to the protection of conductors and apparatus. It is much more effective to screen off conductors where practicable so that they cannot be accidentally touched than to tell persons who have to pass or work near them that they must not touch them or go within a certain prescribed distance.

It is satisfactory, however, to note that the Bureau of Standards is not neglecting the other side of the question, and that rules for construction, installation and maintenance of electrical equipment to safeguard employés and the public are in course of preparation. Such rules should naturally come before operating rules, but as they no doubt are more difficult to frame, and as a considerable time must necessarily elapse after they are issued before they can be effectually complied with, the decision of the Bureau of Standards to issue the operating rules which can be adopted without delay, and without waiting for the completion of the structural rules, is no doubt the best in the circumstances.

The scope of the rules includes all operation on or about generating stations, sub-stations, private plants, power lines, signal lines, tunnels and subways, and testing departments. The rules are divided into three sections. The first comprises rules applicable to the employer, the second general rules applying to the employé, and the third special rules for the employé according to the class of work he is engaged upon. The rules for the employer deal firstly with organisation, and provide that each employé shall be furnished with a copy of the rules, and with an organisation diagram showing the division of responsibility between the several classes of employés, the names and addresses of the physicians and members of the organisation who are to be called upon in emergencies, and a copy of rules for first aid, resuscitation and fire extinguishment. Similar diagrams, lists and rules are required to be posted in stations, testing rooms and line wagons. A properly qualified chief operator is to be directly responsible to the management for the safe conduct of all operations. A properly qualified foreman is to be in charge locally where any work is done if two or more men are engaged. The employer has to provide in electrical stations a sufficient supply of first-aid and fire-extinguishing devices, including

* U.S.A. Department of Commerce. Circular of the Bureau of tandards, No. 49.

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first-aid outfits, insulating gloves, sleeves, boots, shields, covers, mats and platforms, protective goggles with insulating frames, insulating rods and tongs, electroscopes, insulating tools, "men-at-work" tags, fire-extinguishing appliances, &c., &c. Report sheets for the reporting of accidents with all necessary particulars are also to be provided. A further rule deals with the arrangement and marking of equipment and lines for the purpose of ready identification.

There is little in these requirements which would not as a matter of course be provided for in the case of any of the larger undertakings in this country. Two of the rules are, however, specially noteworthy. One requires that employés shall be thoroughly and regularly drilled in approved methods of first-aid, resuscitation, and fire-extinguishment. This is an excellent requirement, and might with advantage be more generally adopted in electrical stations and other works in this country. Although directions for first-aid in case of electric shock are required by the Factory Act Regulations to be posted in all electrical works, there is no requirement as to drilling and practice in the methods, and although first-aid and fire-extinguishing appliances are in many instances provided in addition, there is seldom sufficient instruction or practice in their use. When the emergency for which they are intended arises, their provision is apt to prove ineffectual because the employés are not immediately able to put them to the best use.

The other noteworthy rule deals with the qualifications of employés. It provides that each employé must be qualified for the work he has to perform. This elementary requirement has its counterpart in both the Factory and Mines Acts Regulations in this country, but the rule goes beyond this and requires that the employé shall be given his authorisation only after he has demonstrated his fitness for that kind of work by examination, and further that he shall be instructed in the application of the rules to his work, and that he shall be periodically examined in order to determine his continued fitness for work and his knowledge of the safety rules. It does not appear who is to conduct the examination. In the larger undertakings the trained technical staff would no doubt be able to examine the employés of the lower grades. In other cases difficulties would arise unless diplomas from technical colleges or other educational bodies could be accepted, but in such cases the examinations would have to be of a specially practical nature to meet the requirements for the particular classes of work. Neither the Factory nor the Mines Regulations in this country specify any such examination of the employé, though no doubt it would be a useful provision if practicable to enforce.* The Institution of Electrical Engineers has recently introduced an examination for admission to the class of Associate Membership, and the Association of Mining Electrical Engineers grants certificates after examination, but this is purely voluntary. These examinations may ultimately prove of great service to employers in this country in selecting men for the more important posts, and incidentally may raise the status of the electrical engineer-in-charge, but such examinations would hardly meet the case of the workman who has to prove his competency in any particular branch of work.

One more important provision is included in this rule. It is that no employé shall be permitted to work unless he be in a competent mental and physical condition and uses neither intoxicants nor drugs. This again is no doubt an excellent provision in theory, but would be extremely difficult to enforce in practice. Even if the prohibition of intoxicants and drugs is practicable, how is the employer to ensure that each employé is every day and all day in a competent mental and physical condition? A daily medical examination would be impracticable. The employés might certainly be instructed that they must not come to work if they are feeling not quite up to the mark, but in such a case they would expect to receive their pay just the same, or at any rate, say, half-pay. This would inevitably lead to a considerable portion of the staff taking days off whenever they felt disinclined for work, and would seriously interfere with the smooth working of the undertaking. The question would have to take into account the hours of work. Emergencies sometimes arise when employés may have to work "all round the clock." It is at such times that a man requires all his wits, and yet as the hours run on his mental and physical condition are apt to deteriorate accordingly. Overtime, even in emergencies, would therefore have to be curtailed or prohibited.

(To be concluded.)

* In New South Wales there is a Government examination for mining electricians.

THE OTHER WAR.

[COMMUNICATED.]

Without any intention of dogmatising one may try to ascertain the reasons of German commercial success, and the lines upon which this other war, to be successful, must be conducted. A few selections from the columns of the Review will suffice as a take-off. In the issue of October 9th, on page 486 (column 2), in the Ceylon paragraph, it is stated:—"There is no doubt that the success of German trade in this Colony has been due to the comparative cheapness of the goods when compared with similar articles of British make. In the whole of the East cheapness is the main consideration of the purchaser," etc.

On the same page under France: "The consensus of opinion is that the success of German manufacturers in France is largely due to the fact that their goods appeal to the masses, while English makers only consider the better class buyers, who are far less numerous."

On page 487 (column 1) Portugal: "High prices in Portugal, due to protection, cause a demand for cheap manufactures, and excessive production in Germany, permitted a lowering of prices for surplus supplies."

One might augment this list, but let it suffice to show that there is abundance of such impartial first-hand evidence that, first and foremost, German goods are cheaper than British, and the East is not the only locality wherein cheapness is of primary importance. Maybe some of our manufacturers can account for that difference in price. In passing, however, it is significant to note that "Germany has surplus supplies" to sell in Portugal. Excessive production is not a malady from which, as yet, many British electrical firms have suffered. Not twenty miles away from the writer is an English works, built to manufacture electrical goods, only dating from the last decade, and now being used as a gaol for German prisoners. Within the same radius, but in another direction, is a disused watch factory serving as a barracks for a newly-enlisted battalion of "Pals."

"Under-production" shut up these two factories, and Portugal buys Germany's surplus. On the face of it one might suppose that Britain also buys her share of that surplus.

When the German trader sends his representative out with an initial advantage in price he has already half won the battle. Further, it is said, that we are not so ready to send our agents abroad as are our rivals. The British firms who will reap the benefit first in the new situation are doubtless just those firms who have already, for some time, had agencies in various parts of the world. To secure reliable and competent agents on the spot takes time, and to send such out takes more time. Time in this trade war is equally precious as it is to the enemy's legions on the Continent. The Colonies are in the market for goods, the Scandinavian neutrals are without their usual German supplies, and the Latin countries also. They cannot wait until our agencies are fitted up; to-day is the day, to-morrow may be too late.

In this connection may be mentioned the chief conditions and terms upon which goods are sold in sundry countries in those areas at present partly accessible for business purposes. In Norway and Sweden it is usual to quote c.i.f. Scandinavian port, prices to be in local coinage, and to include 2½ per cent. commission for the agent, and quotations in the metric system. Payment is secured by the agent, who remits after deducting commission, but time of payment is somewhat longer than the English "monthly account." The same applies also to Spain, except that in rare cases it is possible to obtain cash against documents. The seller, of course, pays all insurance charges as far as the foreign port. In normal times it is

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difficult to compete in the Scandinavian markets; in Spain almost impossible at anything like remunerative rates. With regard to Egypt and our African colonies, as well as Australia, conditions are most favourable, and business is more frequent. Manufacturers can obtain better terms, and ship f.o.b. English port, often for cash against documents from London agents of the buyers.

Generally, the ordinary home prices, and certainly ring prices, are too high for export orders, but some British firms have evidently yet to learn that half a loaf is, in this case, better than no bread. To cut prices is not always easy; to cut in quality, weight or design is more practicable. Bare copper wire is an instance, however, where no modification is possible. An electric motor can be altered to suit the market, and many other articles, in fact the majority, belong to the latter category rather than to the former.

To come nearer home, however, there is the problem of the British market to consider. Though a steady oversea trade is a great asset for any manufacturer, few will dissent from the view that the primary consideration should be for the home market. America, Germany ,and other foreign manufacturing countries, large and small, are unanimous upon this point. A recent correspondent has truly remarked that in general a 15 per cent. difference in price nullified an enormous amount of patriotism at home; and that if the difference is still there, after the war has passed, things will return to the *status quo*. If it be true, for instance, and we believe it is so, that Germany can sell cables 10 per cent. cheaper than our cost price, we shall realise the necessity of looking to our laurels at home before worrying unduly about the export trade. No time or trouble can be spared, no effort must be neglected, in perfecting all our organisations for the peaceful warfare which has to be waged in order to put British trade on a footing upon which it will have a better chance of success that it has had of late. The method may be this or that, but it must be no half measure, no *laissez faire*, or from the outset we shall be handicapped fatally, and our defeat will be sure if not quick.

THE ELECTRICAL TRADES AND THE WAR.

(*Continued from page* 553.)

Robt. W. Paul.

1. I have plenty of orders in hand from home, Eastern and American markets, and overtime has been necessary since the outbreak of war.

2. The difficulty of obtaining highly skilled labour has long been considerable, and is now not greater than before.

3. The flow of new orders is well maintained and is above the average.

4. Except in the case of the United States, I am not aware of any considerable diversion of orders to me for goods previously supplied from Germany. Continental competition in high-class scientific electrical instruments has never been serious in the home market, and the absence of orders from Germany and Austria will probably be balanced by increased orders from Russia, India and the British Colonies.

5. The temporary difficulty of obtaining certain materials, which occurred during August, no longer exists.

6. The acceptance of home orders is not affected by existing financial conditions. In the case of overseas trade there are occasional difficulties with respect to payments, and in this matter unified action on the part of the trade would be welcomed.

7. I have, so far, not found it necessary or advisable to introduce instruments formerly supplied only from the Continent. I have received numerous requests from agents to produce copies of Continental instruments, but have declined these proposals in the belief that it is inadvisable to perpetuate these types while equivalent or superior English patterns exist. English manufacturers of magnetos, magnets and other apparatus have, however, been supplied with testing apparatus which were not previously required. I have for a long time studied the catalogues of Continental instrument makers, and gradually extended my line of manufactures, so that it already covers practically all requirements for electrical measurement, testing or research ; I have no present intention of departing from my policy of specialisation in this direction, since I have ample field for work along existing lines.

British Insulated and Helsby Cables, Ltd.

We have pleasure in informing you that we have sufficient orders in hand to keep our works fully employed, some of the departments indeed being engaged day and night, and owing to the latter condition of things, coupled with the fact that a number of our employés have been taken away for military service, we have some little difficulty in obtaining an adequate supply of labour.

We are glad to say that new orders appear to be coming in satisfactorily, and we have been able to secure some of the business which has hitherto been placed in Germany by neutral countries.

With rare exceptions, the supply of raw material is sufficient for our requirements.

Generally speaking, the financial conditions are such as to enable us to accept British orders freely, but considerable caution is necessary in dealing with orders from abroad.

St. Helens Cable and Rubber Co., Ltd.

Replies to questions 1-6 are generally similar to the foregoing :—

7. We are considerably extending lines of manufacture formerly dealt with principally by Continental firms, such as ebonite, but although frequently invited we will not lower the quality of our manufactures to take the place of Continental cables, &c., which previously had a large sale among short-sighted and unpatriotic buyers in this country.

The Wardle Engineering Co., Ltd.

We have so far felt no ill-effects from the war. August is always a quiet month owing to the holidays, and trade was already on the decline, but we were surprised to find it quite good. In September, and so far this month, we have been exceedingly busy, in fact, so far the value of orders received creates a record for the period of the year. We account for this in two ways: First, we are obtaining orders which have previously gone to the Continent (and there must have been many); and secondly, the shortage of carbons has necessitated the use of metallic-filament lamps in the place of arc lamps. On the other hand, half-watt lamps are scarce, and deliveries bad, and in addition the reduction of street and shop lighting in London and on the East Coast is certainly a disadvantage. Continental business seems to be developing, and we are making every effort to capture it. We have had inquiries from all over the Continent, including Warsaw. Business from the Colonies, however, seems to be slack.

With regard to raw materials, sheet zinc is almost unobtainable, though fortunately we had a fair stock before the war commenced, and we are substituting aluminium, copper, and other metals, in cases where it is unobtainable. We are, of course, endeavouring to fulfil the requirements previously supplied from the Continent, although we cannot get down to their prices, especially in view of the increased cost of raw materials.

A Large Manufacturing Firm.

1. We have sufficient orders in hand to keep our works fully employed.

2. We have been able to replace a certain proportion of the employés of the company who have joined the Colours. There is apparently not much difficulty in obtaining a further supply of labour, but the billeting of large bodies of troops on the town makes it hard for workmen brought from other towns to find accommodation.

3. New orders are coming in at a satisfactory rate.

4. A certain amount of business which we are securing, both at home and abroad and in the Colonies, undoubtedly formerly went to Continental firms.

5. Generally speaking, the supply of raw material is sufficient.

6. Financial conditions do not prevent our accepting orders freely.

7. The amount of work in hand makes it difficult for us to undertake any new lines of manufacture at the present time.

On the Continent and elsewhere we are offered orders for machinery which had been placed with German and Austrian firms before the war, but in many cases we are asked to allow payments to be spread over several years.

English manufacturers are not bankers, nor are they controlled by groups of financial institutions with funds available for this class of work. If, after the war is concluded, the Continental manufacturers still find themselves in a position to continue to do business on the lines of extended terms of payment, then, in our opinion, some effort must be made by British manufacturers to put themselves into a position to undertake business on similar lines. The suggestion often made, of the establishment of an industrial bank, might be a solution, but British bankers are so conservative, that manufacturers will probably have to fall back upon the alternative of finding the necessary capital themselves.

The Crypto Electrical Co.

We are pleased to inform you that we have more than sufficient orders to keep our works fully employed, but at present, owing to our having lost a considerable number of men who have gone to the war, we are having difficulty in getting enough labour to turn out the machines for which we are getting orders.

New orders are also coming in on the whole at a rate exceeding the average, and we believe that a good deal of the business we are now getting is for machines which have previously been supplied by German firms, but, of course, it is a difficult matter in many cases to prove this ; but we know for a fact that we have several orders in hand which otherwise would have gone abroad, and this is particularly the case with regard to orders we are getting from the Colonies.

We are having very little trouble with regard to the supply of raw material, but the prices, of course, are somewhat higher, although deliveries are not as bad as one might expect.

We are accepting all orders we can possibly get, and are refusing none on account of financial reasons.

We are starting a few lines of special machines to take the place of those which have been supplied exclusively from Continental firms previously.

We are also receiving a large number of orders for transformers, &c., for cinematograph work, which is rather surprising, as it seems to us to indicate a very optimistic spirit, as we should have imagined that a cinematograph show would have been one of the first to have suffered from the war.

Of course we are very busy with Admiralty and War Office works, and deliveries in these cases have to be made very promptly, which necessitates a fair amount of overtime.

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Langdon-Davies Motor Co.

We are able to reply favourably to the seven questions which you ask us, and we find trade gradually improving. We are contemplating starting new lines formerly manufactured by the Germans, in the near future.

A Firm of "Allied Manufacturers."

Our works are very fairly employed, bearing in mind that over 20 per cent. of our total male staff are on active service.

New orders, of the kind normal prior to the war, come in more slowly, many prospective purchasers suspending extensions and other developments involving purchase of machinery.

The supply of raw materials, speaking broadly, has not been seriously affected by the war.

The financial conditions prevailing are a handicap to extended business, especially where fresh municipal loans are necessary for fresh purchases.

Igranic Electric Co., Ltd.

Like most other people, we anticipated considerable disturbance from the war; but, as a matter of fact, we have sufficient orders in hand to keep our staff fully employed.

Although many of our men have joined the Colours, and at first we had some difficulty on account of new employés' lack of special experience, yet, owing to having a sufficient number of the old hands remaining, we have overcome the difficulties in this direction.

New orders are coming in at an encouraging rate, and prospects are improving.

We have not experienced any serious difficulties in obtaining raw materials, and financial conditions appear to be sound, and have not interfered with our acceptance of orders.

Manufacturers of Accessories.

1. A fair number of orders in hand, but less than the average for this time of year.
2. Have not so far experienced any difficulty *re* supply of labour.
3. New orders are less than the average for this period of the year, but a few inquiries are near settlement.
4. Cannot trace any new business. The few inquiries so far received have been for flimsy stuff at prices previously declined. We could only accept such at a financial loss and also loss of prestige.
5. Have had little difficulty *re* supply of raw materials, except a few lines which will ultimately be displaced by British manufacture.
6. The financial conditions are now much easier, and we are able to accept orders within our usual scope.
7. None so far. We should like to mention that firms when inquiring for prices have stated that their supplies from the Continent have been curtailed for the present; presumably their ideas on the matter are to purchase from Great Britain as a temporary stop-gap, and return to their old suppliers when the chance occurs.

(To be continued.)

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Street Lighting Fitting.

The B.T.H. Co. has just introduced a new lighting fitting with the polar distribution curve shown in fig. 3 herewith.

As shown in the sectional elevation, fig. 2, the lantern consists of heavy copper spinnings secured to an internal mild-steel spider, to which the lampholder is also attached. It is so arranged that by the removal of one nut the upper spinnings can be detached, giving free access to the holder, &c., for wiring. The spider also forms a gallery, which holds the reflector in the correct position relative to the lamp.

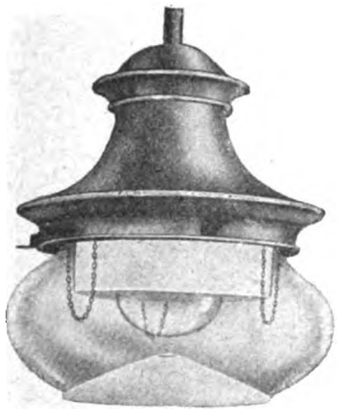

Fig. 1.—B.T.H. Patent Street Lighting Unit.

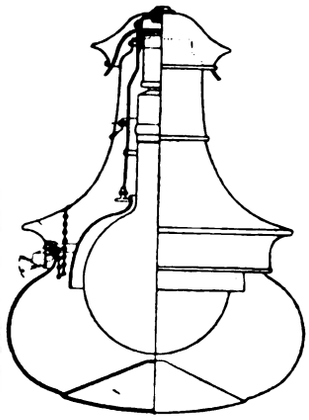

Fig. 2.—Section Showing Internal Construction.

The globe is secured to a copper ring by means of clips held in position by screws, and this ring in turn is secured to the lantern frame by three spring latches of a special type, so that the globe may be easily removed or inserted, and at the same time is quite secure when in position.

Owing to the special form of construction, whereby the top spinning can be removed when the lantern is in position (either on a chain or attached to a bracket), easy access is gained to the interior for wiring. When not connected to a rigid tube it is intended that the leads should be carried in beneath the detachable spinning, which obviates the necessity of employing a weatherproof hood, with the attendant difficulties of wiring, &c.

It will be noted that the fitting embodies an upper reflector and a lower deflector, and it is the combination of these two which produces the desired distribution. The function of the deflector is to deflect the rays which would fall within a zone of 0 to 50° from the vertical, and turn them into a direction of about 15° from the horizontal.

The fitting is especially applicable to half-watt lamps which, from the shape of the filament, give a large portion of their candle-power in a downward direction. The fitting is also supplied either for single Mazda lamps of the standard type or for clusters of from three to seven smaller Mazda lamps. The standard finish of the lantern is black stove enamel, but other coloured enamels or polished copper finish can be supplied.

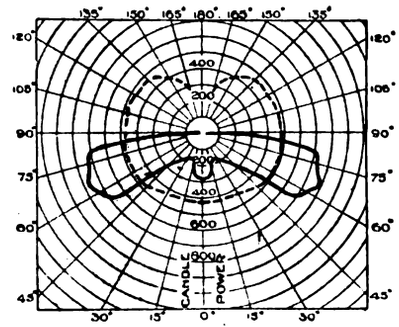

Fig. 3.—Polar Distribution Curve.

The B.T.H. Co. has also brought out a new type of weatherproof lantern for half-watt lamps, intended for use either indoors or out of doors; it consists of a heavy copper spinning, provided with an iron bush suitable for attaching to a tube or hook. The lower extremity of the spinning is reinforced and provided with suitable gallery screws to hold either a plain or a ribbed Alabas ball. The lantern is complete with a B.T.H. porcelain holder, and can be easily wired, after the removal of the globe, by detaching the lower portion of the holder. The lantern is well ventilated. This type of fitting is available either with or without an over-reflector.

Further particulars of these fittings, which are of British manufacture, can be obtained on application to the British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, E.C.

New Plug and Socket Connection.

From Mr. J. W. Annand, 329, Sauchiehall Street, Glasgow—who is the patentee—we have received a sample of a new type of plug and socket connection, which is claimed to get over the troubles caused by bad contact, sometimes found with the usual constructions employed.

In the new type (*a*) parallel contact is obtained; (*b*) the contact improves with usage; (*c*) it can be made in all sizes, large or small, giving equal efficiency; (*d*) the contact pressure can be varied according to requirements by making the outer part of heavy or light gauge tubing; (*e*) it is impossible to overstrain the leaves forming the spring.

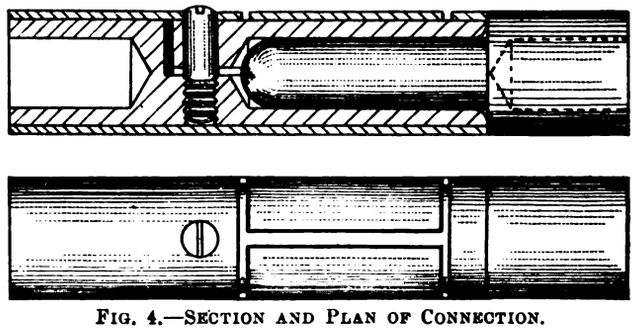

Fig. 4.—Section and Plan of Connection.

The accompanying sectional view, fig. 4, shows an example suitable for connecting two single cables, but it is clear that the method can be applied to all apparatus of the draw-out type, &c.

The socket part is machined and saw-cut; the outer, or spring portion, consists of a piece of solid drawn brass or copper tube cut

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as shown, and fitted over the socket part; the small vertical pin serves to keep all sections in position; the plug part is machined, but no saw cut is required.

When the plug is inserted in the socket, it forces the sections of the socket apart against that part of the tube forming the spring, the plug in return being tightly held in the socket.

The patentee will be pleased to answer inquiries.

Oil-Electric Set.

The accompanying illustration shows an oil-electric set constructed by the Barlaw Engineering Co., Ltd., of 47, Victoria Street, S.W., which is of special interest in that the dynamo is a D.C. generator of 2,000 volts pressure. The latter was made by the India-Rubber, Gutta-Percha and Telegraph Works Co., of Silvertown, and is built on a standard frame with a double commutator, and provided with interpoles. The machine was subjected to very stringent tests, and gave a high efficiency. The

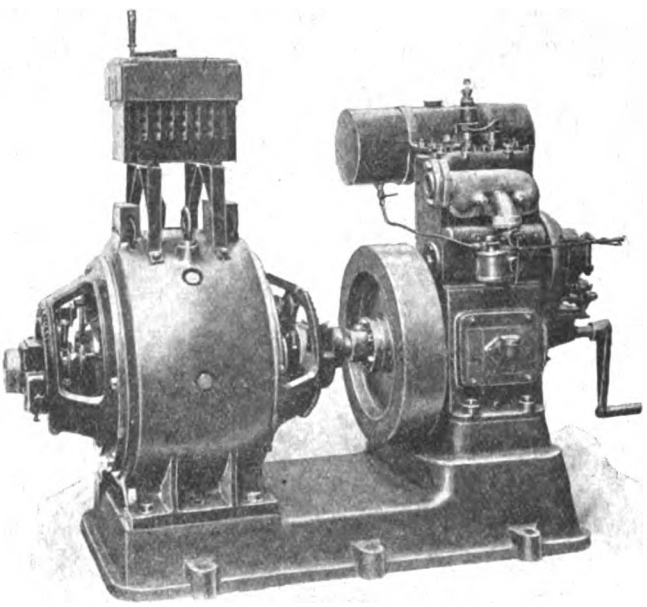

Fig. 5.—2,000-volt Oil-Electric Set.

engine is of the makers' standard type, governed to within 5 volts in 2,000 at full speed. The set was tested to 50 per cent. overload, and passed the ordeal with ease. The engine is of robust construction and can be run with little experience. The output of the set is 4 kw., and we understand that it is required in connection with a new industrial enterprise in which direct current at high voltage is necessary.

LEGAL.

Brush Electrical Engineering Co, Ltd.

A petition for the reduction of the capital of this company was heard by Mr. Justice Neville, in the Chancery Division, on Friday, October 23rd.

Mr. Sheldon, who appeared in support of the petition, to which there was no opposition, said that the company was incorporated in 1889, and there had been several reductions of capital from time to time and also rearrangements of capital.

His Lordship said he had been through the figures. Was there evidence of loss?

Counsel said yes, and the loss arose partly through depreciation of stock and partly through depreciation of patents which were valued in the goodwill. There had been a very large alteration in the profit and loss account since 1908, when a large reduction took place.

His Lordship asked what was the amount of the reduction now proposed.

Mr Sheldon said they were proposing to write off £235,732, and a loss of that amount was proved.

His Lordship sanctioned the reduction as proposed.

Read and Brooks *v.* The Stella Conduit Co.

The hearing of this action commenced before Mr. Justice Joyce, in the Chancery Division, on Friday, the 23rd inst., and continued on Monday, the 26th inst., it being an action brought by the plaintiffs, Mr. Albert Edward Read and Mrs. Ellen Brooks, for an injunction to restrain the defendants, who carry on business at the Highfield Works, Bilston, Staffordshire, from infringing plaintiffs' Letters Patents Nos. 18,375, of the year 1905, and 21,604, of the year 1906, the former granted to J. W. Brooks and the plaintiff A. E. Read for "improved means for connecting tubular electrical conduits together and to their fittings," and the latter, granted to the same persons, for "improvements in fittings for electrical conduits." Plaintiffs also claimed damages and the usual relief in a patent action.

The defence was a denial of the alleged infringement, and a plea that there was no subject matter in the plaintiffs' letters patent, and that the alleged invention was not useful and was a more particular application of common general knowledge which involved no invention.

Mr. A. J. Walter, K.C., Mr. Colefax, K.C., and Mr. Warmington appeared for the plaintiffs; and Mr. T. T. Terrell, K.C, and Mr. A. Grey for the defendants.

Mr. Walter said that the action was brought for the alleged infringement of letters patent, the subject matter of which was extremely simple, but related, however, to a matter as to which there was considerable demand.

Counsel said electric wires in houses were incased sometimes in wood, but were always protected in some way or other. The wires were bound to be isolated and protected to prevent people getting at them. There were two ways of doing this. One was to carry the wires in grooved pieces of wood, in wooden troughs, but with that method they had nothing whatever to do in the present case; the other method, and that was the one with which they had to deal, was where the wires were encased or carried in iron tubes, which, of course, afforded better protection. Rats could not, for instance, get through and sever the insulation, as they could do by eating the wood of the wooden troughs. The metal tubing was made of various sizes, according to the number of wires to be drawn through the tubes. Fire insurance companies and the various building authorities did not allow bare wires to be put in houses or buildings. In the present case they were dealing with devices having relation to the metal tubes containing the wires. The learned counsel explained that the plaintiffs' invention consisted of improved means for connecting tubular electric conduits together, and for connecting the tubular electric conduits to their fittings, such as elbows, tees, crosses, junction boxes, switches and the like, and which enabled the said parts to hold together without screws. He submitted that there was subject matter in which the patentees had done, and that the defendants had been guilty of infringement.

Mr. Jas. Swinburne gave evidence to the effect that there was invention in the device adopted by the patentees.

Mr. Terrell, on behalf of the defendants, argued that there was no subject-matter in the plaintiffs' Letters Patent, their alleged invention being merely another application of the old bicycle-head grip for coupling the ends of tubes together.

At the conclusion of the evidence and the addresses of counsel, his Lordship reserved judgment.

Unemployment Benefit.

At the Halifax West Riding Police Court last week, an electrician named Herbert Willie Pickles, of Elland, was summoned for making a false statement for the purpose of getting unemployment benefit under the Insurance Act. According to the evidence produced by Mr. H. H. Ramsden, of Huddersfield, who prosecuted, the defendant made an application for benefit under the Act on July 28th last. He signed the unemployment register in the usual way and received unemployment benefit. Afterwards, however, it was ascertained by Mr. Vernon Pearson, agent for the Unemployment Insurance Fund at Elland, that the defendant had worked three days for a Mr. Turner, electrician, of Elland. The defendant denied that he had signed the register on the days upon which he had been working, but the Bench said that they must deal with the case rather severely. The defendant would be fined 10s. and 22s. 6d. costs, with an alternative of 14 days' imprisonment.

The Electrical Engineering and Motor Co. (Carlisle), Ltd.

In the Chancery Division, on Tuesday, October 27th, Mr. Justice Eve had before him a motion in *re* The Electrical Engineering and Motor Co. (Carlisle), Ltd., Bolton *v.* The Company.

Mr. Johnstone Edwards, appearing for plaintiffs, said that he had a motion for a receiver and manager. There was a debenture-holder's action, there was an execution in and judgment had been signed upon debts of the company. On the previous day there was an application to enforce judgment for £75, and other writs had been issued. Counsel asked for a receiver and manager and the usual order. The only execution actually levied at present was as to the £75 under a bailiff's warrant.

Mr. Manning, for the company, said that he did not want to put obstacles in the way, as clearly the position of the company was difficult and serious. He was prepared to submit to the usual form of consent judgment.

Mr. Justice Eve said that of course he could give a judgment by consent.

His Lordship eventually appointed the Receiver and manager, with liberty to act at once, the usual order being made upon the agreement to treat the motion as the trial of the action.

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WAR ITEMS.

Board of Trade Reports.

The following further information has been received at the Commercial Intelligence Branch of the Board of Trade :—

Japan.—H.M. Commercial Attaché reports, under date September 7th, that the exports of copper are practically at a standstill. Minor exports are being dealt in to some extent, and certain articles, such as cheap glassware, latex cups for the rubber industry, &c., are being shipped to the Straits Settlements to take the place of German goods. On the whole, the export trade, though considerably diminished, is being carried on with some vigour.

Russia.—H.M. Consul-General at Moscow has forwarded a report received from a reliable source in regard to the machinery import trade of Russia, which contains a list of various classes of machinery which have hitherto been imported from various Continental countries, but which it is considered might now be replaced by British manufactures. It is stated that about 15 years ago German machinery makers sent to Russia representatives who noted what had been supplied by British firms, copied some of the advantages, and proceeded to remedy defects which were pointed out by users, with the result that in a short time machinery was delivered from Germany which met users' requirements, and was delivered at Moscow at lower prices than English machines. All classes of machinery entering Russia have to pay duty by weight, and whilst English makers, with few exceptions, have practically ignored the *rôle* that weight plays when duty is imposed upon it, the Germans have attached importance to it. In many machines there are heavy rough cast-iron and other parts which could be made in Russia at a price which would considerably reduce the total cost of the machine to the purchaser, delivered at his mill or works. This is a phase in the machinery trade worthy of consideration by English producers of heavy rough machinery who are desirous of entering the Russian market.

With the development of municipal institutions in Russia it is asserted that there is a great field for contractors capable of installing waterworks, gasworks, electric light and tramway plant, &c., but recently German firms have invariably obtained such contracts. One of the causes contributing to their success in this direction has been the ready way in which the German business houses have met purchasers in regard to terms of payment, &c. This has been possible owing to the fact that the interests of various German makers have been so interwoven that they could obtain financial support where an isolated English supplier would fail. Moreover, whenever a big scheme has been under consideration, the German combines have had their representatives continually in touch with those who have had the placing of the orders, and by constantly assisting them free of charge to draw up specifications, these representatives have succeeded in getting specified just those classes, designs, models and sizes which could only be obtained from German firms.

British machinery manufacturers who wish to obtain a share of the Russian orders hitherto placed in Germany, are urged to commence the necessary propaganda at once, and not wait until the war has terminated. They should prepare their circulars in the Russian language, and cause them to be distributed to likely customers through reliable agents. The distribution of circulars in a haphazard way will do little good; they should be sent out by firms or individuals on the spot who know exactly who are the users of the machines described.

The report in question may be inspected by United Kingdom machinery manufacturers at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

The Commercial Intelligence Department of the Board of Trade has issued two further pamphlets in connection with its campaign series. No. 81 deals with rubber wares (other than machinery belting, tires for cycles, motor-cycles, and motor-cars and toys); and No. 82 is devoted to carbons for electric lighting.

The War and Turkish Trade.

We have received a communication from a correspondent in Constantinople bearing on the war and its probable effects on certain branches of British trade in Constantinople. He says that in considering the matter it is necessary, in the first place, to have a thorough and definite understanding as to what our firms at home are anxious to do. These firms he divides into two distinct groups:—(*a*) Those desirous of capturing the trade previously held by the Germans, by endeavouring to supply the public with what they have been so far purchasing from Germany, and (*b*) those that have been in the past, and still are, anxious to educate the public to appreciate the value of a superior article at a higher price. The latter class will, to a certain extent, profit likewise by this war, but our correspondent's remarks are addressed more directly to the first group, for sooner or later, when German commerce starts again, it will be the firms who can supply the same quality of material as their competitors, and at the same prices, that will derive a permanent benefit. He continues :—

"I ask these firms to bear in mind the following facts, and to thoroughly appreciate their importance.

"(*a*) Turkey is a country which for some years past has been in the hands of the Germans, and at the present moment especially, is very Germanophile. We may no doubt hope that after Germany has been brought to her knees, this feeling may be weakened, but for a year or two, it has to be taken into account; that means to say, that the general public will give preference to German goods if these are still sold at a lower price than the British product.

"(*b*) The success of a firm here will depend greatly, if not practically entirely, on the result of its efforts at the very outset of the resumption of business, for Britain is not the only country which is trying to profit on this market by Germany's eclipse.

"(*c*) After examining at work, and seeing the way German products give satisfaction to their purchasers here, it is most essential that our firms should once for all get the paralysing idea out of their minds that German exports are cheap and nasty. They are certainly cheap, but they are very often a credit to the ingenuity and labour of their originators. Engineers who live abroad, who are constantly in competition with Germans, gradually realise that they receive at home a wrong impression, and a fatal one, when they are brought up in their technical schools to despise German machines, &c. This may not apply to all branches of industry, but in the majority of cases it does. The consequence is that when an agent informs his principals that a certain article is being constantly sold cheaper by a rival, the unfailing answer is that it is of a cheaper quality. Granted that this is true usually, yet surely if the market wants a cheaper, but still reliable, article, it is for the firm to endeavour to produce it. How do our rivals get hold so thoroughly of business here? In the first place simply by asking their clients what they want, and not by telling them what they ought to have; and, secondly, by adopting offensive tactics, a policy which so characterises their military and commercial training. As soon as they see a British article appreciated, whether it be a lathe, an electric fitting, a tube, or a bottle of Worcester sauce, they get full particulars as to price and characteristics of the article, and then do not rest until they can produce a cheaper article which can, to a certain extent, equal the British product. What do our firms do in similar cases? They usually state that they would rather not compete in the inferior quality of product asked for. To this I have no answer to give, and it is not my business to criticise, but if a firm is anxious to get on here, then it must start working on a different basis, and carry the war into the enemy's camp. Competition in Turkey, and competition in the Colonies are different things, and have to be treated differently.

"*Iron and Steel Girders.*—These articles are practically all supplied by Germany and Belgium, and the difference in price between the Continental and British product is very appreciable. We have not as yet been able to get a satisfactory explanation for this.

"*Rails.*—These come in a large part from Belgium and Germany, the French lines usually favouring the former, whilst the German lines such as the Bagdad Railway purchase everything from Germany.

"*Tools, Iron and Steel Wire, Wire Netting, Metal Sheets.*—The large majority of these come from Germany, although England and the States import a fair amount of tools. As regards machine tools the Germans supply a lighter kind of tool as compared with the British product, and one which seems to do its work satisfactorily. I have come across several, in various works, and they have given their customers satisfaction.

"*Machinery, Steam Engines, Motors.*—Nearly all the factories here dating back a few years are equipped with British engines and boilers, &c., but to an equal degree, nearly all the engines, &c., coming in now, are of German manufacture. The latter do not possess the same finish, but are well made and give satisfaction.

"*Automobiles, Cycles and Motor-Cycles.*—The Austrian, German and French firms share this trade between them. The principal reason is that no British firms care to risk a little money by opening a garage here and keeping a car or two in stock on this market. Their competitors have done so, and in consequence, they get all the orders.

"*Electrical Cables, Lamps, Machinery.*—In this line the Germans excel, and deserve to get all the orders. They supply all sorts of electrical goods, keep large stocks always, give splendid deliveries, and are always anxious to satisfy new needs of customers. In the porcelain line of fittings they are supreme, and we have sent samples of porcelain switches, &c., to England repeatedly to be matched, and have been unsuccessful in our efforts. As regards electrical cable, we can buy here cable which is cheaper than bare copper wire in England. Naturally, we call it rubbish, but the customer finds that it lasts for a good few years, and therefore does not mind.

"Our competitors are also much more accommodating with their terms, and are usually disposed to give their customers a few months' credit. If only our firms would do the same, when we can assure them that the clients are safe, big progress would be made."

Finsbury Students and the War.—Any of our readers who know of any Old Finsbury Students who have joined the Forces, are asked to send their names, and as many particulars as possible, to Mr. F. R. C. Rouse, 15, Clifton Gardens, Golder's Green, N.W.

I.M.E.A. and Foreign Contracts.—A correspondent says the officials of the Electricity Committees of Corporations in Lancashire and other parts of the north of England have received a letter during the last week or two from the Incorporated Municipal Electrical Association asking for information with reference to the extent of the purchase of foreign manufactures by Electricity Committees, with a view to arrangements being made for the manufacture thereof by British manufacturers.

Delayed Contracts.—The delivery of machinery ordered for the electricity works extensions at Rochdale is being much delayed owing to the urgency of Admiralty orders received by the manufacturers. The manager of the electricity works has been instructed to do everything possible to expedite delivery.

Soldiers at Evening Classes.—Some thousands of soldiers are now billeted in Southport, and the Education Committee has decided to admit those who desire it to the evening classes, which cover a wide range, including electricity and magnetism, electrical engineering, and electric wiring.

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Carbons for Electrical Purposes.

If we were to inform our readers that "British exports of carbons to Germany and Austria-Hungary are negligible," we believe that they would make remarks. And if we were to urge upon our traders that to ensure success in exporting carbons to Italy they must "conduct an energetic advertising campaign," and thus "capture a share of the trade hitherto done by their Continental rivals," they might well think that all of our staff were at the war, or ought to be. It is the sweet simplicity of the Commercial Intelligence Department of the Board of Trade that allows it to make these statements, for it can hardly be expected to know all that has been passing lately in the electrical Press and elsewhere regarding the supplies of carbons available in the United Kingdom. Its Pamphlet No. 82 is not prepared exclusively for electrical people, and but for the above-mentioned remarks, which may mislead the uninitiated, we should think it one of the most useful of its series of campaign publications. Although British firms are less likely to go capturing foreign trade in carbons than some other lines of manufacture until there are more of them available, we quote, for the information of those who, we believe, have been giving a good deal of thought to carbon manufacture of late, the following statistics, and refer them to the aforesaid C.I. Department for the complete document: —

Exported from Germany (1912):—

Carbon sticks for electrical arc lamps	£451,400
Electrode carbons, carbon threads for electrical illuminating appliances, carborundum articles other than grinding, polishing and whet stones; and other articles of plastic carbon or gas carbon (retort graphite)	90,200
Total	£541,600

Exported from Austria-Hungary (1913):—

Carbons for lighting purposes, less than 1 kg. per metre, &c.	£48,175

Exported from United Kingdom (1913):—

Electrical carbons	£10,064

The principal Colonial and neutral markets to which these goods were sent were as stated below.

The figures for Germany include the value of carbons exported to the United Kingdom (£90,650), and to Austria-Hungary (£45,400), and those for Austria-Hungary include exports to Germany (£21,500), and to the United Kingdom (£9,200). British exports of carbons to Germany and Austria-Hungary are negligible. Deducting these amounts, it appears that the exports of the three countries to all other markets were as follows: —

From Germany	£405,550
„ Austria-Hungary	17,475
„ United Kingdom...	10,000

The following statement shows the amounts sent from Germany, Austria-Hungary, and the United Kingdom respectively, to each of the principal markets hitherto supplied with electrical carbons by the two first-named countries: —

Country to which exported.	Exported from Germany (1912). Carbon sticks for electrical arc lamps.	Exported from Germany (1912). Electrode carbons, carbon threads for electrical illuminating appliances, carborundum articles, &c.	Exported from Austria-Hungary (1913). Carbons for lighting purposes, less than 1 kg. per metre, &c.	Exported from United Kingdom (1913). Electrical carbons.
Canada	£3,500	£250	—	£259
Australia ...	10,750	—	£120	427
Norway	2,450	23,600	280	—
Sweden	5,450	9,000	200	—
Denmark ...	3,750	250	190	—
Netherlands ...	14,600	1,500	95	—
Belgium ...	33,850	2,400	1,405	68
France	44,250	4,750	1,300	237
Switzerland ...	9,300	4,100	140	558
Portugal ...	2,750	250	—	9
Spain	5,600	1,050	—	288
Italy	32,550	5,850	8,790	—
Roumania ...	5,200	50	3,560	—
Russia	18,850	5,400	110	201
Dutch East Indies	7,550	—	—	—
Japan	4,100	150	—	130
Brazil	5,350	500	—	95
Uruguay ...	4,250	200	—	82
Argentina ...	27,250	250	55	2,606
Chile	3,950	250	—	210
United States ...	69,450	12,750	30	17
Mexico	5,350	450	—	—

"It will be seen that practically the whole of this trade has hitherto been done by Germany, though Austria-Hungary has supplied small quantities to Italy, Roumania, Belgium and France. In view of the large quantities of coal annually carbonised in the United Kingdom at gasworks and coke ovens, there would seem to be a distinct possibility of diverting a large portion of this trade to the United Kingdom."

Australia and Manufacturing.—The war has led to renewed discussions in Australia concerning the question of manufacturing there many of the articles that have hitherto been imported. There is the same keenness there as here for securing German and Austrian trade. The South Australian Chamber of Manufacturers, at a meeting early in September, passed the following resolution:—

"That, with the object of encouraging Australian manufacturers to go to the expense of increasing their plants and premises for the purpose of manufacturing goods previously imported from Germany and Austria into Australia, all specifications for either Commonwealth or State Government contracts should absolutely prohibit the use of manufactured articles or materials produced in either Germany, Austria, or their dependencies for a term of at least 21 years, provided that this does not apply to materials at present in Australia or on the water prior to the declaration of war."

The chairman of the meeting, Mr. W. Forwood, in the course of his speech said:—"During the year 1912 Australia imported from Germany between £7,000,000 and £8,000,000 worth of goods, many of a kind that can be easily manufactured in the Commonwealth if our Governments and people will only give our manufacturers a fair chance to do so. Portion of this money has been used to provide means for slaughter and the maiming of thousands of husbands, fathers, sons, and brothers of our own kin for one of the most unjustifiable wars of modern times, a war that has for its ultimate objective the destruction of the British Empire and the annexation of Australia by people who, by their behaviour in this war, have shown their brutal character."

Mr. H. E. Pratten, president of the New South Wales Chamber of Manufactures, in a recent address, is reported to have advocated the following practical methods of capturing German trade:—

"1. A system of preferential and reciprocal trade throughout the Empire in favour of British-made goods, or a surcharge on goods made in Germany before they are allowed to enter.

"2. An education in national sentiment and patriotism that would make it difficult to sell any goods made in Germany if any reasonable alternative source of supply existed.

"3. A development of new industries throughout the Empire, aided, if necessary, by the importation of highly-trained technical German workers, that would be able to supply and displace goods previously largely obtained from Germany; and by the application of science and industry to the fullest extent, emulating and imitating the marvellous success achieved in Germany in this direction."

In a letter to the *Melbourne Age* the Cooper Engineering Co. Pty. says, on the question of extending Australian Manufacturing, that it has recently undertaken the manufacture of electrical necessities that are not made south of the line. "We refer specially to zincs required in the upkeep of Leclanché cells, and the casting and formation of accumulator plates. This is the first time that these things have been manufactured in Australasia, and we have put down a plant sufficient to cope with the demands of the whole Commonwealth. These are absolute German lines, although they are manufactured in small quantities in England and Belgium. It might be added that we are competing in the manufacture of same without any tariff assistance, and since the outbreak of war we have received orders and inquiries from Brisbane in the east and Perth in the west."

Liverpool and German Contracts.—Representations to the Board of Trade.—Liverpool is to make representations to the Board of Trade, in order to point out the danger of allowing current contracts with German companies, whether registered in England or not, to remain in operation and payments to be made thereon during the time of war. The decision was recorded by the Tramways Committee, on the 21st inst., after a full discussion in camera of the situation created by the recent resolution of the City Council on the subject of the unexpired contracts from the patent welding or repair of tramway rails. Both contracts were made with companies registered in England, but consisting almost entirely of German shareholders resident in Germany. In each case the contract for welding or repair had reference to contract which was to be executed "when required." Roughly speaking, three-fourths of one contract and one-fourth of the other had been executed when hostilities were commenced.

The City Council by a majority of six votes—49 to 43—resolved at the October meeting to continue the contracts without regard to the war, but a strong protest against this course followed, and the Tramways Committee felt compelled to review the situation. A long debate ensued, and eventually the Committee decided to make representations to the Government through the Board of Trade as to the national danger of trading, however indirectly, with Germany so long as the resources of that country were being conserved to wage war against Great Britain and her allies.

Manchester Students with the Forces.—The Manchester School of Technology possesses particulars of more than 550 students who were in attendance at the college during the academic year 1913-14, and who are now serving in various branches of His Majesty's Forces. With a view to the completion of a Roll of Honour, which shall also include the names of past students engaged upon military service, the Registrar will be glad to receive any information from such persons themselves or from their relatives or friends.

British Asphalt.—The Limmer Asphalte Paving Co., Ltd., send us a communication in which they show that they are entirely British, in capital, directorate and management, have their mines in France and none in Germany or Austria, and that the bitumen for their joint-box, troughing and other special uses comes principally from the British Colonies. They employ Germans or Austrians nowhere.

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Northampton Tramways Manager.—At the eleventh hour and chiefly with a view to avoiding municipal contests, which would have thrown the town into a turmoil, the Northampton Town Council at another special meeting on Monday decided to give Mr. J. Gottschalk, the tramway manager, £300 in lieu of notice. Mr. Gottschalk, it will be remembered, is of German birth, and he has managed the tramways during the nine years they have been owned by the municipality. Agitation for Mr. Gottschalk's removal commenced upon the outbreak of the war, but since then he has obtained his naturalisation papers. A special meeting of the Council confirmed the opinion of the Tramway Committee, expressed upon three occasions, that Mr. Gottschalk should continue to hold office, and then the anti-Gottschalk faction in the town, who had a large following, threatened to contest the elections, and they secured their candidates, who handed in their papers on Saturday. Feeling in the town ran so high last week that it was considered advisable by all parties that a compromise should be arrived at. Representatives of the pro and anti-Gottschalkites held a meeting, at which the suggestion was made by the former that Mr. Gottschalk should be suspended and paid one-third salary—£133 6s. 8d. per annum. This was after Mr. Gottschalk had asked the Tramway Committee to relieve him of his post for the period of the war. These terms were not accepted by the anti-Gottschalkites, in spite of the fact that the Mayor-Elect (Mr. F. C. Parker) had intimated that he would reconsider his decision to accept the Mayoralty if there were elections. Monday was the day for the withdrawals at 2 p.m., and the Council met at noon. There was a rather tumultuous meeting, the attack on Mr. Gottschalk being described as "un-English, un-Christian and dastardly." Half an hour before the time for withdrawal there was a deadlock, and the Council agreed to "accept Mr. Gottschalk's resignation," and compensate him to the extent of £300. The anti-Gottschalk candidates withdrew, with the exception of one, a few minutes before two. In this ward there is some personal feeling, and the candidate is not now an official "anti-Gottschalk."

At the Council meeting it was hinted that if the elections were fought it would not be safe for candidates supporting Mr. Gottschalk to go about, and there might be a riot. We understand that Mr. Gottschalk, with whom much sympathy has been expressed, has stated that he is satisfied with the decision of the Council.

U.S. Electrical Imports and Exports for August.—The *Electrical World* gives the following monthly summary of the foreign commerce of the United States issued by the Bureau of Foreign and Domestic Commerce. The imports in electric lamps were valued at $53,403 in August, 1914, and $34,296, in August, 1913. This unusual increase may represent the output of foreign manufacturers who hastened shipment in the early days of the war. The principal gain was in metallic-filament lamps, which increased 87 per cent., or from $28,311 to $52,948. There were no arc lamp imports in August, and imports of carbon-filament lamps had a value of but $455. Exports, on the other hand, declined from $2,279,015 in August, 1913, to $1,024,010 in August, 1914. The value of batteries decreased from $15,326 to $38,722, generators from $134,136 to $114,570, fans from $16,408 to $5,528, insulated wires and cables from $219,736 to $51,236, interior wiring supplies and fixtures from $66,385 to $43,511, arc lamps from $10,387 to $1,620, incandescent lamps from $69,522 to $11,930, motors from $119,280 to $118,490, static transformers from $156,727 to $33,609, telegraph instruments from $6,425 to $3,101, telephones from $189,160 to $78,403, and "all others" from $952,705 to $197,543. The only increase was in meters and measuring apparatus, the value of which was $23,747 in August, 1914, as compared with nothing in the previous year.

Personal.—The following is a list of employés in the electricity department of the Grimsby Corporation who have enlisted in H.M. Forces:—G. Sampson, A. Gibbons, H. Wilmore, H. Welham, F. Wells, T. Thompson (boiler cleaner), H. Hudson (engine cleaner), F. Wilmore (fitter's mate), E. Thompson (joiner's mate), S. Cordock and S. Bradley (labourers), G. W. Parker (mains superintendent), A. Nuttall (motor tester), G. Cooper (motor repairer), G. Wilkinson (joiner), and C. Wells (clinker wheeler).

Mr. J. Callaghan, electrician, in business in Gatsford Road, Worksop, who, on the outbreak of war, rejoined the King's Own Yorkshire Light Infantry as a Reservist, is a prisoner of war in Germany. He was captured whilst wounded on August 26th, and, in a letter to his wife, states that he is almost well, and is being treated very well.

Lance-Corporal J. Jordan, of Bury, who, prior to the war, was in the service of the Lancashire E.P. Co., is reported missing.

Private Hammond and Private Bradley, who were formerly employed as motor inspector and motorman respectively, and have returned home from the front wounded, were *feted* at the Blackburn Corporation Tramway Men's Institute on Tuesday evening, October 13th. Mr. C. Higham (ex vice-chairman of the Tramways and Electricity Committees) presided, and was supported by Mr. J. H. Cowell (general manager of the tramways), Mr. Redmayne and others. There was a good attendance. Mr. Cowell emphasised that the tramway workers were acting nobly during this great crisis. Fifty-six of the Blackburn staff had already joined the Colours, and those left behind were contributing over £9 weekly towards the Prince of Wales's Fund. Private Bradley returned to his military duties the following day, but Private Hammond's furlough has not yet expired.

Roll of Honour.—Lance-Corporal W. Burns, of Salford, who was a Salford Corporation tramway guard, has been killed in battle.

Private Frank Bradshaw, of Higher Broughton, Salford, a motorman in the employ of the Corporation tramways department, has died from wounds received in the battle of the Aisne.

All British.—The Dussek-Bitumen Co., of Canal Bank, Deptford, and Messrs. Dussek Bros. & Co., Ltd., send us information respecting these businesses, showing that both concerns were founded and controlled by British subjects, and have British capital and British employés. Col. H. A. Christmas, a director of Dussek Bros. & Co., Ltd., is now serving his country; Mr. E. A. Dussek is doing likewise with Lord Kitchener's Army, and Messrs. A. S. Dussek (ex-naval volunteer), A. E. H. Dussek and L. A. Dussek are training in volunteer forces.

Oldham Tramway Contracts.—During the consideration of accounts by the Oldham Tramways Committee on October 22nd, a member inquired whether a certain firm was German; if it was, he suggested that they should have no further dealings with it. The manager replied that 60 per cent. of the capital of the firm was British. He had given full details to the chairman of the Committee, and would let the various members have the particulars.

Lancashire Tramwaymen and Red Cross Work.—A movement has been started with the object of forming a detachment of the British Red Cross Society for the employés of the South Lancs. Tramways Co. So far some 30 names have been given in at Atherton of those desiring to join, and when a sufficient number has been enrolled arrangements will be made for lectures to be given to the men.

Drilling Machines.—Messrs. Morris & Lister (London), Ltd., of Westminster, S.W., announce that they are making a general reduction in the price of all their drilling and grinding machines with a view to securing as much as possible of the trade which formerly went to Germany.

BUSINESS NOTES.

Australian Customs Tariff Inquiry.—*The Import Duty on Generators.*—According to the *Sydney Daily Telegraph*, Mr. Forbes Mackay appeared before the Inter-State Tariff Commission to support the petition made by the Melbourne Electric Supply Co. for the reduction of the duty on electric generators for direct-coupling to steam turbines. The present tariff made a distinction between the turbines and generators. Mr. Mackay thought that the latter should be on the same footing as the turbines, which were free if British made. By charging duty on generators, the Commonwealth Government tended to increase the cost of electricity. This view was supported by Mr. Donoghue, the chief engineer of the Electric Light and Power Supply Corporation, who said the generators could not be made in Australia, and it would not pay anyone to start such an undertaking. The application was also supported by Mr Erskine, of Crompton & Co., Ltd., and Mr. Mulroney, of Shaw Wireless, Ltd.

The Government's Interest in Construction Material.—According to the same jounal, Mr. William Hutchinson, chief engineer for railway and tramway construction of New South Wales, appeared, by direction of the Minister of Works, to oppose extra duties on rails and materials used in railway construction. He said their last contract represented £6 13s. 6d. per ton f.o.b. England for 80-lb. rails. The freight was £1 3s., making £7 16s. 6d. *ex* ship Sydney. The duty was based upon £6 13s. 6d. plus 10 per cent. There were lightering charges in addition, so that the total cost of the rails equalled £8 13s. 6d. That meant £2 per ton in favour of the local manufacturer. Mr. Huchinson considered his department had a grievance, too, in connection with American rail importations. He paid £6 16s. c.i.f. for a 60-lb. rail, but the duty had been charged on the freight as well, as the Controller of Customs had fixed a definite price for American steel rails.

Book Notices.—*British Industry and the War.* By J. Taylor Peddie. 1s. net.—In this pamphlet the author, who is the chairman of the Provisional Organising Committee of the proposed Institute of Industry and Commerce, sets forth the objects of the scheme. The need for the better organisation of British industry, the reorganisation of the educational system in force at our Universities, Technical Colleges and Secondary Schools, the reform of the British Consular service on business-like principles—these are among the many points covered in the course of the author's comments, and in the reported speeches of well-known men who were present at the inaugural meeting of the movement held on October 8th. Mr. Peddie advocates the opening of a subscription list, which shall remain open for several years if necessary, until it reaches £1,500,000, the interest received on this capital sum to be devoted to the development of national and inter-Imperial trade and other matters of general trade interest. The speeches of Sir C. W. Macara, Bart., Earl Grey, and other speakers will form profitable reading for all who are seriously studying the industrial possibilities of the present position. We observe that several trade organisations were represented at the function, the B.E.A.M.A. among them, and one of the resolutions passed invited each of these organisations to nominate a delegate to act on the Organising Committee which is to take the steps necessary to form the Institute of Industry and Commerce. It is proposed that the Institute shall have its home in Aldwych in the building proposed by Earl Grey in his Dominion House project. We observe at the end of the pamphlet a statement of the constitution and some of the principal objects of the scheme. Although the Organising Committee has only just been appointed, it is stated that very many things are already done. An Imperial Advisory

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Committee has its duties allotted to it, an Irish Advisory Council is also to be formed, and it is further stated that a strong Provisional Committee of journalists and publishers has been appointed—why?—because the "usual trade journals are deadly in character" (whatever that may mean—it reads very much like the reports of the firing of the British monitors on the German trenches!) It is intended, for the purpose of stimulating trade within the Empire and its neutral markets, to establish an official trade journal, which shall be "lively, illustrated and interesting at all times," and shall provide "a remunerative source of revenue for the Institute." We frankly confess that we think it somewhat spoils all ambitious and deserving schemes for the better organisation of British industry when they end like this—a huge subscription list of 1½ millions sterling, and the revenue from a lively trade journal, seem to be the most pressing needs of the moment.

The *Tramways and Light Railways Journal* for October (6d.) contains the Board of Trade Regulations relating to guard wires on electric tramways and light railways laid on public roads, also a report on defects in tramcar controllers.

"Institution of Electrical Engineers. List of Officers and Members." 1914. London: The Institution.

Catalogues and Lists.—British Thomson-Houston Co., Ltd., Rugby.—List No. 4,160 (16 pages), fully describing, illustrating, and giving outline and connection diagrams of their ironclad draw-out oil-break switchgear.

Messrs. Holophane, Ltd., 12, Carteret Street, Queen Anne's Gate, London, S.W.—Illustrated list of Holophane glassware for half-watt lamps—reflectors and semi-indirect bowl, reflector hemisphere and "Excellite" types. Prices of each type are given in tabular form.

Messrs. Siemens Bros. & Co., Ltd., Woolwich, London, S.E.—Forty-page illustrated pamphlet (No. B. 517), giving full descriptive information concerning the "O. S." wiring system. The larger part of the publication is occupied with a collection of excellently executed half-tone pictures of buildings of all kinds at home and abroad which are wired with "Stannos" wire.

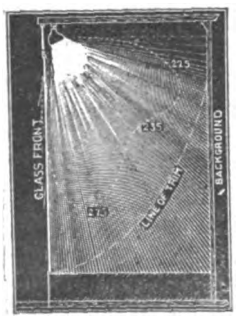
The Cressall Manufacturing Co., 40 and 41, Staniforth Street, Birmingham.—Illustrated and priced leaflet relating to woven wire resistance netting, and "Cord" resistance material.

Messrs. L. Andrew & Co., 2, Whitworth Street West, Deansgate, Manchester.—Net wholesale price list of insulating materials for electrical purposes.

Edison & Swan United Electric Light Co., Ltd., Ponder's End.—Ten-page illustrated price list of Royal Ediswan drawn-wire tungsten-filament lamps of a wide range of candle-powers and voltages, and in various shapes of bulb, including, in addition to the every-day types, fancy, crinkled, tubular, olive-shaped and "Downlite" lamps. The front cover is of true British colouring and design.

In issuing a neat little brochure on Ediswan radiators, the company draw attention to the important selling point that the electric radiator, unlike all others, can be placed in any part of a room, and need not be put in the fireplace.

Shop-Window Lighting.—Referring to the gloomy appearance of the streets of eastern towns after dusk, due to the precautions adopted against a possible attack by enemy airships, the British Thomson-Houston Co. have written to point out that shopkeepers do not adopt the right methods of reducing their window illumination. Switching out lamps is certainly effective in one sense, but renders the window useless for displaying goods except in the daytime. Shading the lamps with coloured paper, &c., is less drastic, but crude and possibly dangerous. The proper course is obviously to use suitable reflectors, such as the B.T.H.



"X-ray" type, specially designed to throw the light inwards on the wares instead of wasting it on the foot-path. Not only should this method prove effective against the guidance of Zeppelins and profitable to contractors, but also it may help to counteract the barbarous tendencies of the average tradesman towards the use of a violent glare outside his shop window, and thus may assist in bringing about a permanent reform in this respect. To walk at night along some London streets that we could name, before the war began, was positively and literally painful. The accompanying illustration shows how the company above-named would deal with the case.

Time Switch Approved.—The B. of T. has given its approval to the Venner time switch type "C" deposited in October, 1913, by Venner Time Switches, Ltd.

Books Received.—"The Underwar: Patriotic Policy in British Trade." By A. G. Whyte and T. C. Elder. London: Electrical Press, Ltd. 1s. net.

Winter Resort.—For the benefit of those who, for obvious reasons, will not this year desire to follow their accustomed habit of wintering abroad, the Falmouth municipality has issued an illustrated handbook in which the attractions and claims of that resort are set forth. Copies may be obtained free from the Town Clerk.

Lantern Slides for Lectures.—Messrs. Edward Bennis & Co., Ltd., (Publicity Department, 28, Victoria Street, S.W.), inform us that they have a number of lantern slides dealing with the development of mechanical stoking, elevating and conveying apparatus, which they will be pleased to loan to any responsible engineer for lecture purposes. A list of the slides and particulars of their subject matter can be obtained on request.

Trade Announcement.—With reference to a notice appearing under "New Companies" in our last issue respecting the registration of a new company with the name of Wm. Sanders and Co., Ltd., we are asked by Messrs. Wm. Sanders & Co., switchgear manufacturers, of Falcon Electrical Works, Wednesbury, and 90, Charing Cross Road, London, W.C., to state that they are in no way connected with the new concern.

New Industry.—At Heath Town (Wolverhampton) District Council last week, plans were approved for the building of new works by the A.B.C. Coupler Co., Ltd., of London, at Park Village, on the estate of Sir R. A. Paget, Bart. The works are for the manufacture of electrical and engineering appliances for use in the construction of railways.

Trade Expansion.—It is stated that a Committee known as the Committee for the Expansion of British Trade has been formed, with offices at 19, St. James's Street, Sheffield. It proposes to consider and deal with many of the handicaps under which British manufacturers labour in the markets abroad.

Stoker Contracts.—Among recent sales of stokers, &c., effected by the Underfeed Stoker Co. are the following for electricity works:—

Central Electric Supply Co., St. John's Wood	.. ..	4 E.
South Metropolitan Elec. Light and Power Co.	.. ..	2 A.
Bristol Corporation Electricity Department	.. ..	2 E.

Patent Restoration.—An order has been made restoring the following patent:—C. E. Hunter. "Improvements in electric switches." No. 27,196 of 1903.

LIGHTING and POWER NOTES.

Aldershot.—The U.D.C. has given notice that no further applications for current for photographic arcs or equivalent purposes will be entertained at present.

An appeal on the amount of the reassessment of the electricity works, which is £1,120 as against £215, is to be made, unless the estimate of the engineer, £510, is accepted.

Argentina.—A new electricity company is being formed in Santa Fé to exploit the various agricultural colonies of the Province. The capital will be a million dollars.

The tariff of the River Plate Electricity Co. in La Plata has been in force 10 years, and current is said to be dearer than elsewhere in the Province. The Government and public authorities are now urging a reduction in price.

The Government is generally in favour of the Mollard Concession for making use of the falls of the Rio Uruguay for hydro-electric works.

The Electricity Co. has suppressed the public lighting at San Luis, and insists on being paid $100 a day before it will resume service.

The Coronda (Santa Fé) authorities are considering the installation of a public electric service.—*Review of the River Plate.*

Australia.—The North Sydney (N.S.W.) Council has come to an agreement with the Sydney City Council for the supply of electricity to private consumers at the same rate as elsewhere. The City Council must complete the installation within 12 months, under penalty.

Barrow.—Plant Extensions.—The T.C., on Monday last, on the recommendation of the Electricity Committee, agreed to increase the supply of energy to Messrs. Vickers's Works, from 1,040,000 to 5,000,000 units per annum for a period of three years, and with a guarantee of 3,000,000 units for a further two years. It was decided to apply to the L.G.B. for sanction to borrow £13,000 for plant extension, and to accept the tender of the B.T.H. Co. for one 2,000-kw. turbo-alternator, with condensing plant, &c., for £6,718. The purchase of boiler and other plant was left to the chairman and engineer.

Barking.—The Education Committee has decided to obtain estimates for installing electric light throughout the North Street School. The District Council has been asked to take steps to remove all sources of possible electrolytic trouble in connection with the lighting cables.

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Blackpool.—Works Extensions.—With a view to carrying out extensions at the electricity works, it is proposed to acquire a block of property in Caroline Street.

Bradford. — Proposed Loan, &c. — The Electricity Committee has accepted the terms agreed between the electrical engineer, representatives of the B.E.A.M.A. and Messrs. Freer and Howard, in regard to the payment of expenses already incurred in connection with the proposed Bradford Electrical Exhibition. Application is to be made to the L.G.B. for sanction to a loan of £52,000 for new mains, transformer chambers, &c., services and foundations. The Committee has decided to support the I.M.E.A. in the promoting of a joint private Bill for the purpose of obtaining increased powers with regard to electric supply.

The Committee has also resolved to contribute £50 towards the cost of the defence in the action of Attorney-General (at the relation of the Ilford Gas Co) *v.* Ilford U.D.C., in which the question of undue preference to certain consumers of electricity is raised.

Buxton.—Proposed Loan.—The U.D.C. has applied for a loan of £2,335 for electricity purposes, and to cover £335 overspent on a prior loan.

Chelmsford.—Police Court Lighting.—The T.C. has decided to install electric light in the police courts and other portions of the police buildings not at present lighted by electricity.

Dartford.—The U.D.C. has applied to the Dartford R.D.C. and the West Kent Electric Co. for their consent to the supply of current to the Wilmington Works of Messrs. Vickers.

Darwen.—Power Supply.—The Corporation has agreed to supply electricity required for power purposes at the Springfield Mill.

Deal.—Prov. Order.—The T.C. has decided, on the advice of Mr. Lacey, to apply for a prov. order for electric supply, the estimated cost of the plant, apparatus, and mains is £12,000, and with other outlay the total is placed at about £16,000. It was understood that the application was to be made if the Walmer U.D.C. joined in as recommended by a Joint Committee.

East Ham.—The electrical engineer has been directed to furnish an estimate of the cost of wiring Brampton Road School. The Electric Lighting Committee has under consideration applications from hirers of arc lamps for a rebate to be made in the charges, in view of the largely reduced consumption of current caused by the police restrictions.

Eccles.—British Goods.—The T.C. has consented to supply particulars of purchases for the electricity department from foreign manufacturers to the I.M.E.A., with a view to arrangements for the goods so purchased being made by British firms.

Edinburgh.—Mains Extensions.—The Electric Lighting Committee has decided to extend the mains to Colinton, a considerable number of residents in the district having agreed to take electric light.

The Committee has remitted the question of the purchase of an electric car and electric lorry to a sub-committee for consideration and report.

Egham.—Mr. A. P. Trotter, of the B. of T., who heard objections to the erection of an electricity generating station at Egham, in 1911, has written to the Council and been informed that no complaints had been received as to noise, vibration, or anything else.

Enniscorthy.—Prov. Order.—The U.C. has decided to make application to the B. of T. for a prov. order to supply electricity in the town and district.

Exeter.—The Electric Lighting Committee, in reply to a communication from the I.M.E.A., has agreed to subscribe towards the expenses of the Ilford U.D.C. in its case with the Gas Co., and the city electrical engineer has been authorised to attend and give evidence if required.

Falkirk.—Plant Extension.—The T.C. has accepted the contract of £3,620 for the installation of a new battery at the electricity works and of £907 for a new switchboard. The battery is required to equalise the load and as a stand-by; the new installation is expected to result in a saving of £80 per annum.

Fleetwood.—New Plant Started.—The new 550-kw. turbo-dynamo which, with condensing plant, has been installed at the electricity works, was formally started by Mr. R. Eaves, chairman of the D.C., on October 23rd. The extensions which have been carried out at the works have cost about £7,000.

A sub-committee is conferring with the electrical engineer on the question of improved lighting in Lord Street and North Albert Street.

Gillygaer.—E.L. Scheme.—The U.D.C. has received from the South Wales Electrical P.D. Co. terms for lighting the Fochriw district, and these have been submitted to the consulting engineer (Mr. Dixon) for a report.

Haworth.—Prov. Order.—The U.D.C. has decided to apply to the B. of T. for a provisional order to supply electrical energy within the urban district of Haworth.

Huddersfield.—In connection with the extension of the Corporation gas works, inquiries are to be made from the Electricity Committee as to the cost of electric power for the new plant which is to be installed.

Irlam.—Prov. Order.—A favourable report having been presented to the U.D.C. in regard to the prospects of demand for electricity for lighting and power purposes, it was decided last week to make application for a prov. order before December 21st.

Knowle.—Village Lighting.—An E.L. scheme for this village has been carried out by Mr. J. Dennis, at whose sawmills the plant is installed. Six public lamps have been connected, and it is anticipated that private houses and the public buildings will take a supply of current.

Liverpool.—At the annual meeting of the Lighting Committee, in reviewing the work of the past 12 months, it was stated that there were now 10,800 consumers, as against 9,600 last year. Applications for energy for power purposes of about 4,500 H.P. had been received, and the revenue for the six months ending June last had increased by £8,000 over the corresponding period last year. £25,000 had been allotted for the relief of rates during the current year.

London. — St. Pancras. — Ljungstrom Turbine Results.—In a report to the Electricity Committee, Mr. Sydney Baynes points out that the 1,000-kw. Brush-Ljungstrom turbine has been in use since July, and has generated nearly two-thirds of the output of King's Road station. The steam consumption has been less than the guaranteed figures, being as follows:—On full-load, 12·75 lb.; ¾-load, 13·57 lb.; ½-load, 14·67 lb.; and ¼-load, 17·76 lb. per kw.-hour. This has resulted in a coal saving equivalent to £1,700 per annum. The plant runs noiselessly, and the electrical and mechanical control is all that can be desired. The improved steam consumption, particularly on low loads, as compared with the earlier turbine plants, is very marked. The department has a 5,000-kw. turbine of the same make on order, the steam consumptions guaranteed being:—Full-load, 11·8 lb.; ¾-load, 12·38 lb.; ½-load, 13·4 lb., and ¼-load, 15·9 lb.; and it is anticipated that these results may be improved on in use.

L.C.C.—The Finance Committee recommends the Council's sanction to a loan of £10,504 by the Poplar B.C. for the electricity undertaking.

Lambeth.—The B.C. has been recommended to renew its agreement with the South London Electric Supply Corporation, Ltd., for the lighting of Electric Avenue, Brixton, for a further period of five years.

Poplar.—As the Port Authority is to extend pumping operations to the East India Docks, the engineer recommends that an additional E.H.T. feeder should be laid from the generating station to the Blackwall sub-station, and an L.T. feeder from the sub-station to the Docks, at a total cost of £1,996. The Committee has recommended the carrying out of the work.

Manchester.—The Corporation is supplying electricity free to local drill-sheds where recruiting and rifle practice is being carried out.

Manorhamilton (Co. Leitrim).—Workhouse Lighting.—The B. of G. has decided to apply to the L.G.B. for sanction to have the Workhouse lighted by electricity. The installation is to be carried out by the Manorhamilton and District E.L. Co.

Normanton.—Prov. Order.—The U.D.C. has decided to promote an electric lighting order in the next session of Parliament.

Oldham.—Power Supply.—The Electricity Committee has received an application for the supply of energy from Messrs. Bradbury, engineers, who have decided to electrify their Wellington Works.

Salford.—Proposed Loan.—The T.C. has been recommended to apply for sanction to borrow £9,410 for additional plant at the electricity station. The Electricity Committee has accepted the offers of Messrs. Chamberlain & Hookham, Ltd., and the British Thomson-Houston Co. to accept the return of 200 old electricity meters supplied by them and to supply new ones in exchange.

Southampton.—The conference between the Electricity and Tramways Committees, with a view to a reduction in the price of current supplied to the tramways department in accordance with the finding of the experts' report, has been postponed until the Electricity Committee has had an opportunity of fully considering the report.

Stainborough.—Overhead Lines.—The Yorkshire E.P. Co. has applied to the B. of T. for consent to use 2,000-volt overhead lines from Wentworth Silkstone Colliery to Lowe Wood, Stainborough, in the area of the Barnsley R.D.C.

Walmer.—Prov. Order.—The U.D.C. has decided not to apply for a prov. order for E.L.; it had been recommended that the Council should co-operate in the matter with the Deal T.C.

Warrington.—The Electricity Committee of the T.C. has received a letter from the Mersey Power Co., Ltd., asking for clauses to be inserted in the proposed provisional order for providing a future date for a repurchase of the area by the company, at the then value, and adopting a 50-cycle 440/250-volt system. The Committee has agreed to the latter clause, but refuses the condition as to repurchase.

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Walthamstow. — Proposed Loans. — The Public Lighting Committee recommends that application be made for sanction to borrow £14,590, made up as follows:—600-kw. set, £3,610; 1,500-kw. turbo-alternator, £7,350; 1,000-kw. rotary converter, £3,035; low-tension cable together with controlling switchgear, £595, and that tenders be invited for the above-mentioned plant. The Finance Committee recommends the formation of a Sub-Committee to consider the question of the capitalisation of the electricity undertaking, with a special view to making arrangements for dealing with the cost of superseded work. It has been agreed to reduce the assessment of the electricity undertaking from £6,500 to £6,000 rateable value, and to further reduce from £2,000 to £1,350 the assessment of the light railways undertaking.

Willesden.—The electrical engineer recommends the laying of an additional feeder, at a cost of £4,000, to meet the growing demand at Willesden Green. The Committee proposes to supply energy for cooking purposes experimentally to certain schools at 1d. per unit, and to Christ Church, Brondesbury, for experimental heating.

Windsor.—Electric Pumping Saving.—In the annual account of the Windsor Corporation are included the sewerage works results, which show a great saving due to the adoption of electric pumping. A comparison of similar items as between 1913 and 1914 shows, in the former year, the following costs:—Wages, £759; coal, £398; engine charges, £44; electric pumping, £11; a total of £1,202. In 1914 the figures were:—Wages, £429; coal, £31; engine charges, £8; electric pumping, £298; a total of £766, showing a saving of £436, which has been utilised in half-payment for the electric pumping plant.

TRAMWAY and RAILWAY NOTES.

Aberdare.—Proposed Tramway Extensions.—The U.D.C. has decided to seek Parliamentary powers for the extension of the tramways on the Aberowmbri route to a point near the Aberdare boundary; an extension along Regent Street along the present railless route to the terminus at Cwmaman; an extension from the Cemetery to a terminus at Hirwain; the extension of the existing Cwmdare railless route; and a new railless traction route to Llwydcoed, and from the Abernant route to Cwmbach.

Argentina.—The Government has approved of the Anglo-Argentine Tramways Co. taking over the administration of the combination passenger services on its lines and those of the Buenos Ayres-Quilmes Co. The electrification of the Quilmes horse tramway is expected to be complete by November 1st. The Compania de Tramways Electricos del Sud has been authorised to open its branch line to Plaza Constitucion.—*Review of the River Plate.*

Bolton.—The Tramways Committee has decided to relay the track in Great Moor Street—in the centre of the town.

Brighouse.—New Tramways.—The Corporation has decided not to support the Halifax Parliamentary Bill, so far as it relates to the construction of tramways from the centre of Brighouse to Rastrick, and has accepted the proposals of the Huddersfield Corporation, which intends applying for powers for an extension of the tramways from the present terminus at Brighouse to near the terminus of the Halifax tramways.

Bristol.—The Corporation recently adopted a report by the Tramways Committee, which contained a recommendation that the latter be authorised to negotiate with the company with a view to ascertaining what rent the company would pay if the Corporation refrained from exercising its option to purchase for 7, 14 or 21 years.

Colwyn Bay.—The U.D.C. has received intimation from the constructional engineer of the Llandudno and Colwyn Bay Electric Railway of the extension of the line from Colwyn Bay to the Queen's Hotel, Old Colwyn.

Croydon.—Loan Sanction.—The T.C. has received the B. of T. sanction to a loan of £1,918, for a double line of tramway between Selhurst Station and Princess Road.

Edinburgh.—The Tramway Committee of the T.C. recommends the Corporation to include in its application for a prov. order proposals for the extension of the tramway to Corstorphine village, and for the linking up of the Comiston Road and Craiglockart routes by way of Firhill to the south of the Colinton Hospital.

Halifax.—Proposed New Tramway.—A sub-Committee of the Tramways Committee has recommended that in the event of a Parliamentary Bill being promoted powers should be included for the construction of a line to Elland from Salterhebble, *via* Wood Bottom.

Half-Year's Working.—On the Corporation tramways undertaking, during the half-year ended September 30th, there was a profit of £8,611, the income being £61,305, and the expenditure £52,694. On the motor-buses a profit of £259 had accrued.

Huddersfield.—Half-Year's Working.—In connection with the tramway undertaking the figures for the half-year's working ended September 30th showed receipts of £64,784, and expenditure £34,371, as against £59,606 and £32,443 during the corresponding period of last year. The surplus was £10,677, as against £8,792 a year ago. During the six months £6,883 had been transferred to the reserve or renewal account, which now stands at £22,210.

London.—The Court of Common Council has resolved to oppose the L.C.C.'s proposed tramway extensions in the City, viz, from Aldgate to Aldgate Station; Aldgate to Mark Lane, *via* Mansell Street; Charles Street to Blackfriars, *via* Farringdon Street and Ludgate Circus; and from Gray's Inn Road, *via* Holborn and Charterhouse Street, to Farringdon Street.

P.O. Tube Contract.—The Postmaster-General has accepted Messrs. John Mowlem & Co.'s tender for the construction of the tube from Paddington to the Eastern District office, a distance of six miles.

Northampton.—Last week the B. of T. inspected the new route to Far Cotton, and a service was inaugurated on Monday. So far it has proved successful, though handicapped by the fact that the lines have not been laid over the railway, for, it is understood, military reasons.

Preston.—Loans Sanctioned.—The town clerk has received sanction from the B. of T. for the borrowing by the Corporation of £7,000 in respect of car-shed and office extensions, and £5,049 for additional cars.

Stalybridge. — Proposed Additional Powers.—The Joint Board decided on October 22nd to apply for a Parliamentary Act in the next Session giving it power to construct and work additional tramways; to run motor-omnibuses; to enable the Board, with the consent of the local authority, to purchase tramways of the Oldham, Ashton, Hyde and District Tramways, Ltd., and the Hyde Corporation, and to lease such tramways and enter into working agreements; to construct an additional generating station; to extend the area for the supply of electricity, and to enable the Board to borrow further moneys.

West Ham.—The Tramways Committee recommends that sanction be obtained to the laying of double lines of tramway track in portions of Woodgrange Road.

TELEGRAPH and TELEPHONE NOTES.

A Dastardly Scheme.—An attempt was recently made to murder Dr. A. M. Low with a poisoned cigarette. Dr. Low is in charge of a section of wireless telegraphy and field telegraphy, and has paid several official visits to France.

An Alien at the Switchboard.—It has been ascertained that a German arrested at Dunfermline last week was for a time in charge of the telephone department at Rosyth Dockyard. The works are connected by telephone, and the manipulator of the switchboard had every opportunity of listening to the conversations which took place between the various departments of the works, now in an advanced state of construction.

Cable Profits.—The *Financial Times* states that the gross earnings of the Western Union Telegraph Co. increased by $1,380,000 during the quarter just ended, while the surplus at credit of profit and loss account advanced by $1,157,000, due partly to the temporary suspension of code communications in favour of plain-word messages.

Telegrams in Code.—The Postmaster-General announced on Saturday last that the Army Council had agreed to the use of registered addresses in extra-European telegrams, as from the 26th inst. under the following conditions:—

1. The address must have been registered before July 1st last.
2. It can only be used as the address of a telegram; its use as the signature is still prohibited.
3. Telegrams having such addresses can only be sent to, and received from, British or Allied territory in the extra-European telegraph system (and Egypt), or the United States of America.
4. In the case of telegrams to Allied territory or the United States, the full name and address of the addressee must be given on the back of the telegram form.

On Monday a further announcement was made that, as from November 1st, the prohibition of the use of codes would be relaxed, subject to certain regulations. These prescribe that the use of code will only be permitted in telegraphing to British possessions and allied or neutral countries outside the European telegraph system, with the exception of the Argentine Republic, Brazil, Danish possessions, Dutch East Indies, French possessions, Italian possessions, and Angola (Portuguese). The following codes only are authorised:—A B C, 5th edition; Scott's code, 10th edition; Western Union code; Lieber's code. Messages in any other code will be stopped. Neither private supplements nor the numerical equivalents of the phrases in published codes are admissible. All messages in code will be decoded by the Post Office for submission

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to the censors. Persons handing in coded telegrams should deposit at the same time translations of the messages. In all cases the name of the code used must be indicated on the form. A fee of 6d. will be charged for each outward telegram in code.

National Revenue.—The returns for the September quarter show revenue from telegraphs £800,000, a decrease of £15,000, and from telephones £1,350,000, a decrease of £285,000, as compared with the corresponding quarter last year.

U.S.A. Wireless Stations.—By direction of President Wilson, the telegraph station of the Marconi Co. at Siasconset, Mass., has been closed, as the company refused to recognise the right of the Government to censor messages. The company had just previously filed suit for an injunction in a Federal District Court of New York, to restrain the naval officers from closing or censoring messages at the station.—*Electrical Review and Western Electrician.*

A suit brought by the Marconi Wireless Telegraph Co., of America, to enjoin the Secretary of the Navy of the United States from further interference with the transmission and reception of wireless messages at the stations of the company located at Sea Gate and Sagaponack, L.I., was argued in the United District Court; the Assistant Attorney-General appeared and argued that the Court had no jurisdiction, and on October 8th the Judge dismissed the Bill on the technicality.—*Telegraph and Telephone Age.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—December 9th. Victorian Railways. 110 tons of block tin. Contract 27,436. Contractors' Room, Spencer Street.

December 16th. Victorian Railways. Rubber-covered copper wire. Contract 27,705. Contractors' Room, Spencer Street.

December 16th. Victorian Railways. 100 neutral track relays for electrical circuits. Contract 27,712. Contractors' Room, Spencer Street.

December 28th. Victorian Railways. Three 50-kw. static transformers. Contract 27,737. Contractors' Room, Spencer Street.

It is reported by Reuter dispatch from Melbourne that the Melbourne City Council requires electrical plant and material to the value of £71,000 and has resolved to call for tenders for machinery, which must be British made. "No tender in which German or Austrian capital or work is concerned will be entertained."

Adelaide.—December 9th. Telephone instruments and parts, for the Postmaster-General. See "Official Notices" October 3rd.

December 15th. Switchboard, common battery, automatic or semi-automatic, for the Postmaster-General. See "Official Notices" October 9th.

Sydney.—December 9th. P.M.G. Various telegraph instruments and measuring instruments.

December 21st. City Council. Motor-generators and switchgear suitable for electric vehicle battery charging. Specifications, 10s. 6d., from City Electrical Engineer.

Barnes.—The Electricity Committee reports that the coal contracts expire in December next, and owing to the present state of the market it recommends that the electrical engineer be authorised to purchase coal in the open market as and when required.

Blackpool.—November 19th. Corporation. Water-tube boiler, mechanical stokers, economiser, steel chimney, coal-storage hopper, one 1,500-kw. turbo-alternator, surface condenser and auxiliaries. See "Official Notices" October 23rd.

Connah's Quay.—November 6th. U.D.C. (Contract 2) Gas engines, suction gas plant, pipework, cooling tank, dynamos, booster, switchboard, connections and storage battery. (3) Overhead and underground mains, services and public lighting. See "Official Notices" October 16th.

Dublin.—November 5th. G.N. Railway Co. (Ireland). Twelve months' supply of stores, including a number of electrical items. See "Official Notices" October 16th.

November 9th. Dublin United Tramways Co. Twelve months' supply of stores, including car fittings, electric supplies, &c. See "Official Notices" October 23rd.

Hawarden (Flint).—November 11th. R.D.C. Gas engines, suction gas plant and dynamos, switchboard, balancers and boosters, storage battery, underground mains. See "Official Notices" October 23rd.

London.—November 4th. Installation, 235 wiring points, 290 lights, at Senior Street Elementary School, Paddington. See "Official Notices" October 23rd.

Hammersmith.—November 4th. H.T. and L.T. underground electric supply cables, for the B.C. See "Official Notices" October 23rd.

H.M. Office of Works.—November 3rd. Portable electric hand lamps. See "Official Notices" to-day.

Neath.—Coal for a year (2,000 to 2,500 tons of through and through or small steam) for the generating station of the R.D.C. at Court Sart. Mr. G. H. Thomson, Electrical Engineer, 12, Green Street, Neath.

New Zealand.—November 25th. Public Service Stores Tender Board, Wellington. 50 miles insulated and braided wire, twin twisted; 7,000 dry cells for telephones.—*Board of Trade Journal.*

Gisborne.—December 5th. Borough Council. Direct-current meters for electric lighting. (Deposit £25, to Town Clerk.) Specifications, &c., may be seen at Board of Trade Commercial Intelligence Department in London.

Tunbridge Wells.—November 7th. Corporation. 12 months' supply of H.T. and L.T. cables. See "Official Notices" October 9th.

Wakefield.—December 4th. Yorkshire (W.R.) Electric Tramways Co., Ltd. Twelve months' supply of electric lamps, fittings, insulating materials, &c. Schedules can be obtained from the Central Offices, Belle Isle, after November 9th.

Wigan.—November 11th. T.C. 40 electric torches for the police. Mr. John S. Percival, Chief Constable.

York.—November 9th. Construction of about 1½ miles of light railway, excluding overhead electrical equipment, for the T.C. Mr. F. W. Spurr, City Engineer (returnable deposit of £5).

CLOSED.

Australia.—An Australian paper states that the tender of the Automatic Telephones (Australasia), Ltd., has been accepted by the Postmaster-General for the supply and erection of automatic switchboards in the telephone exchanges at Randwick, Mosman, Parramatta, Ashfield, Burwood, Homebush, Lidcombe and Watson's Bay, which are all in the Sydney network; £101,115 is involved. The switchboards are manufactured in the United States.

Barnsley.—The Electricity and Lighting Committee has accepted the tender of the Paterson Engineering Co., Ltd., amounting to £55, for alterations to existing water-treatment plant.

Bradford.—The Electricity Committee has accepted the tender of Messrs. Ferranti, Ltd., at £373, for the supply of five static transformers.

The Guardians have been recommended to accept the tender of Mr. Charles Bell, at £90, to carry out outside electric lighting at the St. Luke's Hospital.

Cardiff.—Messrs. Venner Time Switches, Ltd., have received a repeat order from the Corporation for 49 time switches.

Cleckheaton.—The U.D.C. has accepted the tender of the Union Cable Co. for 880 yards of cable for house services; and that of Messrs. Siemens Bros., Ltd., for feeder pillars.

Derby.—The Borough Education Committee has accepted the tender of Messrs. Newton Bros. for the electric light installation at the Girls' Secondary School, at £198.

Eastbourne.—The following is a list of the firms who submitted tenders for switchboard for the Corporation Electricity Department:—

Electric Construction Co.	General Electric Co.
Siemens Bros.	British Thomson-Houston Co.
Spagnoletti, Ltd.	Bertram Thomas.
Switchgear & Cowans (accepted) £1,026	Ferguson Pailin & Co.
Crompton & Co.	Johnson & Phillips.
British Westinghouse Co.	Cox-Walkers.

India.—The Commissioners of the Port of Calcutta have accepted the tender of Messrs. Pyne Hughmann & Co. for electric cranes at £12,100.—*Indian Industries and Power.*

Liverpool.—The Tramways and Electric Power Committee recommends the acceptance of the offer of Messrs. J. Henshaw & Sons to carry out the work in connection with the reconstruction of the second section of the boiler-house of Lister Drive No. 1 power station.

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London.—Poplar.—The Electricity Committee has recommended the acceptance of the tender of Messrs. Fairweather and Ranger, at £1,133, for the construction in reinforced concrete of stores for the department.

Southwark.—The tender of Messrs. G. Hinchliffe & Co. has been recommended to the Borough Council for acceptance for the supply to the electric light station of 10,000 tons of various descriptions of coal, at 12s. 7d. per ton.

It is announced in the *Times* that the Postmaster-General has accepted the tender of Messrs. John Mowlem & Co., Ltd., for the construction of the railway tunnel from Paddington to the Eastern District Office, authorised by the Post Office (London) Railway Act, 1913, for the conveyance of mails.

The London Education Committee has received the following tenders for the installation of electric lighting at two schools:—

	Gifford Street.	Vallance Road.
Foote & Milne, Ltd.	(accepted)	£504
T. W. Vaughan & Co.	883	581
Defries & Goldman	393	595
Kent & Co.	895	661
Tyler Apparatus Co., Ltd.	393	547
G. P. Aleen & Co.	404	—
J. & F. May	427	619
G. Weston & Sons, Ltd.	435	—
Lund Bros. & Co.	441	—
Tredegar & Co.	442	644
A. Hawkins & Sons	449	619
Alpha Mfg. Co.	450	—
Hill & Harrington, Ltd.	456	—
Duncan Watson & Co.	468	715
Derry & Toms	—	564
Northern Electric Co.	—	599
Arthur Newman	—	655
H. J. Cash & Co.	—	706
The Petrolite Lamp Co.	—	849

Stepney.—The Electricity Committee reports the acceptance of the following offers of coal:—A. Blackmore & Co., 200 tons Lanarkshire washed peas, 14s. per ton; Shipping and Coal Co., Ltd, 103 tons of Cowpen nuts, 14s. 9d. per ton; Spenser Whatley, Ltd., 110 tons Warwickshire peas, 13s. 9d. per ton.

Luton.—The Town Council has been recommended to accept the tender of Messrs. Hayward-Tyler & Co., Ltd., at £120, for a feed pump in connection with the electricity station extensions.

Mansfield.—The Education Committee has accepted the tender of the Mansfield Engineering Co., amounting to £108 10s., for electric lighting installation at Rosemary Boys' and Girls' Schools.

Rochdale.—Contracts for the supply of 15,000 tons of coal for the electricity works have been placed, the price agreed upon showing a reduction of just over 2s. 6d. per ton. Last year the price averaged 13s. 9d. a ton; now it is about 11s. 2d.

Salford.—The following tenders have been accepted by the Tramways Committee:—

Bayliss, Jones & Bayliss, Ltd.—2,000 single-ended tie-bars, £11 17s. 6d. per ton; 2,500 double-ended tie-bars, £12 per ton—plus 3s. per ton for cartage in both cases.

Hadfields, Ltd.—24 manganese-steel points and 12 manganese-steel crossings, £528.

Titan Trackwork Co., Ltd.—Eight manganese-steel points and four manganese-steel crossings, £173.

Walter Scott, Ltd.—500 tons Sandberg steel tramway rails, £7 15s. per ton, plus 2s. per ton for cartage.

The following tenders have been accepted by the Electricity Committee:—

J. Wolstenholme & Son.—4-in. steel piping with cast-iron flanges, £67.

Bradley & Lonsdale.—Erection of gangway over condenser pit, £29 10s.

Buxton Lime Firms Co.—Lime, 26s. per ton.

J. J. Knight.—Additional office, gangway, &c., at the electricity station, Frederick Road, £340.

Warrington.—The Electricity Committee has accepted the tender of Messrs. Johnson & Phillips, Ltd., at £430, for cables.

Woolwich.—The tender of the British Westinghouse Co. has been accepted by the B.C., at £135, for a 200-K.V.A. transformer.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, October 30th. At 8 p.m. At Storey's Gate, S.W. "Thomas Hawksley" Lecture.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, October 30th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General meeting.

(**Graduates' Section**).—Saturday, October 31st. At 7.15 p.m. At Bolbec Hall. Address by Mr. E. L. Champness.

Institution of Municipal Engineers.—Saturday, October 31st. Eastern and North-Eastern District meeting, Lincoln. At 11.45 a.m. At Guildhall. Business meeting; luncheon. Afterwards visits to various undertakings, including, at 2.45 p.m., electricity works and tramway undertaking.

Society of Engineers.—Monday, November 2nd. At 7.30 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Ordinary meeting.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, November 3rd. At 7.30 p.m. At Engineers' Club, Albert Square. Chairman's address, by Mr. P. P. Wheelwright.

(**Yorkshire Local Section**).—Wednesday, November 4th. At 7.15 p.m. At Hotel Metropole, Leeds. Opening meeting and smoking concert.

Rontgen Society.—Tuesday, November 3rd. At 8.15 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Presidential address, by Sir A. P. Gould.

Institution of Civil Engineers.—Tuesday, November 3rd. At 8 p.m. At Gt. George Street, S.W. Presidential address, by Mr. B. Hall Blyth.

Salford Technical and Engineering Association.—Saturday, November 7th. At 7 p.m. At Royal Technical Institute, Peel Park. Short papers by members (for gold medal).

NOTES.

The "Electrical Review" during War Time.—For the convenience of any of our readers who may be serving with the naval or military forces, either in camp or elsewhere, we have pleasure in announcing that any electrical or engineering unit or individual electrical man will be provided with a copy of the Electrical Review regularly every week as long as the war lasts if the Manager, the Electrical Review, 4, Ludgate Hill, E.C., be furnished with the name and address to which it is to be sent.

The William White Memorial.—The *Times* states that nearly £3,000 has been subscribed to the Sir William White Memorial Fund, and the principal part of the fund is to be devoted to the establishment of a scholarship for research work in naval architecture.

Fire Prevention.—The British Fire Prevention Committee has issued a special fire warning for buildings in which Belgian refugees are being temporarily housed, printed in English, French and Flemish. Copies can be obtained upon written application (giving requirements as to language) addressed to the Registrar, the British Fire Prevention Committee, 8, Waterloo Place, London, S.W.

French Red Cross Society.—The French Committee formed for the assistance of dependents of local residents who have joined the Colours of our Allies, has also undertaken to collect funds for the French Red Cross Society, which is now in very urgent need of assistance. The resources of this society have been overwhelmed by the needs of the wounded from the enormous battle area. The numbers of wounded to be dealt with increase daily, and, of course, British, Belgians, French and Germans are all ministered to alike. The expense incurred is naturally excessive, and is altogether beyond the ordinary resources of this society, and an urgent appeal is made to this country for assistance. Donations may be sent to Mr. A. Reyrolle, care of A. Reyrolle & Co., Ltd., Hebburn-on-Tyne, who is a member of the Local French Committee.

Diesel Electrical Locomotive Cars.—On the railway line between Rastatt and Gernsach, in Saxony, some experiments have been made with the running of the first Diesel electrical locomotive cars constructed in Germany. The car is built to accommodate 100 persons, and has a cab for the driver at each end. It is mounted on two bogie-trucks. On one of these is carried the Diesel engine, by which the energy is supplied, and which is coupled direct to a dynamo; on the other, which has two axles, are installed two electromotors, for the propulsion of the car. The Diesel set has a capacity of 147 KW. and runs at 450 R.P.M. The six cylinders are of the four-cycle type and are arranged in a kind of V, each three of the same side being placed at an angle of less than 30° to the vertical. The internal diameter of the cylinders is 260 mm, and the stroke is 300 mm. The speed under the control of the driver can be reduced to about 200 R.P.M.

The trials made with these new cars were very successful, and a speed was achieved of 75 km. or 45½ miles per hour. The running of the cars was very quiet, and there was scarcely any vibration.

The mechanical parts of the cars were supplied by Messrs. Sulzer Bros., and the electrical parts by the A.G. Brown, Boveri & Cie. The State Railways in Saxony have placed orders for a number of new cars of this type, and the example has been followed by the Prussian State Railways. The price is considerably higher than that of ordinary motor-cars, but this is counter-balanced by the decreased cost of running of the electrical cars. A comparison is being made with cars of British manufacture; these have been run over a distance of 1,600 km., and the average consumption amounted to 0·21 pfennig per km. This works out on the basis of price of energy of 1·06d. per KW.-hour at 0·31d. per km., a result which it would be impossible to approach with other types.

Simpler Control for Rolling-Mill Motors.—In a paper read before the American Association of Iron and Steel Electrical Engineers, W. Sykes and G. E. Stotz plead for simpler controllers on rolling mill motors. The motors themselves have been so perfected that trouble with them arises only under extraordinary circumstances, but, to reduce the risk of overloading the machines while accelerating the heavy rotating parts of the mill drive, complicated automatic controllers have been introduced which not infrequently introduce more maintenance troubles than they remove. Interlocks and a multiplicity of contacts and relays should be avoided, as far as possible, in favour of manual operation by proper attendants. Rolling mill motors necessarily carry high momentary peak loads, hence it is difficult to protect them against long continued moderate overloads. Ordinarily, the speed drop of an induction motor from light to full load is only 2 or 3 per cent., which does not permit a fly-wheel to relieve appreciably peak loads on the driving motor. A liquid slip regulator, providing 10 to 15 per cent., or greater speed drop on full load, permits the fly-wheel to become usefully operative, and maintains more uniform load on the motor than is possible where step-by-step grid resistances and switches are used. As compared with a controller and fixed slip arrangement, a liquid slip regulator effects very important reductions in the maximum power required for rolling; this saving becomes more considerable the smaller the fixed slip, and in a particular case the use of a liquid slip regulator reduced the maximum demand 30 per cent. and 40 per cent., as compared with the demand when rolling with 11 per cent. and 6 per cent. fixed slip respectively.

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The Insulating Properties of Solid Dielectrics.—In the scientific papers of the Bureau of Standards, U.S.A., an account is given by Harvey L. Curtis of a research on the volume resistivity and the surface resistivity of dielectrics. The volume resistivity of a material is the resistance in ohms between two opposite faces of a centimetre cube. The surface resistivity is defined as the resistance between two opposite edges of a centimetre square of the surface film which is deposited upon the material.

In measuring the volume resistivity, mercury electrodes were employed in order to make good contact, and a guard-ring was used to prevent any errors on account of surface leakage. Some values of the volume resistivity are given below :—

VOLUME RESISTIVITY OF SOLID DIELECTRICS.

Material.	Resistivity. ohms-cm.	Material.	Resistivity ohms-cm.
Special paraffin ..	over $5{,}000 \times 10^{15}$	Paraffined mahogany ..	40×10^{12}
Ceresin	over $5{,}000 \times 10^{15}$	Stabilite	30×10^{12}
Fused quartz ..	over $5{,}000 \times 10^{15}$	Plate glass	20×10^{12}
Hard rubber	$1{,}000 \times 10^{15}$	Bakelite No. 150.. ..	4×10^{12}
Clear mica..	200×10^{15}	Opal glass	1×10^{12}
*Sulphur	100×10^{15}		
*Amberite..	50×10^{15}	Paraffined poplar ..	500×10^{9}
*Rosin	50×10^{15}	Paraffined maple ..	300×10^{9}
*Mica (India ruby slightly stained)	50×10^{15}	Bakelite No. 1	200×10^{9}
Mica (brown African clear)	20×10^{15}	Bakelite No. 190	100×10^{9}
Bakelite L558	20×10^{15}	Italian marble	100×10^{9}
*Electrose No. 8 ..	20×10^{15}	Vulcabeston	20×10^{9}
*Shellac	10×10^{15}	White celluloid	20×10^{9}
*Sealing wax	8×10^{15}	Hard fibre..	20×10^{9}
*Yellow electrose ..	5×10^{15}	Black galalith	20×10^{9}
*Yellow beeswax ..	2×10^{15}	White galalith	10×10^{9}
Khotinsky cement ..	2×10^{15}	Red fibre	5×10^{9}
*Moulded mica	1×10^{15}	Marble, pink Tennessee	5×10^{9}
		Marble, blue Vermont..	1×10^{9}
Unglazed porcelain ..	300×10^{12}	Ivory	200×10^{6}
Black electrose	100×10^{12}	Slate	100×10^{6}
Mica (India ruby stained)	50×10^{12}	Bakelite No. 140.. ..	20×10^{6}
German glass	50×10^{12}		

* Apparent resistivity taken after the voltage had been applied for 15 minutes.

Upon the surface of all insulators except the waxy materials a film of moisture collects from the surrounding air. The thickness and conductivity of this film depends upon the material of which the insulator is composed and upon the relative humidity of the surrounding air. For some materials the surface resistance at 1 per cent. humidity is 10^{11} times larger than at 95 per cent. humidity, though for the majority of materials the surface resistance does not change by a factor of more than 10^{6} under these conditions. Since the change is not uniform, it has been found necessary to construct curves showing the change of surface resistivity with humidity. These curves are given in the original article.

Electrical News in German Papers.—The *Electrical World* of October 10th contains the following note regarding the *E.T.Z*, which, of course, no longer reaches us :—

"In the *Elektrotechnische Zeitschrift* of September 10th (Nos. 36-37, containing 20 pages of text and 20 pages of advertisements) there is a note on 'War and Industry,' signed by the initials of the editor (Mr. C. Zehme), referring to a statement of the commander-general of the Seventh Army Corps of the German army to the inhabitants of the provinces of Rhineland and Westphalia. In this statement it is emphasised that Germany needs its men not only for the war but also for maintaining some of the most important industries ; that in order to make a successful issue of the war possible it is necessary above everything else to keep the coal mines of the district in full operation and in the same way the metallurgical works making war materials ; but that it is also necessary to keep open the boat traffic in the River Rhine, the mills, the waterworks and electric central stations.

"It is pointed out by the editor that the electrical industries have lost 25 to 30 per cent. of their employés, who have gone to the front. Some departments of the industries had to be restricted, others had to be extended in operation. The editor thinks that in view of the importance of keeping the electrical industries in full swing, the recent raise of price made by several of the German electrical manufacturing companies is of doubtful economic soundness.

"Under trade notes it is stated that the Gottfried Hagen Storage Battery Co, in Cologne, has raised the price of plates and batteries by 10 per cent. as a result of the rise in price of lead.

"On the front page the editors and publishers make the following announcement : 'On the supposition that the mail facilities permit it, one number of the *Elektrotechnische Zietschrift* will be issued at least every two weeks. We hope that political conditions will soon enable us to resume the issue of weekly numbers and in any case to bring the current yearly volume to a complete conclusion.'"

The I.M.E.A. and the Ilford Case.—The Willesden Electricity Committee has received a request from the I.M.E.A. asking for financial assistance in defending proceedings instituted by a gas company against the Ilford Council in respect of alleged preferential treatment. The Committee states that it is advised that the Council has no power to comply with such request, and it recommends that the Association be so informed. In this connection, Bradford Electricity Committee has decided to contribute a sum not exceeding £50, and Salford Electricity Committee a sum not exceeding £20 towards expenses.

B.E.A.M.A. Annual Dinner.—The Council of the B.E.A.M.A. decided, at the last meeting, not to hold the usual annual dinner this session.

Electricity in the Iron and Steel Industry.—Statistical data showing an immense increase in the use of electricity in the iron and steel industry of the United States were presented by R. Tschentscher, at the Cleveland Convention of the Iron and Steel Electrical Engineers. Inquiries were sent to 85 companies operating from 1 to 33 plants (200 installations in all) and replies were received from 62 companies, operating 175 plants. Of these companies, all but three generate their own current, and a summary of the data collected reads as follows :—

No. of generating stations ...	170
Generating sets—No. of ...	840
KW. capacity	394,500
Motors.—No. of	45,510
H.P.	1,261,150 H.P.
Load—Lighting	33,863 KW.
Metallurgical	7,047 KW.
Miscellaneous	4,810 KW.
Units.—Purchased in 1913 ...	7,800,000 KW-hours
Generated „ „ ...	1,633,764,000 KW.-hours
Average do. per plant...	9,610,000 KW.-hours

The total KW.-hours generated during 1913 in individual plants ranged from 100,000 up to 330 millions, and three companies alone in their 19 plants generated 683 million units, *i.e.*, 42 per cent. of the total. The largest and next largest electrical equipments accounted for 20 per cent. and 8 per cent. respectively of the total output from the whole 170 plants reported.

Nothing could show more clearly the immensity of the remaining possible electrical applications in existing iron and steel works—applications which will doubtless be made, as present plant becomes obsolete or worn out, and as competition demands that advantage be taken of the economies of electric driving.

There are from 225 to 250 separate iron and steel works in the States, and, excluding mining, making and handling of raw materials and transport of the latter, their total electric power production was approximately 2,000 million units in 1913, say an average of 9,000,000 units per plant, as compared with the 1912 census averages of 4·8 million units for each of the 1,260 electric railway companies and 2·2 million units for each of the 5,221 central stations (including railway and lighting) in the States.

Allowing for light load, metallurgical and miscellaneous load, and on the basis of 6,400 working hours per annum, the generator power for motor load in the steel industry is 236,000 KW. This correspondends to an average motor load factor of 20 per cent., and it is probable that load factors between 15 per cent. and 25 per cent. cover all average conditions in the iron and steel industry. The consumption of electrical energy in iron and steel works in the States is about 20 times as great as it was 10 years ago—a record of development approached in no other single industry.

Banks and Government Contracts.—The opinion is held that greater facilities might be afforded by banks in the present position of affairs to many firms who have secured contracts with the Government if the latter would accept from the banks notices of the charges by customers against such contracts, and would pay the moneys due from time to time direct to the banks on the order of the customer. This would better enable banks to make advances in respect of such undertakings. At present the Government declines to do this. The banks, it is said, are anxious to finance these contracts, and they are taking exceptional risks to assist their customers, but naturally they are not disposed to run risks which might be difficult to justify unless the Government assists them in the manner indicated.—*Times.*

Electromagnets for War Surgery.—At the recent meeting of the French Academy of Medicine, Dr. A. Dastre explained the uses to which a powerful electromagnet could be put in removing shrapnel splinters and steel-jacketed bullets from wounded soldiers. It is claimed that an electromagnet used by Prof. Rolet drew shrapnel fragments to the surface from a depth of 6 in., and bullets from a depth of 2½ in.—*Electrical World.*

America Appoints More Trade Consuls.—In view of the exceptional activity of the United States Department of Commerce, and the Consular officers under their control, in investigating fresh business opportunities arising from the war, it is of interest to note that seven commercial attachés have been appointed by the department "to undertake the new service of American trade promotion abroad." Mr. A. H. Baldwin, who has been appointed to London, was during the past four years chief of the Bureau of Foreign and Domestic Commerce. Dr. Veditz, who will go to Paris, has been expert investigator to the United States Government, after having filled the Professorship, at several American Universities, in Economics, which subject he studied extensively on the Continent. The special qualifications of the attaché at Berlin (Mr. E. W. Thompson) are mill designing, and the manufacture of cotton goods and cotton seed products. The other appointments are to Pekin (Mr. J. H. Arnold), Buenos Ayres (Dr. A. Hale), Rio de Janeiro (Mr. L. Hutchinson), and Lima (Mr. A. Harrington).

Inquiries.—A correspondent wishes to know whether balata is suitable for use in electrical manufactures, and to what extent cheap rubber will affect the demand for gutta-percha and balata.

Names of firms to stamp out the metal frames of cheap electric bells, and makers of wood bases and gongs for bells, are wanted.

Inquiries are still being received for British makers of pocket-lamp batteries, of whom we know only a few ; if any other firms have taken up this line we shall be pleased to hear from them.

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Institution and Lecture Notes.—Institution of Electrical Engineers.—The 1914-15 Syllabus of the Manchester Local Section contains the following items :—

November 3rd, 1914.—Chairman's Address by Mr. P. P. Wheelwright.
„ 17th.—"Cables." By Mr. C. J. Beaver.
December 1st.—"Power Plant Testing." By Mr. W. M. Selvey.
„ 15th.—"Automatic Protective Switchgear for A.C. Systems." By Mr. E. B. Wedmore.
January 12th, 1915.—"Conditions Affecting the Variation in Strength of Wireless Signals." By Prof. E. W. Marchant.
„ 26th.—"Electric Furnaces." By Mr. T. D. Robertson.

The following provisional programme for the session 1914-15 has been drafted by the Scottish Local Section :—

November 10th, 1914, (Glasgow).—Chairman's Inaugural Address.
December 8th, „ (Glasgow).—Paper on "The Magnetisation of Iron at High Flux Density with Alternating Currents." By Mr. J. S. Nicholson, B.Sc.
January 12th, 1915, (Edinburgh).—Paper on "Cables." By Mr. C. J. Beaver.
February 9th, „ (Glasgow).—Paper on "Distribution and Rise of Temperature in Field Coils." By Prof. M. Maclean, Mr. D. J. M'Kellar and Mr. R. S. Begg.
March 9th, „ (Edinburgh).—Paper on "Automatic Protective Switchgear for Alternating-Current Systems." By Mr. E. B. Wedmore.
April 12th, „ (Glasgow).—Annual General. Paper on "Power Plant Testing." By Mr. W. M. Selvey.

Owing to the war it has been decided not to have the annual dinner and smoking concert, and there will be no meetings of the Students' Section this session.

Institution of Engineers and Shipbuilders in Scotland.—The report of the Council for the past Session shows that the membership at September 30th was 1,669. The treasurer's statement shows surplus revenue £202, and total assets £33,239. The "James Watt" anniversary dinner will not be held this year.

Igranic Engineering Society.—The first meeting of the Session was held on the 21st inst. The chair was taken by the President (Mr. G. A. Mower), and Messrs. A. H. Curtis and J. H. Mould were elected vice-presidents. Addresses were given by the President and Mr. Mould on the effect of the war on the electrical industry. Mr. J. T. Mould's remarks were devoted largely to the commercial effect of the war, and to a review of the opportunities afforded by the present situation to secure those markets for electrical apparatus which had been in the hands of German manufacturers and exporters. If the whole of the German markets were captured, our exports of electrical apparatus could be doubled; the field was promising, provided that the necessary sustained and well-directed spade work was carried out and a careful study made of the exact requirements and business methods of the markets now made available. Reference was made to the Roll of Honour of the Igranic Electric Co., on which appeared the names of 100 employés serving with H.M. Forces, and 11 members of the staff who had recently joined the Colours were elected hon. members of the Society.

Association of Electrical Station Engineers.—A meeting of the London Branch was held at Stone's Restaurant, Ludgate Hill, E.C., on Tuesday last. The general secretary reported that the London branch secretary had handed in his resignation, which had been accepted by the London Committee, and the general secretary would undertake the London Branch work for the time. He also reported that one of the trustees and two of the London committee had enlisted in the Army, as well as a large number of the members (a full list was being compiled). It was agreed that those members who had undertaken military duties should be relieved from payment of their subscriptions during their period of service, and they should retain full membership. The secretary pointed out that it was the duty of those who still continued their usual occupations to pay up all arrears of subscriptions, to make up for the large loss entailed, and to keep the Association on a firm footing, financially and otherwise. The conference originally arranged for October 3rd has been postponed indefinitely.

The Secretary also stated that he had received large numbers of applications from engineers and others for men to fill various vacancies (for the period of the war) but except in a few cases early in August had been unable to supply men; the difficulty in some cases had been overcome by overtime. There was a shortage of skilled men for the supply side of the industry under present conditions, and there was a feeling that unskilled men were being put into responsible positions. There was no doubt that this was happening in a few cases, but the Association proposed to take no action in the matter, as most were only engaged during the period of the war. On the return of members from active service their interests would, of course, come first; in most cases reinstatement was sure.

The next meeting of the London Branch will be held on November 17th, as above.

Fatality.—An inquest was held on the 19th inst. at Parkhurst, I.O.W., on Edward Belcher, a Territorial bandsman, who was killed through an explosion in an electric inspection chamber in St. James's Street, Newport. During the previous Saturday evening a foreman in the Electric Light Co.'s employ replaced a fuse in a feeder-pillar in the market, and simultaneously the explosion occurred in the inspection pit; the cover being blown into the air fell on the head of Belcher, who was dead when picked up. Efforts to elicit the cause of the explosion failed, and the jury returned a verdict of "Accidental Death," adding that the chamber covers should be lifted at least once a week as a precaution.

Patents and Alien Enemies.—Applications have been lodged for the avoidance or suspension of the following patents :—

No. and year of patent.	Name of grantee.	Short title.	Name and address of applicant.	Date of hearing.
362/12 25,719/13	Hinselmann Gebrüder Hinselmann	Jig conveyers	E. Mills, 9, Harper Street, Willenhall, Staffs.	Nov. 5th
19 369/11 19,370/11	Julius Pintsch A.G.	Apparatus for flashes of light	Pintsch's Patent Lighting Co., Ltd., Friars House, New Broad Street, London	Nov. 6th
8,561/13	Julius Pintsch A.G.	Railway signalling	Pintsch's Patent Lighting Co., Ltd.	Nov. 6th
8,585/13 8,586/13	Julius Pintsch A.G.	Lighthouse lamps for aerial navigation	Pintsch's Patent Lighting Co., Ltd.	Nov. 6th

The following cases have been decided :—

No. and year of patent.	Name of grantee.	Applicant.	Decision.
20,922/12 23,150/12	"Vulkan" Maschinenfabriks Akt.-Ges.	Glenfield & Kennedy, Ltd.	Application refused.

Late Correspondence.—We have received the following letter :—

Spagnoletti, Ltd.—From several sources in the trade it has come to our knowledge that the above company is said to be financed by Germans, or else supplies goods of foreign origin and manufacture.

Some months before the war broke out our company, the Park Royal Engineering Works, Ltd., was formed with the object of acquiring and extending the business of Spagnoletti, Ltd., by providing the necessary fresh capital to build and equip a modern up-to-date factory. With this object in view, we purchased forthwith, and still hold, all the debentures and practically all the shares of Spagnoletti, Ltd. We also at once commenced the building of the new factory at Park Royal, and but, in the first instance, for the builders' strike, and subsequently, on the declaration of war, for the pressure of Government orders, our scheme ere now would have been completed, and the business of Spagnoletti, Ltd., non-existent under that name.

Every member of the board, debenture-holder and shareholder of the Park Royal Engineering Works, Ltd., is a British subject. Further, the managing directors, staff, and all workmen employed by both companies are English, and the material used and the goods produced are solely of British design and make.

One of the managing directors, Mr. J. Lothian Nicholson, a son of the late General Sir Lothian Nicholson, Governor of Gibraltar, has four brothers at the present moment at the front, two in the Army and two in the Navy, while a fifth brother, serving in the Indian Army, may shortly also be joining his other brothers at the front.

In addition to the damage done to both companies by these base and groundless rumours it is needless to point out how painful it is to Mr. Nicholson to hear it even suggested that his company is in any way connected with his country's enemies.

We shall be very much obliged to anyone who can give us any further information as to the source of these rumours, in order that we may at once take legal steps to prevent their repetition.

The Park Royal Engineering Works, Ltd.,
Arthur G. Morrish, *Chairman.*

London, E.C., *October 27th*, 1914.

Wimbledon Lighting.—The T.C. Electricity Committee recommends the purchase of land in Coombe Lane, from the Metropolitan Water Board, as a site for a transformer sub-station at £600. The Committee also recommends the Council to contribute £10 towards the costs of the Ilford U.D.C. v. Gas Co., provided equal support is given by other local authorities owning electricity undertakings.

The Council is recommended to contribute £5 towards the cost of the Joint Private Bill, promoted by the I.M.E.A., for the purpose of obtaining increased powers with regard to electric lighting.

Consular Notes.—*Packing Lamps for Export.*—The United States Consul at Rio de Janeiro makes a suggestion as to the method of packing incandescent lamps, which he thinks may contribute to better sales. Dutch and German lamps have been replacing those of American manufacture. The latter are usually packed separately in corrugated paper jackets, and then in large wooden cases. The Dutch lamps are protected with similar corrugated paper jackets, but the packing case, instead of being wood, is a cardboard carton holding 100 lamps. On board ship such packages are assigned to a special part of the ship, where they will not be crushed by heavier cases. By adopting a similarly inexpensive type of packing, the Consul thinks lamp shippers could sell at a more competitive price.

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Openings for Fans in India.—The American Consul understands that in connection with the large amount of building to be done at Delhi the authorities are considering the possibility of constructing buildings with inner as well as outer walls, between which artificially cooled air can be circulated by means of exhaust fans. The use of electric fans in India is constantly increasing. Ceiling fans which will operate directly over a person's bed and force air through the mosquito netting, or over the dining table, or over the business man's desk, are the most popular type. Fans of the table type, usually attached to walls, are much used in theatres and such places, where it is desired to force a current of air along particular directions. There is a very big demand for all types of fans, for direct and alternating current, and for ceiling, table, desk and wall use.

OSAKA.—The British Vice-Consul at Osaka reports that the completion of the works of the Ujigawa Hydro-Electric Power Co. in June, 1913, came at a time most fortunate for the company, coinciding as it did with a period when the high price of coal had become a matter of concern to all industries using steam power. The company supplies power to both Osaka and Kyoto, the power house being situated at Uji (about 9 miles from Kyoto and 22 miles from Osaka), from which point the three-phase, 60-cycle, alternating current is transmitted by aerial lines to Osaka, at a pressure of 55,000 volts, and to Kyoto at 11,000 volts. A contract has been made with the Osaka municipality for the supply of power for the tramway service from January, 1915, which will account for 4,000 KW. The company's tariff ranges from 4½ sen (1·1d.) to 3 sen (¾d.) per KW.-hour, though contract prices appear to be considerably lower. The growth of electric railway systems continues. In April this year there were within a radius of 50 miles of Osaka close on 250 miles of double track in operation and 80 miles more under construction or proposed in the near future.

CEYLON.—*Graphite.*—According to the recently issued Colonial Office Report on Ceylon, there are about 450 plumbago mines in the colony. Last year the market was dull, especially during the closing three months, but prices showed an appreciable advance on those realised in 1912. The averages per ton for large and ordinary lumps rose from Rs. 376 to Rs. 441 (Rs. 15 = £1), and for chips and dust from Rs. 210 to Rs. 270. The quantity shipped amounted to only 571,000 cwt., against 655,000 in 1912. The United States took over 20,000 cwt. less than in 1912, and Germany 40,000 cwt. less, whilst exports to the United Kingdom showed little change. Last year, in addition to the competition of the Korean product, another competitor made itself felt in the shape of the Madagascar product.

Import Trade.—Next to British India, the United Kingdom continues to be the chief source of supply of imports generally into Ceylon, her percentage of the total import trade last year being 29·2, as compared with 28·76 in 1912. The position which we have thus maintained against foreign competition appears, therefore, satisfactory. At present the United Kingdom possesses exactly nine times the trade of Germany—her greatest foreign rival. Imports of lamps into Ceylon last year showed more than a 50 per cent. increase.

A recent report by the United States Consul at Colombo says that plumbago miners and dealers are suffering from a slump in the market. There is an impression that the rivalry in foreign markets, which the increased output of plumbago in Madagascar has created, threatens to drive Ceylon plumbago from the markets of the world. Inquiries into the Madagascar industry are being made by Ceylon interests, and Government assistance in further investigation is being requested. A comparison of samples indicated that whilst the Madagascar quality was not so good as the two best Ceylon qualities, it was well above the average. If the Madagascar output continues, Ceylon dealers are of opinion that the only way to compete against it is to import modern mining machinery into Ceylon, and go into plumbago mining on a scientific basis, which has never yet been done.

Another view which has been advanced is that present conditions are not due to Madagascar competition, but the unsettled state of the general situation throughout the world. There would be far more plumbago from Ceylon going into consumption now were it not for the wild speculation in the mineral last year by numbers of small dealers, who cannot afford to sell at the prices now ruling without making heavy losses.

Walking Contest.—The Hackney Walking Club are holding a 20 miles scratch walking race on Boxing Day, open to all amateurs, starting and finishing at the Cross Keys Hotel, Lower Edmonton. The route will be the main road to Hoddesdon and back again; prizes will be given, and no entrance fees will be charged. As several members of the club are serving their country a large entry is not expected, but the Committee feel that events should be arranged to cater for those at home. Owing to the death of Mr. S. C. Haynes, the hon. sec., all communications should now be addressed to Messrs. L. H. and S. H. Smith, 136, Inderwick Road, Hornsey, N., the hon. secs., *pro tem.*

Appointments Vacant.—Switchboard attendant (32s.), for Burnley Electricity Department; assistant engineer (35s.), for Rampton Criminal Lunatic Asylum, Retford; a few first-class telephone mechanics and instrument makers, for R.E. Stores, Royal Dockyard, Woolwich; engineers (mechanical and electrical), for the Cornwall (Fortress) Royal Engineers, Electric Light Co. (Territorial); junior charge engineer (£80), during war, for Crewe Corporation. Particulars are given in our advertisement pages.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Whilst making a tour of inspection of sub-stations on September 11th, Mr. Arthur Douglas Broadbent, youngest brother of Mr. Frank Broadbent, and chief assistant engineer to the municipal electricity department of Perth, West Australia, was shot in the back by some unknown person and very seriously wounded. The outrage took place in the main street of Maylands, a suburb of Perth, in daylight, but the assailant apparently was not seen by any one. No motive for the attack is known. The latest information to hand showed that Mr. Broadbent was in a critical condition.

Mr. W. T. Le Feuvre, borough electrical engineer at Bexhill, who was formerly lieutenant in the 2nd Home Counties Royal Engineers (Territorials), having applied for a commission in the army, the Council have agreed to keep his post for him and to allocate his salary as follows:—£225 per annum to Mr. Le Feuvre's wife and family; £100 per annum to the assistant-engineer, Mr. Frost; £100 per annum for the provision of any further engineering assistance should this be found necessary.

Hackney B.C. last week selected for the appointment of generating engineer Mr. F. D. Osborn, at present assistant shift engineer. There were 42 applicants.

Mr. W. H. Weldon, who has for several years been engaged in the Bridlington Corporation electricity works, has received an appointment under the Government at the Curragh Camp, Ireland. His colleagues at Bridlington have made him a presentation of a solid silver cigarette-case.

Mr. Eugene Mathews, the testing engineer at the Hackney electricity works, and secretary of the Hackney Electric Rifle Club and also of the Electricity Supply Rifle League, was married on the 19th inst., at Leyton parish church, to Annie Dorothy, only daughter of Mr. and Mrs. George Harry Hallam, of Leyton.

Mr. A. J. Bridge, who is at present employed in the electricity supply department at Sheffield, has been appointed junior engineer-in-charge at the Darlington Electricity Works.

According to a Maidstone paper, the Maidstone Town Council in Committee recently resolved that the electrical engineer be requested to refund any bonus received by him for the past year in excess of the £500 limit fixed in 1910. There are two resolutions bearing on this matter. On July 22nd, 1908, it was resolved:—

That, as and from March 25th, 1908, Mr. Hoadley be paid a salary and commission calculated as follows:—When the total costs per unit sold, excluding capital charges, shall be 1·8d., the salary shall be £800 per annum, and for each £100 saved to the Committee through the reduction in cost per unit sold, a bonus of 20 per cent. per annum. In all cases the salary for the financial year ending in March shall be calculated on the costs of the preceding financial year.

But a resolution passed on November 10th, 1910, varied the basis of the bonus calculation and also contained a provision that "The total amount of remuneration and bonus not to exceed in any one year the sum of £500." The amount of salary and commission paid in 1913 was £300 and £200 (£500), and in 1914, £300 and two sums of £200 (£700).

Mr. Chas. L. Troup, of Messrs. Troup, Curtis & Co., has joined the Sportmen's Battalion (Royal Fusiliers) for active service.

General.—Mr. H. D. Pearson is severing his connection with Messrs. Drake & Gorham, Ltd., and is taking up a position as manager of the electrical department of the Associated Manufacturing Co., of 72-80, Mansell Street, Aldgate.

Obituary.—It was with very deep regret that we observed in the *Times* of Monday last the following announcement:—"Lieutenant Alexander Nigel Trotter, who was killed in action on October 12th, aged 20, was appointed to the 3rd Batt. Royal Scots (Lothian Regiment) in December, 1912. He was the only son of Mr. and Mrs. Alexander Pelham Trotter, of 181, Ashley Gardens, S.W., and Coates Farm, Fittleworth, Sussex." We are sure that every one of our readers will be anxious to join with us in expressing the deepest possible sympathy with so highly esteemed a member of the profession as Mr. A. P. Trotter, and Mrs. Trotter, in their terrible bereavement. Words fail us in these days when we want to express both our gratitude and our condolence as the Roll of Honour daily bears evidence of the sacrifices which are being so cheerfully made and so bravely borne. Mr. Trotter may be assured that the hearts of a host of friends in the electrical world are with him and his wife.

Mr. Angus Macleod.—We regret to record the death, which occurred on 22nd inst. at Hornsey, at the age of 70 years, of Mr. Angus Macleod, who, we understand, was a pioneer of electricity supply in Scotland. About the year 1892 he started, in conjunction with Mr. Robert Hammond, the Scottish House-to-House Electricity Supply Co. Upon Mr. Hammond relinquishing contracting for consulting work Mr. Macleod carried through, in conjunction with the old County of London and Brush Provincial Electricity Supply Co., the construction and running of the electricity supply works for Coatbridge, which was the first electricity supply undertaking in Scotland to be carried out by a company under Parliamentary powers. Mr. Macleod had been an invalid for years, but he had always taken the keenest interest in electrical work and development.

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NEW COMPANIES REGISTERED.

William Baily & Sons, Ltd. (138,088).—This company was registered on Oct. 23rd, with a capital of £6,000 in £1 shares, to take over the business of a manufacturing, wholesale, retail and furnishing ironmonger carried on by H. D. Baily at 54, Gracechurch Street, E.C., as William Baily & Sons, to carry on the same, and the business of electrical engineers, electricians, manufacturers of electrical apparatus, makers of cooking apparatus and stoves, etc., and to adopt an agreement with the said vendor (1) for the acquisition of the said business and for undertaking certain contracts and engagements, and (2) relating to management. The subscribers (with one share each) are:—H. D. Baily, 54, Gracechurch Street, E.C., ironmonger and engineer; Mrs. M. D. Baily, 32, West Park, Eltham, S.E. Private company. The number of directors is not to be less than two or more than five. The first are H. D. Baily (permanent managing director) and Mrs. M. D. Baily. H. D. Baily shall be entitled to draw upon the company's banking account for his salary up to £200 per quarter. Qualification (except first directors, who require none), £100. Registered office, 54, Gracechurch Street, E.C.

City of Freetown (Sierra Leone) Electricity Co., Ltd. (138,058).—This company was registered on Oct. 22nd, with a capital of £15,000 in £5 shares, to acquire a concession granted to A. I. S. Baron by the Corporation of the City of Freetown, to carry on the business of an electric supply company in all its branches. The subscribers (with one share each) are:—M. Railing, 67, Queen Victoria Street, E.C., electrical engineer; L. G. Byng, 67, Queen Victoria Street, E.C., electrical engineer. Private company. The number of directors is not to be less than three or more than seven; the first are H. Hirst, M. Railing, L. G. Byng and A. I. Suckling (managing director). Qualification (except local directors) 50 shares. Registered office, Midland Bank Chambers, 71a, Queen Victoria Street, E.C.

Wiring, Ltd. (138,027).—This company was registered on Oct. 22nd, with a capital of £2,500 in £1 shares, to carry on the business of electrical, mechanical and general engineers, electricians, manufacturers of electrical appliances, machine and engineering tool makers, boiler makers, founders, etc. The subscribers are:—Israel Davies, 12, Hyde Park Place, W., builder, 40 shares; B. Davies, 12, Hyde Park Place, W., electrical engineer, 40 shares; E. Davies, 12, Hyde Park Place, W., electrical engineer, 20 shares. Private company. The number of directors is not to be less than two or more than three; the first are Israel Davies and B. Davies (both permanent). Qualification, £20. Remuneration, £50 each per annum. Registered office, 90, Charing Cross Road, W.C.

Alpha Electrical Co., Ltd. (138,040).—This company was registered on Oct. 21st with a capital of £2,000 in £1 shares, to carry on the business of electricians, electrical, mechanical, sanitary, gas and water engineers, contractors, ironmongers, makers of electric tramcars, motor cars, carriages, cycles and other vehicles, manufacturers and suppliers of and dealers in dynamos, motors, telephones, bells, electroliers, etc. The subscribers (with one share each) are:—W. Schofield, 11, Boscombe Road, South Shore, Blackpool, yarn agent; G. S. Mills, 11, Hartley Road, Chorlton-cum-Hardy, Manchester, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered office, 263, Oxford Road, Chorlton-on-Medlock, Manchester.

Derby Day and Night Sign Co., Ltd. (138,042).—This company was registered on Oct. 21st, with a capital of £5,000 in £1 shares, to acquire certain options, to adopt an agreement with Helen Goulton as "grantor" and W. Goulton as "grantee," being an agreement to grant a licence to manufacture and sell under Patent No. 21,191 of 1913, to carry on the business of makers of illuminated and other signs, discs, reflectors, globes, lamps, etc. The subscribers (with one share each) are:—W. Goulton, 1a, Grove Park Road, South Tottenham, N., mining engineer; H. H. Speed-Andrews, 37, Abbotsford Avenue, South Tottenham, N., retired naval officer. Private company. The number of directors is not to be less than two or more than five; the first are W. Goulton and H. H. Speed-Andrews. Qualification, one share.

British Electrical Export Co., Ltd. (138,028).—This company was registered on Oct. 20th, with a capital of £3,000 in £1 shares, to carry on the business of manufacturers of and dealers in electrical fittings, fixtures, machinery, plant, utensils, lamps, stoves, etc. The subscribers (with one share each) are:—H. F. Simon, 27, Martins Lane, Cannon Street, E.C., electrical engineer; S. C. Russ, 27, Martins Lane, Cannon Street, E.C., electrical engineer; H. Sturton, 74, Great Tower Street, E.C., solicitor. Private company. The first directors are H. F. Simon, S. C. Russ and H. Sturton. Registered office, 27, Martins Lane, Cannon Street, E.C.

Metal Scrap, Ltd. (138,017).—This company was registered on Oct. 19th, with a capital of £12,000 in £1 shares, to take over from S. O. Cowper-Coles and work certain processes for (1) the detinning of tin scrap, (2) the recovery of zinc from galvanised iron, and (3) the removal of enamel from enamelled iron, to carry on the business of smelters, refiners, rollers and assayers, dealers in minerals, metals, and ores, electricians, electrical engineers, etc. The subscribers (with one share each) are:—C. W. Denny, 22, Edwardes Square, Kensington, W., engineer; H. Sawyer, 1 & 2, Old Pye Street, Westminster, plater. Private company. The number of directors is not to be less than two or more than 5; the first are S. O. Cowper-Coles and J. J. Gordon Gordon. Qualification, 100 shares. Registered office, 1 & 2, Old Pye Street, Westminster.

Ruthin Electric Supply Co., Ltd. (138,021).—This company was registered on Oct. 19th, with a capital of £5,000 in 400 cumulative preference shares of £5 each and 1,000 preferred ordinary and 2,000 ordinary shares of £1 each, to carry on the business of an electric lighting and power company in all its branches. The subscribers (with 50 shares each) are:—A. A. Douglas, Brendon, Colwyn Bay, manufacturer; J. H. Edwards, Haresfield, Stonehouse, Glos., engineer. Private company. J. H. Edwards is the first managing director. Qualification, 50 shares. Solicitors, Seymour Williams & Co., 38, Parliament Street, Westminster, S.W.

Barford Electric Supply Co., Ltd. (137,994).—This company was registered on Oct. 16th, with a capital of £5,000 in 4,000 preference shares of 10s. each and 3,000 ordinary shares of £1 each, to carry on at Barford and elsewhere in England the business of an electric light company in all its branches. The subscribers (with 50 shares each) are:—W. O. Rooper, 30, College Street, Dowgate Hill, E.C., civil engineer; V. Caldwell, Wray Cottage, Reigate, accountant and cashier. Private company. The number of directors is not to be less than three or more than seven; the first are D. Smith-Rylland, F. G. Bulby, V. Caldwell, R. Jones, and W. O. Rooper. Qualification, £50. Registered office, 30, College Street, Dowgate Hill, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Llangollen & District Electric Light & Power Co., Ltd. (75,384).—Capital, £6,000 in £1 shares (2,500 pref.). Return dated September 2nd, 1914. 2,114 shares taken up; £1 per share called up; £2,110 15s. paid, leaving £3 5s. in arrears. Mortgages and charges: £2,800.

Carmarthen Electric Supply Co., Ltd.—Particulars of £5,000 debentures, created 30th September, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Liverpool Electric Cable Co., Ltd. (71,099).—Capital £20,000 in £1 shares. Return dated July 21st, 1914; 10,000 shares taken up; £7,833 paid; £2,167 considered as paid. Mortgages and charges: Nil.

Newtons, Ltd. (48,936).—Capital, £40,000 in £10 shares. Return dated October 6th, 1914; 3,265 shares taken up; £18,650 paid; £14,000 considered as paid. Mortgages and charges: £14,000.

Bombay Electric Supply & Tramways Co., Ltd. (85,055).—Capital, £1,200,000 in £10 shares (60,000 pref.). Return dated July 7th, 1914; 60,000 ord. and 59,992 pref. shares taken up; £10 per share called up on 59,992 pref. and 33,000 ord. shares; £929,956 paid, including £36 paid on eight shares forfeited; £270,000 considered as paid on 27,000 ord. shares. Mortgages and charges: £763,730.

CITY NOTES.

Uxbridge & District Electric Supply Co., Ltd.

The directors' report for the year ending 31st December, 1913, shows that the gross profit amounted to £4,603, less interest on debenture stock £3,750, leaving a balance of £835, plus £362 brought forward, making a total available of £1,215. Of this amount the dividend on preference shares absorbed £900, and £315 is to be carried forward. The business of the company continues to increase in a satisfactory manner as will be seen from the following figures:—

	Total output, B. T. Units.	Gross revenue. £
1910	654,853	6,895
1911	815,995	8,037
1912	1,266,209	10,389
1913	1,557,424	12,121

The supply of electricity to the Beaconsfield area and the extensions at Gerrard's Cross, to which allusion was made in the last report, have been completed; the outlay thus occasioned having been absolutely necessary in order that the company might maintain its rights under the Provisional Orders relating to those districts. The directors confidently anticipate that this expenditure will have a beneficial effect upon the future earnings of the company, as the returns arising therefrom should greatly exceed the cost of obtaining the necessary pecuniary assistance and the interest charges thereon. The capital expenditure of the company now amounts to £123,105, the total amount received under this heading having been only £116,275. In order to provide temporarily for this deficiency a sum of £10,000 has been raised by way of special loan. During the year the question of obtaining further capital to meet the above deficiency and to provide for further necessary extensions and plant has been receiving the very careful attention of the directors, but the outbreak of war has necessitated the postponement of any negotiations to that end, and therefore the whole question of the re-arrangement of the capital of the company must remain in abeyance for the present.

The fourteenth ordinary general meeting was held on Oct. 22nd at Hamilton House, Victoria Embankment. Mr. J. O. Callender, who presided, formally proposed the adoption of the above report. The motion was seconded by Mr. T. Petersen and carried.

River Plate Electricity Co., Ltd.

An extraordinary meeting of the shareholders was held on Monday at the offices, 62, New Broad Street, E.C., Mr. M. W. Mattison, K.C., in the chair.

The Chairman said that the object of the meeting was to consider a resolution for increasing the ordinary share capital of the company by £50,000, raising it from £150,000 to £200,000. The company did not propose at the present time to issue all the new ordinary capital—they proposed to issue £25,000 of it and, in addition, £25,000 of the 6 per cent. preference shares which were unissued. He quite agreed that the present was not a convenient time for the issue of fresh capital, but, on the other hand, it was not convenient or desirable that the company, which had an uncompleted programme of extensions and improvements, should be left without sufficient cash resources to meet its commitments. The board would not have been justified in taking such a risk, and therefore they had secured a guarantee of a full subscription of the proposed issue upon exceptionally easy terms. He did not think it could be said that the board had ever been guilty of any lavishness in the issue of new capital. The company had been in existence for 12 years, and during that time they had only issued £55,000 of fresh capital. In those twelve years their electrical system in the Argentine had grown out of all recognition. The money spent on extensions exceeded the new capital raised many times over; the difference had been found out of money put to reserve and depreciation, and from

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other sources, and in that way, with a very small amount of new capital, they had built up a very large and valuable system. With regard to the proposed issue and the price, the preference shares carried 6 per cent. interest, non-cumulative. On the other hand, in the event of favourable liquidation they had to be paid off at 115. Some five years ago they issued £25,000 of those shares at par. The ordinary shares had for several years past received a 10 per cent. dividend, and two years ago, when they issued £30,000 of them, the price was 40s. for every £1 share. The board quite recognised that the present time was much less favourable than was the case two years ago, and therefore they proposed to issue the new ordinary shares to the ordinary shareholders in proportion to their existing holdings at 25s., combined with the issue of a corresponding amount of preference shares at par. They also intended to issue "letters of right" so that any holder who was so disposed could sell their rights. As to the disposal of the money, the principal work they had in hand was the completion of the underground area in the centre of La Plata. About two years ago they entered into a contract with the Government in which they undertook to place their works underground in the leading streets of La Plata. The Government on its part undertook to extend the public lighting contract for a further term of ten years, and the company also got other advantages. Nearly three-fourths of that work was completed, and the remainder ought to be finished in the course of the coming year, and it was only right that they should be in the possession of funds so as to be able to complete in due course. Then, again, they had made extensions in their operating plant at Ensenada, where about a year ago they put in some large turbine units. That plant had been erected and was nearly all paid for, but during the last year or so they had had considerable negotiations in connection with taking big power loads at Ensenada, one of which had been happily completed. The prospect of having to provide for those heavy loads had necessitated some increase in the boiler-house and the transforming plant, and the new capital would cover their expenditure in that connection. Within the last two or three weeks they had definitely concluded a contract for a period of ten years with Messrs. Armour, the big meat packers, to supply them with all the power required for large works which they were erecting at Ensenada, which would necessitate their putting down a certain amount of new machinery. As regarded the present position and prospects of the company, that was obviously a subject upon which he could say very little. During the first seven months of the current year and up to the outbreak of the war the business at La Plata continued to steadily progress, and if it had not been for the war he had no doubt that at the end of the year they would have been able to point to an increase in net profits in excess of any previous year. What the effect of the war might be upon their business he could not tell. Personally, he did not take a gloomy view of the situation, but it would be the height of rashness for anybody to attempt to predict how things would develop either at home or abroad during the next twelve months. It would be idle to suppose that their company any more than any other concern, whether here or in the Argentine, could hope wholly to go free from the evils growing out of the war. It was true that the Argentine was outside the actual area of the conflict; but, on the other hand, the trade and commerce of the world was now so connected that the first effects of financial disturbance and trade dislocation were felt nearly as badly in neutral countries as in those countries that were at the seat of war. On the other hand, the countries that would first recover were neutral countries, and especially a country like the Argentine which was associated with the production of the necessaries of life. The silver lining to the cloud at the present time was that all indications pointed to an excellent harvest there, and that, combined with the probability of high prices for all foodstuffs, gave hope of an early recovery in Argentina. As far as their own company was concerned, while it would unquestionably be an anxious time for the board and for the management abroad, and though it was possible they might have some temporary set-back, his personal belief in the continued success of the undertaking remained unchanged. In conclusion he proposed the following resolution:—

"That the directors be and they are hereby authorised to increase the capital of the company from £300,000 to £350,000 by the creation of 50,000 ordinary shares of £1 each, such shares to rank equally with the existing £150,000 ordinary stock of the company and to be issued at such time or times and on such terms and conditions and to such persons as the directors may prescribe and with power for the directors by a resolution of the board to convert such shares when fully paid up into ordinary stock of the company."

Mr. R. Miller seconded the resolution, which was carried unanimously.

Spanish & General Wireless Trust, Ltd.

The directors' report to the 30th June, 1914, states that the business of the Compania Nacional de Telegrafia sin Hilos, in which this company is a very large shareholder, although showing improvement, has produced no revenue to this company. The receipts from the stations, although increasing, are still unsatisfactory. The terms of the concession granted by the Spanish Government have been seriously impaired by later legislation, which it is believed entitles the company to substantial compensation. The managing director paid a visit to Madrid in the early part of the year and conferred with members of the Government with a view to arriving at a satisfactory settlement of the position which had been created. The negotiations are being continued by the directors of the Compania Nacional de Telegrafia sin Hilos and it is contemplated that a satisfactory solution may be reached at an early date. All the necessary arrangements have been made for the opening of the service between this country and Spain and the Canary Islands, but the inauguration of the service has been deferred owing to the outbreak of war.

Mr. Godfrey Isaacs (managing director) presided on October 23rd, at Marconi House, over the third ordinary general meeting of the company. In moving the adoption of the above report he said that the year had not been a very propitious one for any financial transactions such as would normally come within the province of that company's affairs, and therefore it had done little or nothing in that direction. The principal assets of the company, as they were aware, consisted of the shares held by them in the Compania Nacional de Telegrafia sin Hilos. That company's business had certainly made some progress. The receipts of the stations, as they anticipated last year, had shown quite an appreciable increase, but they had not increased to that extent which alone would enable the company to work upon profitable lines. The main business upon which that company would depend in an ordinary way would be that of the telegraphic business between Spain and other parts, mainly the Internal and Canary Islands. Unfortunately, since the Spanish Government granted the concession under which the Spanish Co. worked it had found it necessary to make certain changes in legislation which had materially impaired the value of the concession. In those circumstances the necessary representations had been put before the Spanish Government, and he went to Madrid and personally took part in that work, and he was satisfied that the Spanish Government appreciated the fact that it had very seriously impaired the property which the company held. He thought it would result in the Government deciding to purchase the stations held by the Compania Nacional at proper prices and pay them such other compensation in consequence of the harm which had been done to the concession, and this should place the Spanish and General Wireless Trust Co. in a fair intrinsic position. That was to say that the compensation and the price to be paid to the Compania Nacional, he hoped, would put it in the position of holding its capital intact, in which case, of course, the business it would in future conduct would require a very much smaller capital than that with which it was to-day registered, and consequently in all probability when the proper time came there would be some changes which would enable a very considerable return to be made of the capital originally invested. The service which it was intended to have opened between this country and Spain had been ready now for some time, all the necessary formalities having been dealt with between the General Post Office of Madrid and the British Postmaster-General, but in consequence of the war it had not been possible to start the service, the stations on this side being otherwise much more importantly occupied. That question, therefore, for the present had been deferred until the existing condition of things should change.

Mr. H. S. Saunders seconded the motion and the report was adopted.

Sao Paulo Tramway, Light and Power Co., Ltd.—The directors have declared a dividend of 2½ per cent.

Rio de Janiero Tramway, Light and Power Co., Ltd.—The directors announce a dividend of 1½ per cent..

Lisbon Electric Tramways, Ltd.—The directors have declared an interim dividend of 3 per cent.

Babcock & Wilcox, Ltd.—Interim dividend 5 per cent., free of tax.

New St. Helens and District Tramways Co., Ltd.—The directors recommend a dividend of 2½ per cent. (2s 6d. per share) on the preference shares, £2,000 is to be put to reserve, and £3,387 carried forward.

Anderston Foundry Co., Ltd.—The directors announce an interim dividend of 4s. 6d. per share, less income-tax.

Callender's Cable and Construction Co., Ltd.—The directors have decided to pay, on November 2nd, the usual interim dividend on the ordinary shares at the rate of 10 per cent. per annum.

Western Telegraph Co., Ltd.—The directors, after transferring £160,000 to the general reserve fund, £50,000 to the land and buildings depreciation fund, and £130,000 to the provision on account of investment fluctuations, have decided to recommend a final dividend of 3s. per share, making, with the previous distributions, a total dividend of 6 per cent. for the year ended June 30th, 1914, and also the payment of a bonus of 2s. per share, both free of income-tax. The balance of the account is carried forward. The register of transfers will be closed from November 3rd to November 11th.

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Montevideo Telephone Co., Ltd.

Mr. C. Lock (Chairman) presided on October 22nd, at Winchester House, E.C., over the annual meeting.

The Chairman, in moving the adoption of the report (see Elec. Rev., p. 535), said that with regard to the balance sheet the item of purchase price of property stood at £191,606, and after deducting £8,500 for depreciation out of last year's revenue they brought the purchase price down to £183,106. Telephone enterprises always required feeding, so to speak, and therefore every year witnessed additional outlay on capital account. This year the capital expenditure amounted to £6,603, bringing up the total of their purchase price as standing in the books to £189,709. The capital outlay was £4,400 less than in the previous year, when they incurred considerable expenditure in fitting up the new Aquada Exchange. That was not a recurring expenditure, and therefore they reaped the benefit this year. In the same way they had for two or three years past been making substantial capital expenditure in connection with the camp lines, and that expenditure was bearing fruit in that the lines were in good condition and needed little attention this year. Stores at Montevideo and in transit, £11,425, were about £3,200 up. Investments at cost were £4,700 up, due, of course, to the partial investment of some of the money retained as reserve fund and the carry forward last year. Their investments had always shown an appreciation at the end of the year, and they showed an appreciation on July 31st, but their present value was a matter for which no exact standard could be obtained. They must be satisfied with the fact that they were good substantial and good revenue bearing investments. Real estate in Montevideo showed an increase of £700, due to their having acquired the freehold of an exchange at one of the small country towns. Bills receivable were about the same, whilst the item of cash showed a substantial increase of £11,800 over last year. This was partly due to the fact that they had had refrained from investing some of the money coming from the other side, as they thought it better in such times to keep their assets in the most liquid form. At Montevideo they had a larger balance than usual, owing to instructions from the board, because the different sections of the switchboard sent out involved the payment of heavy duties. On the other side of the account, the capital remained the same. Sundry creditors showed a small increase, and the reserve fund was the same as last year. The reserve for renewal of plant was £35,500 against £27,000 last year. This year they were setting aside £9,500, which would bring the item up to exactly £45,000, which was a very substantial sum, but they might have to draw on it for the switchboard to which he had alluded. The profit and loss account showed the usual satisfactory moderate increase in receipts from subscribers—in round figures about £4,400 above those of last year. Interest on securities also showed a small improvement. On the other side working expenses were up about £1,800, and London expenses and income-tax were much about the same. The result was a profit of £28,524, as compared with £25,833 for the preceding year. They would infer from what he had said that the changes in the figures were due to the normal growth of the business and indicated a continuance of the yearly progress which they had experienced for a long time past. Last year he referred to several matters of interest. He told them that in one section they had put a portion of their plant underground, which they thought was a good thing, and had also obtained consent to putting another small section underground. This had now been completed. They had not found it necessary to apply for permission to lay any other isolated sections underground during the year, but they had always before them the question of a general underground concession. Although they had achieved no actual results in the way of getting an underground concession, yet the London Board and the Advisory Board had been in constant communication during the year, and under the advice of Sir J. Gavey the local board had been put into a position to open *pourparlers* with the Uruguay Government. No definite result had been received, but their position with the Government was better than it had been for some years past. They were not without hope that in course of time a reasonable and business-like arrangement might be come to with the Government which would enable them to put in a proper service and give satisfaction alike to the Uruguay Government, the Montevideo public, and the company. He need hardly say that the state of affairs caused by the war rendered it a matter of satisfaction rather than the reverse that they were not committed to heavy expense which an underground system would have involved. They could not put that down at less than £200,000 or £300,000 to start with, and such a heavy committment would at this time be a thing rather to be deplored. It was a satisfaction to the board at the present time to be able to say that they had no capital committments on any account, and their policy was to hold the investments they had and to place any further sums they received on deposit at their bankers, so as to keep their assets in the most liquid form. They hardly expected to be able to do so much next year because Uruguay, like other South American countries, had been affected by the long depression, and still more by the deplorable war which existed. For that reason they would be prepared for some diminution in their receipts. Under the circumstances, although they had an increased profit, the board felt that they should pay the same dividend as last year, viz., 5 per cent. on the preference shares and 6 per cent. on the ordinary. This was after substantial allocations for depreciation and an increased carry forward.

Mr. J. G. Le Marchant seconded the motion.

Mr. Herzheim asked what the total cost of the switchboard would be after paying the duties and other expenses to which the company would be put, and also whether the returns to date from Montevideo showed a serious falling off.

The Chairman said it was difficult to give the exact cost of the switchboard. It would come to five figures on this side and there was a duty of 40 per cent. payable on the plant at Montevideo, so that they might have to pay anything from £14,000 to £17,000 before the switchboard was erected in their exchange. He had only the return for August for Montevideo, which showed that the falling off in the number of subscribers was in the neighbourhood of 50. He did not know that it would affect the revenue greatly as they had got their system in a good state of repair and might be able to reap the benefit of this in the current year.

Sir John Gavey explained that the company was compelled to introduce a magneto switchboard as it would have been impossible to work a common battery board except with a perfect underground system. But they had taken advantage of all modern developments so as to import into the magneto board as many of the elements of perfection as were possible in a common battery board. He thought theirs was the most up-to-date magneto board which had ever been manufactured. Another point was that they would always have to use magneto boards in the camp lines. The number of subscribers and the size of the exchange were too small to justify common battery working, and this particular board had been so constructed that when the time came for them to place wires underground and introduce a new system, whether common battery or automatic, this board could be cut up and used for any of the camp line exchanges. In fact they rather hoped to renew the camp line system with this board cut up in 200 line sections.

The report was then adopted.

Barbados Electric Supply Corporation, Ltd.

Mr. A. W. Tait (chairman) presided on October 21st, at Basildon House, Moorgate Street, E.C., over the annual meeting.

In moving the adoption of the report (Elec. Rev., p. 535), the Chairman said the profit on operation for the year ending June 30th amounted to £1,381, which compared with a profit of £395 during the previous year, an increase of £986, or, approximately, 250 per cent. This improvement resulted after charging £483 for repairs and maintenance, or £319 more than in the previous year. Charges for maintenance were naturally of an increasing nature in a new undertaking, but the apparently large increase in the year under review was explained by the fact that it was principally for replacement of poles. It had, unfortunately, been necessary to replace a large number of the poles originally sent out, which were of Norwegian pine, by poles of harder wood, as they were found unsuitable for the local conditions, quickly rotting and becoming dangerous. The poles being substituted were Wallaba poles from Demerara, and they were particularly suited to local conditions. He was afraid that this heavy charge for replacement of poles would continue until the whole of the poles had been renewed. The general results had been satisfactory. The progress made had been steady and should be lasting. The number of lamps and motors connected, of an equivalent of 25 c.p., was 12,715 on June 30th, which was an increase of 3,285 during the year, or nearly 35 per cent. The number of consumers had now reached 737, the work of wiring and installing the new services, 281 in number, having been in most cases carried out by their own wiring department. The profit on this department was satisfactory. The profit would, however, tend to decrease as there were now two other wiring contractors in Barbados. This change had facilitated the work of connecting consumers, as it had been difficult for the company to train and maintain a sufficiently large wiring and fitting staff to meet requirements. With regard to public lighting, this had grown during the year from 7,200 c.p. to 13,800 c.p. There were difficulties in the way of extending this supply, the principal being that a larger outlay was required than was justified by the length of the contracts, which were usually for a period of twelve months only. Last year he spoke as to the high cost of generation and explained that this was largely attributable to the low load factor. Everything possible had been done to encourage a day load, but the scope for power supply was small and their progress had not been appreciable. Reference was also made in this connection to negotiations with the Tramways Co. for the supply of power for electric traction. These negotiations had reached a certain point, and further proposals by the company were now being considered by the Tramways Co., but nothing definite had evolved so far. They were still hoping that they would be able to come to some arrangement which would be of advantage to both concerns, but, as the shareholders would appreciate, financial conditions were not favourable for the raising of capital. The question of oil fuel had again been one of the contributory causes of high generating costs, but this question had received very careful consideration and samples of various kinds of oil had been tested and tried during the year. They might be roughly summarised as follows:—Barbados oil, of which the supply had ceased for the present, 9,000 gallons; Trinidad oil, 1,650 gallons; American oil, 26,071 gallons; total, 37,621 gallons. Steps had been taken to ensure that their supplies did not

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run short owing to the war, and at the present time there should be sufficient oil in store, which they were able to secure largely from Trinidad, for over a year. No progress appeared to have been made by the Mexican Eagle Oil Co. to establish an oil depôt in the island, which was a proposal he mentioned at the last annual meeting. Their general manager reported that with the exception of the trouble with poles, the plant and mains had been kept in satisfactory working order. A re-arrangement of the transformers, better in accordance with the needs of the various districts, had resulted in a reduction of the transmission losses. With regard to the profit and loss account the expenses had been £1,823, or an increase of £139. The capital expenditure during the year was £1,830, and this represented, with the exception of £35, extensions to the mains for public and private services and house connections with consumers. The other items in the balance sheet did not call for comment. In view of the present state of the war and the consequent disturbance in industrial and financial arrangements, it was difficult to speak of prospects for the current year. Naturally the applications for new connections had fallen off, but it was impossible to forecast to what extent the supply of current might be affected. There should, however, be an increased revenue from the increased number of consumers now connected, and, personally, he would be disappointed if they were not able to show continued improvement. The business now seemed to have turned the corner, and if they followed the usual experience of electric supply companies the results should be gradually progressive, although, of course, they had a long way to go before there could be any prospect of a return upon the share capital invested. The general manager reported that the staff had worked well.

Mr. W. F. Leese seconded the motion, and the report was adopted without discussion.

Auckland Electric Tramways Co., Ltd.

The annual meeting was held on October 22nd at the Electrical Federation Offices, Kingsway, Mr. C. G. Tegetmeier presiding.

In proposing the adoption of the report (Electrical Review, p. 534) the Chairman said that the company had contributed £1,000 to the patriotic fund which was being raised in New Zealand in connection with the war, and he felt sure the shareholders would heartily endorse that action of the directors. The outstanding feature of the company's operations during the past twelve months was the strike in New Zealand which, commencing in a small way in October of last year was quickly turned by mischievous agitators into the most serious industrial upheaval that the Colony had ever witnessed. There was no question of hours of labour or rates of pay involved—the real question was whether a socialistic and revolutionary organisation called the Federation of Labour should be allowed to control the whole of the labour conditions in the Dominion and set at defiance the Conciliation and Arbitration Act, which provided the necessary machinery for the equitable adjustment of industrial disputes. The employers refused to submit to the dictation of this organisation or to recognise it as the controlling authority in labour questions, and a general strike was called. The call was not uniformly responded to by the labour unions, but after a time every industry throughout New Zealand was affected. The community took measures for self-preservation; gradually the forces of order prevailed and it was not long before the strikers were going back to work—many to find their places filled. With the collapse of the general strike and the complete defeat of the Federation of Labour, he thought they might look forward to a period of industrial peace in New Zealand for some time to come. The effect of the strike upon their business was very considerable—not only was there a diminution in receipts but there was a large increase in expenses. The tramway service was stopped entirely for 18 days—from 8th to 25th November—owing to their not being able to get any coal, so that the question of their men joining the strike did not arise. The loss of traffic receipts owing to the stoppage was estimated at approximately £15,000. The receipts were also adversely affected in the year by the prevalence of an epidemic of smallpox among the Maori population which caused a scare among the Europeans. The traffic created by the Auckland Exhibition helped their receipts, but not to the extent they had anticipated, and the same might be said with regard to the six motor 'buses which they specially acquired for the purpose. Having in view the many adverse circumstances that had affected the business during the year it was gratifying to know that they had maintained that progressive expansion in their traffic receipts which they had experienced in every successive year of the company's operations since they started electrical running in 1902. The total traffic receipts amounted to £271,701, which was £14,110 more than in the preceding year, and the number of passengers carried increased from 40,300,000 to 42,100,000, which represented an average of more than the whole population of Auckland every day throughout the year. In view of the monetary position brought about by the war it was matter for satisfaction that they were able to regard their financial position without uneasiness. They had adequate liquid resources and an unissued balance of £150,000 in debenture stock. On renewals they had spent a total of £31,494, which had been charged to the renewals and maintenance account. That, added to the £34,834 spent in the preceding year made a total of £66,338 expended in two years. A good deal of re-construction work on the earlier constructed lines had now been carried out, and, although the renewals expenditure would necessarily be continuous, they looked forward to a material decrease in the annual outlay during the next few years. The total expenses showed a large increase, and for the first time in the history of the company the increase was greater than the increase in the receipts. The principal item was power and running expenses £118,130, or £18,320 more than in the preceding year. That was due to several causes. In the first place they ran a greater number of car miles during the year, and the cost of running was largely increased for some time after the strike by the higher price they had to pay for coal. Then, again, although their receipts entirely ceased during the time the cars were not running, a good deal of their expenses continued all the same. The net profit of £51,719, after placing £22,500 to renewals and depreciation account, was £2,458 less than in the preceding year. Considering the many adverse circumstances which had affected their operations during the year, and the fact that the £125,000 of new capital on which they had had to pay a full year's interest and dividend had been only partially productive, it was very satisfactory to find that they were able to maintain the same rate of dividend—1s. 7d. per ordinary share for the year and to place £32,500 to the credit of reserve accounts. As to the future, he did not anticipate that the war would prejudice the position in Auckland or New Zealand to any serious extent. Their cabled returns up to September 25th, which comprised nearly two months of war time, showed that their traffic receipts from July 1st to that date amounted to over £4,000 in excess of the corresponding period last year, which represented a very material increase in the net profit.

Mr. C. Shirreff Hilton seconded the motion, and the report was adopted.

Official Notices re Companies.—The following companies will, unless cause is show to the contrary, be struck off the Register at the expiration of three months :—

Automatic Lock Nut Co.
Bean Co. (British Electrical and Mechanical Co).
British Medical Electric Appliances Co.
Dioptric Sign Co.
Electrical Power Users' Association.
Electric Fire Prevention Appliances and General Manufacturing Co.
International Syndicate for Electric, Water-Power and Public Works Concessions.
Institution of Signal Engineers (Inc.).
London Electric Treatment Institute.
Machinery, Ltd.
Never-Skid Band Manufacturing Co.
North Lancashire Tramways, Power and Construction Syndicate.
Power Engineers.
Salamander Fire Bar and Smoke Preventer Co.
Star Electric Light Co.

Calcutta Electric Supply Corporation, Ltd.—The directors have declared an interim dividend on the ordinary shares for the half-year ended June 30th last at the rate of 7 per cent. per annum, payable November 15th.

STOCKS AND SHARES.

Tuesday Evening.

The news of the week has contributed to a feeling of quiet confidence in Stock Exchange markets, and has assisted in the liberation of fresh money for investment; so that securities of the gilt-edged order have come to the front—using the phrase in its Stock Exchange sense—at improving prices. There is naturally plenty of stock on offer, and probably a great deal more to come out before the floating supply gets into the hands of permanent holders. At the same time, the steady absorption of small amounts is a factor of encouragement and hopefulness. So far as the electric section is concerned, the enquiry runs mainly upon good-class preference shares and the debenture stocks.

Doubt exists whether the Stock Exchange will be able to carry through its intention of having a settlement on Nov. 18th, as already arranged. There is sharp conflict of opinion as to the desirability of opening the House at the present juncture, and it is contended that, if the Stock Exchange remains closed, the arrangement of a settlement will present unlooked-for difficulties. A factor of much uncertainty is what may be the result of the raising of the moratorium on Nov. 4th. Trade circles are not likely to be affected to any appreciable extent, and most people concede that the moratorium has now served its purpose and can be cast off without giving rise to financial difficulties.

This view is controverted in some of the banking circles, which profess apprehension at the prospect of what is likely to happen after Nov. 4th. It is obvious that any serious disturbance to the banking world must be reflected in commercial spheres, but the misgivings that have been voiced seem to some of us to be needlessly timid and fearful. However, the event will not be long now in declaring itself; and the Stock Exchange, at all events, waits with composure for it to materialise.

The electricity supply market remains dominated a good

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deal by the absence of buyers rather than any particular pressure to sell. While the authorities regard it as necessary to enshroud London in semi-darkness at night, it is scarcely likely that the investor will turn to thoughts of illumination shares as remunerative channels for his money. The increase in the number of serious accidents points to the necessity for relaxing the stringency of the present regulations as far as it can be done with reasonable safety; meanwhile, the companies have to content themselves with curtailment of their profits as one of the contributions they are obliged to make towards the price paid for European war.

The London County Council, as already noticed here, has postponed until Nov. 10th deliberation of its scheme for unifying London's electric supply, and there is a good deal of speculation as to what is likely to happen when the proposal is again put forward. The first point that strikes a layman is that the County Council must include in its Parliamentary Bill powers for the raising of new capital, and to any proposal of this sort the Government might quote its urgent necessities at the present time as a reason for refusing to pass the Bill.

This, of course, is simply supposition, based on the fact that the war-needs of the country call for such substantial amounts of money that they may be advanced as a reason for Parliamentary refused to sanction any municipal or other scheme that would involve appeal to the public for large sums just now. Alternatively, of course, it might happen that the Government would consent to the Bill, provided the issue of fresh capital were to be delayed, or spread over such a term as would render the instalments to appear comparatively small. In the ordinary way, moreover, other difficulties could have been foreseen in the way of a measure of such comprehensiveness that it embraces local authorities so far outside the area of the L.C.C. as, for example, Woking and Tilbury.

Again, the layman brings his foresight to bear on the probability that during the present weeks the County Council is no doubt doing all in its power to ensure as smooth a passage as may be for its Bill, and, to this end, working now to bring into line those conflicting interests which in the past have proved such stumbling blocks to schemes of like nature. These are generalisations apparent to anyone who cares to explore the ground as it stands revealed at present. There is as yet nothing sufficiently definite to warrant more than practical surmises as to the probabilities concerning the whole important plan.

The telegraph market is very steady. In this section we hear of more demand recently than has been the case for a couple of months; and the prospective buyer is engaged in obtaining particulars of dividend yields, reserve funds and so forth, in connection with the cable companies. Eastern Telegraph stock, Eastern Extension shares and Western Telegraphs are all wanted by cheap buyers; the returns on these at the present prices are 5¾ per cent., 6¼ per cent., and 5¾ per cent. respectively. Those who are in a position to know how the companies are doing, declare that traffics are excellent and that the loss occasioned by curtailment of commercial cables has been more than compensated by the necessity for sending cables in plain language, and the enormous demand which there is for war news. The former has just been modified, but its effect upon the traffic returns for the past three months should be found very satisfactory.

Globe Telegraph and Trust Preference have still to be classed in the "wanted" list, and various others of their kind are being quietly bought. New York Telephone bonds, which were the other day offered at 95¼, have risen to 97½, with little stock about. The bonds carry a coupon payable on Nov. 1st, and the security is so liberal that investors are content to buy them at a figure which compares favourably with many of those quoted for most other foreign industrials. In Marconis there is not much business going on. The slight flutter of excitement which dropped the price to 30s., after its having been 35s., has died away, and the price keeps round about 32s. 6d., with Canadas at 4s. 6d. and Americans at 9s.

As the situation in Mexico appears to worsen instead of improve, prices of the various Mexican issues are naturally dull. There are still buyers, however, of Mexican Electric Light and Power First Mortgage bonds at 73. Mexican Electric Light First Bonds can be sold at 55. Monterey Debenture is quoted about 50. Mexico Tramways changed hands the other day at 52, but in the Light and Power Common shares we have not been able to trace a transaction for several weeks past. Brazil Tractions held their rise at 50 until dullness supervened in other markets, ostensibly on the advance of the Germans on Calais, when the quotations eased off to 49. British Columbia Electric Railway Deferred is 103, the Preferred 91¼; while the Company's Vancouver 4½ per cent. Debenture can be negotiated on the basis of 83. Rio Tramway Firsts changed hands at 80 in a very small amount, and there are now one or two buyers at 81. Anglo-Argentine Tramways 5 per cent. Debenture stock is being dealt in on the basis of 87-90.

British Electric Traction 5 per cent. Debenture changed hands the other day at 88. Amongst other debenture stocks that are wanted are London Electric at 88½ and Westminster Electric 3½ per cent. stock at 83½. The latter price looks unduly high until it is remembered that the company must redeem this issue in 1920 at 100, and it is understood that the company has the money in hand already—invested in first-class securities. At 85, the yield is £6 15s. per cent., taking redemption at par into account.

The manufacturing list is still attracting some little attention. Edison & Swan £3 paid shares are favourites at 6s., and the fully-paid stand at 1⅛; buyers have given more during the past few days. Crompton Ordinary at 5s., and the Preference at 10s., are somewhat neglected. General Electrics keep at 11½ for the Ordinary, 9¾ for the Preference. There is a demand for British Westinghouse Prior Liens at 99, although the 4 per cent. Debenture Stock can be picked up about 73; the Preference shares are 28s. 9d.

In the Rubber market business is idle, with fluctuations from Monday to Saturday scarcely worth mentioning. The novel and important part which rubber is playing in the present war is merely having the effect of keeping prices steady. Some of the Antwerp refugees have found refuge and employment in Mincing Lane and its environs. Armament shares show no special movement, and here, again, buyers seem to think that prices are now sufficiently well valued. Amongst copper shares the tendency is distinctly heavy.

MARKET QUOTATIONS.

Owing to the war, the prices given below are, of course, more or less nominal.

Wednesday, October 28th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	Nom.	..
a ,, Nitric	,,	,,	..
a ,, Oxalic	per lb.	8d.	..
a ,, Sulphuric	per cwt.	Nom.	..
a Ammoniac Sal	,,	,,	..
a Ammonia, Muriate (large crystal)	per ton	£49	..
a Bleaching powder	,,	Nom.	..
a Bisulphide of Carbon	,,	,,	..
a Borax	,,	£18 10	..
a Copper Sulphate	,,	£22	..
a Lead, Nitrate	,,	£31	..
a ,, White Sugar	,,	Nom.	..
a ,, Peroxide	,,	,,	..
a Methylated Spirit	per gal.	7d.	..
a Potassium, Bichromate, in casks	per lb.	7d.	..
a Potash, Caustic (88/90 %) ..	per ton	Nom.	..
a ,, Chlorate	per lb.	7½d.	..
a ,, Perchlorate	,,	5½d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	,,	Nom.	..
a Shellac	per cwt.	55/-	..
a Sulphate of Magnesia	per ton	Nom.	..
a Sulphur, Sublimed Flowers ..	,,	£9 10	..
a ,, Recovered	,,	Nom.	..
a ,, Lump	,,	£7 10	..
a Soda, Caustic (white 70/72 %) ..	,,	Nom.	..
a ,, Chlorate	per lb.	,,	..
a ,, Crystals	per ton	,,	..
a Sodium Bichromate, casks ..	per lb.	3½d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£88	..
b ,, Wire, in ton lots (1 to 14 S.W.G.)	,,	£112	..
b ,, Sheet, in ton lots ..	,,	£113	..
p Babbitt's metal ingots	,,	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¾d.	..
c ,, Tube (brazed)	,,	9¾d.	..
c ,, ,, (solid drawn)	,,	8¾d.	¼d. dec.
c ,, Wire, basis	,,	7¾d.	..
c Copper Tubes (brazed)	,,	9¼d.	¼d. dec.
c ,, ,, (solid drawn)	,,	9¼d.	¼d. dec.
g ,, Bars (best selected) ..	per ton	£72	..
g ,, Sheet	,,	£73	..
g ,, Rod	,,	£73	..
d ,, (Electrolytic) Bars ..	,,	£56	..
d ,, ,, Sheets ..	,,	£74	..
d ,, ,, Rods ..	,,	£63	..
d ,, ,, H.C. Wire	per lb.	7¾d.	..
f Ebonite Rod	,,	8/-	6d. dec.
f ,, Sheet	,,	2/6	6d. dec.
n German Silver Wire	,,	1 7	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	2/7½	2d. dec.
l Iron Pig (Cleveland warrants) ..	per ton	48/3	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£16	..
g Lead, English Pig	,,	£18 10	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£10 to £10 5s.	..
e Mica (in original cates) small ..	per lb.	4 1. to 2/6	..
e ,, ,, ,, medium	,,	8/- to 5/-	..
e ,, ,, ,, large ..	,,	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	,,	Nom.	..
p Phosphor Bronze, plain castings	,,	1/1 to 1/3½	..
p ,, ,, rolled bars & rods	,,	1/0½ to 1/2	..
p ,, ,, rolled strip & sheet	,,	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	£141	..
g Tin, Block (English)	,,	£133 to £135	..
n ,, Wire, Nos. 1 to 16	per lb.	2/1	1d. dec.
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

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LARGE INDUCTION MOTORS: SOME FEATURES OF MECHANICAL DESIGN.

By G. MOORES, B.Sc. Eng.

(*Concluded from page* 573.)

Diamond Windings.—This is probably the most familiar type of winding on electrical machines, being used for both stators and rotors as well as for D.C. armatures. When it is used on an induction motor stator (with half-closed slots) it is formed by pushing straight bars through the slots and

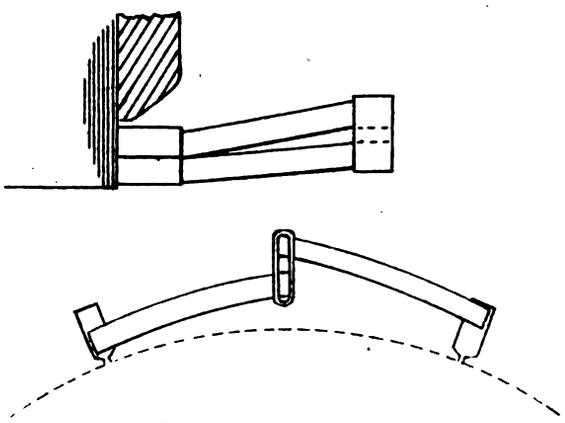

Fig. 36.

then bending the ends of the bars over to form diamond end connections. The bars are then connected together at the ends as shown in fig. 36, which represents an end view and section of the winding.

The design of the shape of diamond windings is a simple matter, and is shown in several text-books. The only thing to be calculated is the slope of the end-connection relative to the slot portion of the bar, the angle between these two being $\sin^{-1} T/P + 90°$, where T is the thickness of the insulated coil together with any clearance or packing which may be deemed necessary, and P is the pitch between adjacent coils at that point where they are nearest the centre of the machine.

In the case of open slot machines, diamond coils are often wire or strap wound, and are made in three different ways:—(1) Round wire coils, usually made to finished

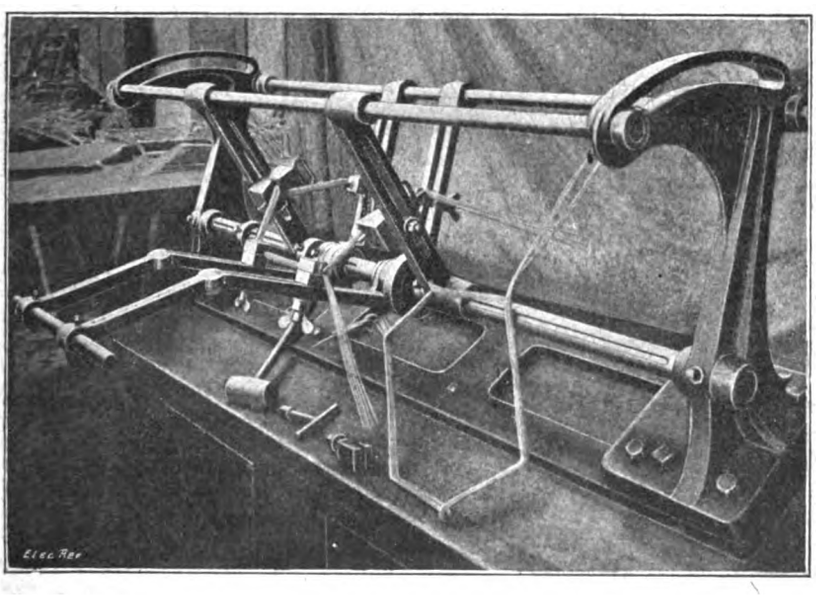

Fig. 37.—Machine for Pulling Coils.

shape on a mould of wood or fibre; (2) Rectangular wire, or ribbon coils, usually wound first in a loop, thus ⊂⊃, and then pulled in a separate machine to the finished shape; (3) Strap coils, usually wound to finished shape on an iron former. Round wire coils may of course also be pulled in a separate machine, and even light strap coils as well. Fig. 37 illustrates a type of pulling machine used for this purpose, showing a coil in the machine and one which has been pulled lying in front of it.

Involute or "Butterfly" Windings.—Bar windings of this type on stators are formed by pushing straight bars through the slots, and then connecting them by separate end connectors of copper strap bent into the shape of two involutes, these lying in two different planes at right angles to the axis of the machine. An end view and section of this type of winding are shown in fig. 38. The design of the shape of involute end connectors will be dealt with

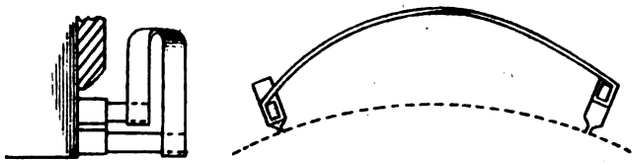

Fig. 38.

under rotor windings, as they are similar to involute coils, and these are more commonly met with on rotors.

Concentric Bar Windings.—This type is generally found on large high-speed machines with two or four poles, where the length of the end connections is too great to permit of the use of diamond or involute windings. Fig. 39 is an excellent example of this type. It represents a two-pole, bar-wound, concentric-winding in three tiers, and shows the extremely neat construction possible and the small space occupied by end-connectors of this type. The stator here illustrated is for a 550-H.P., 2,400 R.P.M. induction motor by Messrs. Vickers, Ltd., Sheffield. This type of winding is also largely used for turbo-alternators.

Concentric Wire Windings—For the largest machines, particularly those of high voltage, concentric wire windings are the most common. They are shown in the table classified as "hand-wound" and "push-through." Hand windings, though formerly very common, are not of much importance now commercially. They can be made up into a very neat winding, but they have three great disadvantages—the expense of winding them, the difficulty of insulating them, and the expense, time, and skilled labour required for repairing them. They are now, therefore, seldom met with.

By far the most important of all stator windings at the present day is the "push through" concentric wire winding. Coils for this type of winding are wound on a wooden mould to the shape shown in fig. 40. The slot portions of the coil are then thoroughly insulated, and when dry the coil is pushed through (hence the name) the slots from one end of the machine, and at the other end the wires are bent over and connected to one another by special connectors or by welding.

The moulds used for winding these coils vary considerably. Some moulds are rotated and the wire wound on to them directly off a reel. The coils may be either wound to the finished shape or wound flat on the mould and afterwards bent. By another method, the wires are cut off to the correct length and then laid in a mould and pressed into shape under a screw press. The most suitable method for any particular case depends to a great extent on the size of the coil and the number and size of wires composing it.

Mush Windings.—For moderate and smaller size machines, and for low voltages, mush windings are very convenient and economical. Success with these windings, however, depends to a great extent upon the correctness of the design of the coil shapes. The ends of the coils have to be shaped finally by hand in the machine, and unless the original shape is well designed, a great deal of hammering is necessary

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to get the coils into position, with the result of damaged insulation and very ugly appearance of the machine when wound. This type of winding would probably be much

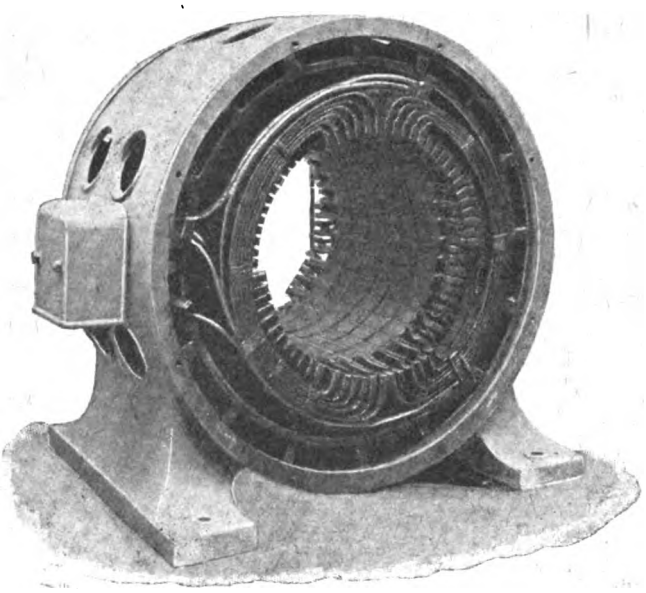

Fig. 39.—Stator of Vickers 550-h.p. Motor.

more widely used were it not for the difficulty of obtaining correct original shapes for the coil ends. The coil end when the machine is wound should be an evenly curved spiral, in shape something between a diamond and an

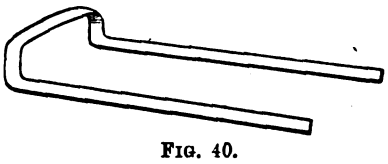

Fig. 40.

involute end connector. The original shape should be similar to fig. 41, but it will be found to vary somewhat for different makes of machines, as it depends slightly on the relations of slot width to slot depth, and number and depth

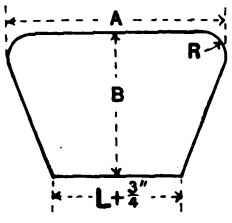

Fig. 41.

of slots to diameter of stator. For preliminary designs the writer has deduced the following formulæ, which may, however, require slight modification to suit particular conditions. Fig. 41 represents the shape of the centre block of the mould on which the coil is originally wound, and the

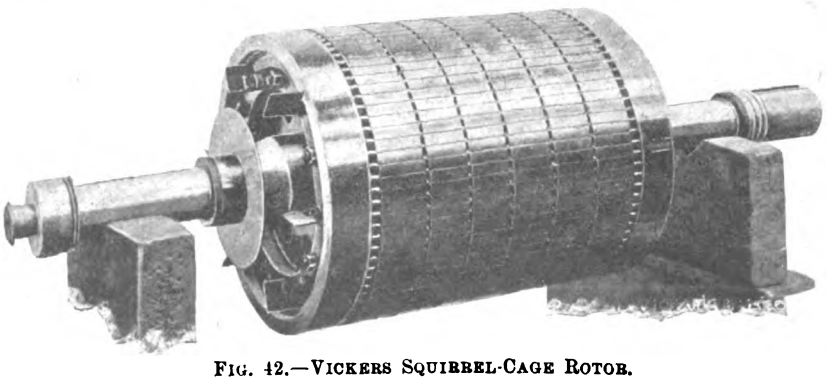

Fig. 42.—Vickers Squirrel-Cage Rotor.

formulæ are for stators only. There are three formulæ, the correct one to be used depending on the "throw" B of the coil.

1. For values of B from $2\frac{3}{4}$ in. to $4\frac{3}{4}$ in.,
   $B = DC + \frac{5}{16}$ in.
   $A = L + 1{\cdot}14\,B - \frac{5}{8}$ in.
   $R = 1$ in.
2. For values of B from $4\frac{3}{4}$ in. to $5\frac{1}{4}$ in.,
   $B = DC + \frac{3}{4}$ in.
   $A = L + 1{\cdot}115\,B - 1\frac{1}{4}$ in.
   $R = 1\frac{1}{2}$ in.
3. For values of B over $5\frac{1}{4}$ in.,
   $B = DC + 1$ in.
   $A = L + 1{\cdot}18\,B - 2$ in.
   $R = 1\frac{3}{4}$ in.

where T is throw of coil (1 and T + 1),
S = number of slots,
D = internal diameter of stator,
L = length of core,
and $C = 2{\cdot}12\,T/S + {\cdot}12$.

Mechanical Support.—There exists some difference of opinion as to the necessity for securing the windings of

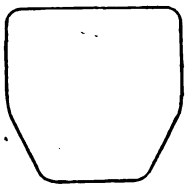

Fig. 43.

induction motors by means of clamps to the stator frame. In the case of generators this necessity is undoubted as the end connections are subject to enormous stresses if a short

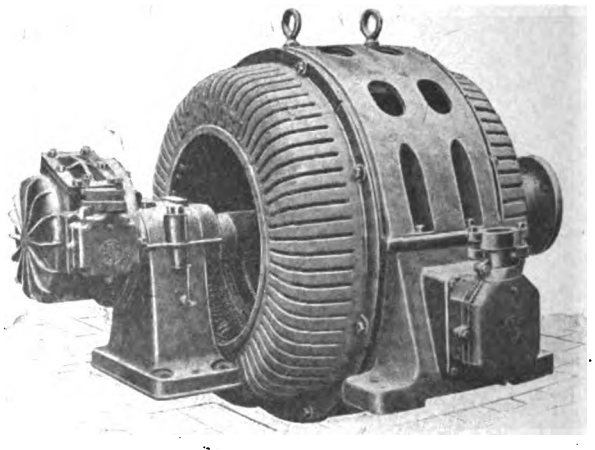

Fig. 44.—British Thomson-Houston Colliery Motor.

circuit occurs, but in the case of motors there is not the same necessity, as, although the winding may be subject to sudden rushes of current due to sudden changes of load and momentary heavy overloads, these excess currents are not to be compared with those obtaining when a "short" occurs in a generator circuit. It is, therefore, probable that the natural rigidity of the end connections of a motor winding gives sufficient mechanical strength without rendering it necessary to clamp the windings to the frame. There is, of course, the matter of vibration to be considered; if this is likely to be exceptionally severe in any particular case, clamping may be considered advisable.

Concentric v. Diamond Windings.—In the case of open slot machines, the choice is open between these two types of winding, so that a list of their comparative advantages may be useful. The diamond winding has advantages in that—(1) One former can be used for all coils, hence this is the cheaper winding; and (2) There is no difference in the self-induction of the individual coils. On the other hand, points in favour of the concentric winding are—(1) Simplicity in shape, and therefore ease of

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effecting insulation; (2) Comparatively short end-connections, especially for high-speed machines; (3) Low voltage between conductors in same slot; (4) By suitable arrangement stator can be split without disturbing coils; (5) Convenient shape for clamping to frame.

Rotor Windings.

Squirrel-Cage Rotors.—The features of interest at present in connection with rotor windings are to be found chiefly in connection with squirrel-cage rotors. The windings of these consist of copper bars lying in the slots, all the bars being connected at each end of the rotor to a resistance ring. This, of course, forms a very compact and reliable construction, and considering its simplicity it is rather remarkable how many different methods have been evolved for obtaining a mechanically and electrically sound construction. And such a high degree of efficiency has been attained in many cases that it is very difficult to choose between one and another.

A good example of a modern squirrel-cage rotor is illustrated in fig. 42. This is by Messrs. Vickers, Ltd., and is from the stator previously illustrated. The end rings of this rotor are made of Vickers "high tensile manganese bronze," and are shrunk on to forged steel end supports with pure mica insulation. It is fitted with fan blades for ventilating the stator end connections.

Messrs. Bruce Peebles employ a construction in which the bars are connected together by rings of special alloy which, by means of a patented process, are cast solid on to the ends of the copper bars, thus ensuring perfect electrical contact as well as sound construction mechanically.

A third method of construction is that patented by Messrs. The Lancashire Dynamo Co. The end rings of the winding consist of sheet copper punchings like armature punchings, with the same number of teeth as there are rotor slots, the teeth being bent round at right angles to the plane of the end rings and the bars being slotted to receive them.

In still another type, the conductors in each slot consist of two or three copper straps side by side; at the outside of the slot these straps are twisted together through a right angle; they then lie on top of one another on the end ring, to which they are secured by screwing and soldering.

Wound Rotors.—Of rotors with slip rings those provided with diamond bar windings are by far the most common, partly because of the convenience of winding, but chiefly because they lend themselves to a convenient method of banding. The voltage of an induction rotor being independent of that of the stator, a moderately low voltage can always be used, so that the rotor may be bar-wound. In this form of winding the bars are cut off into straight lengths and insulated, and then pushed through the slots and the ends bent over to form a diamond-shaped winding. Such machines have generally a "six-circuit" wave winding, but the largest machines are sometimes lap wound and provided with equalising rings. A good example of this type of winding is afforded by the British Thomson-Houston rotor previously illustrated.

Rotors have also been wound with hand-wound concentric coils of pressed cable, but this practice is not very common now, as the winding was found to be expensive, and there was, besides, the difficulty of satisfactorily supporting the coils mechanically.

Coils of double involute form are occasionally used, though they are much rarer than they used to be, even on D.C. machines. The principle of the design of such windings is the same whether for rotor coils or for stator end-connections of the type previously mentioned. The shape of the involute should be correct geometrically, the radius of the base circle of the involute being $N/2$, where N is the total number of coil sides or connectors in one plane, and "t" is the total insulated thickness of one such coil or connector. Unless the shape of the involute is fairly accurate there is always difficulty in winding such coils, especially on a rotor. These double involute, or "butterfly" coils, are usually made by first winding on a flat mould, and then pulling out to the correct shape on a former.

Many rotors of medium and smaller sizes are wound with mush coils, similar to those already described for stators. The shape of this type of rotor coil differs, however, from that of stator coils, as the former should be made suitable for banding when the machine is wound. The general shape to which the coil is first wound is shown in fig. 43. When the coil is placed in the rotor its ends are formed by hand approximately to the shape of an involute, as this shape gives the completed winding the necessary amount of self-support and rigidity to make it suitable for banding. The important point in the design of these coils is to get the correct length of turn, that is, the correct perimeter for the centre block on which the coils are wound. Slight variations in the shape do not then matter, as the shape can easily be adjusted by hand when the coils are being placed in the machine. A method which the writer has found satisfactory for obtaining the correct lengths of coils is to plot a curve showing the relationship between $(P-2L)/D$ and T/S, where P is perimeter of centre block, L is length of core, D is diameter of rotor, T is the "throw" of the coil (1 and T + 1), and S is the number of slots. Such a curve, which will be found to approximate to a straight line, can be constructed for any particular make of machines from a few experimental windings, and will be found to be fairly reliable for all similar windings.

Accessories.

The accessories for a completed motor, which may perhaps with advantage be briefly mentioned here, are those for (1) reducing the wear and tear on the brush gear; and (2) protecting the brush gear and terminals of motors which are used in fiery mines, so that there shall be no possibility of gas being ignited by sparks from the motor.

A motor designed to fulfil this latter condition is illustrated in fig. 44. This was a motor supplied by the British Thomson-Houston Co. for operating a rope haulage in a Welsh colliery. It will be seen that the slip rings are enclosed in a strongly ribbed cast-iron cover which makes a flame-proof casing for the brush gear. This is fitted with an inspection cover so that the brushes are easily accessible for attention. Both stator and rotor are further fitted with trifurcating boxes in which the connections between motor terminals and three-core cable mains are enclosed. It will be seen that each trifurcating box is fitted on to the motor by a square flange, so that the box gland for the three-core cable may be turned in any of four directions.

The reduction in the wear on brush gear of motors which are intended for continuous running is effected by means of a brush lifting and short-circuiting gear. This device, which is generally operated by a handle on the collector case, enables the slip rings to be short-circuited and the brushes to be raised from them when the motor has started, so that so long as the motor is running the brush gear is out of operation altogether. When the machine is stopped a reverse operation brings the brushes back into position ready for re-starting. The brushes are, therefore, only in use for short periods, and the saving is such that the motor requires a very much smaller brush gear when fitted with this brush-lifting device. It would not, of course, be practicable to use this gear on motors for intermittent service, such as the machine just described.

In concluding these articles, the writer desires to record his thanks to the various firms whose machines have been illustrated for the photographs, &c., which have been reproduced, and his appreciation of their kind permission to publish them.

A Large Turbo-Generator. — The A. G. Brown, Boveri & Cie. has recently been building for the Municipal Electrical Works Mark, at Hagen, a turbo-generator of 29,500 KW. output. The floor-space required for this set in comparison with one having an output of 5,000 KW., at 3,000 R.P.M., is in the proportion of 2·6 : 1, so that six sets of 5,000 KW. each, or with a total output of 30,000 KW., would require about 2·3 times as large a space as this set alone. It is thus evident that it is considerably more economical to install such large units than several small ones, in view of the saving in cost of space, buildings, foundations, piping, &c.

The new set is designed for use with superheated steam at 350° C., at a pressure of 13·5 atmospheres and with surface condensation, the temperature of the cooling water being 12° C.

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HIGH-SPEED ELECTRIC PASSENGER LOCOMOTIVE.

An interesting example of the way in which electric traction is being developed for passenger service in the United States is to be found in the group of sixteen locomotives which have been recently placed on high-speed main line passenger service by the New York Central and Hudson River Railroad Co. Fig. 1 illustrates one of these locomotives which is claimed to be the most powerful electric passenger locomotive thus far constructed. It is capable of continuously hauling a train of fourteen steel Pullman cars at a sustained speed of 60 miles per hour, while with a lighter train the maximum speed of these locomotives is 85 miles per hour. These speeds and capacities have been actually obtained in tests made both on the experimental track maintained by the railroad company west of Schenectady and on the electric division before the locomotives were put into commercial service.

The electrical features of these locomotives are generally the same as in the original electric locomotives first operated by the above company eight years ago. The principal change is in the mechanical arrangement of the wheels and trucks. In the first thirty-five locomotives there were four driving axles set in a rigid wheel base, and the guiding of the locomotive was accomplished by two-wheel pony trucks at each end. These original locomotives each weigh 100 tons, and are capable of hauling eight Pullman cars at a speed of 60 miles per hour. The next development was the placing of four-wheel bogie trucks at each end of the locomotive for the purpose of improving the riding qualities at high speeds. Of this class, twelve locomotives were built, and they weigh 122 tons each, their hauling capacity being about the same as that of the original locomotives.

The new locomotives weigh 132 tons, and the great increase in capacity, compared with the slight increase in weight, is due to the fact that motors have been placed on the axles of the leading and trailing bogie truck wheels; thus there is no "dead" weight, all wheels being driving wheels, and the entire weight of the locomotive is available for producing tractive effort or draw bar pull. The acceptance tests recently conducted by the railroad company were very complete, and represented actual operating conditions. The trials were made with a fourteen-car train of the heaviest steel Pullman cars, and actual train schedules were carefully followed. Readings were taken to measure accurately the electric current used and to indicate precisely the speeds maintained. The results demonstrated with these locomotives exceeded the contract requirements and the current consumption was very low, probably the lowest yet attained in this class of service. Moreover, the riding qualities of these locomotives have been found to be excellent.

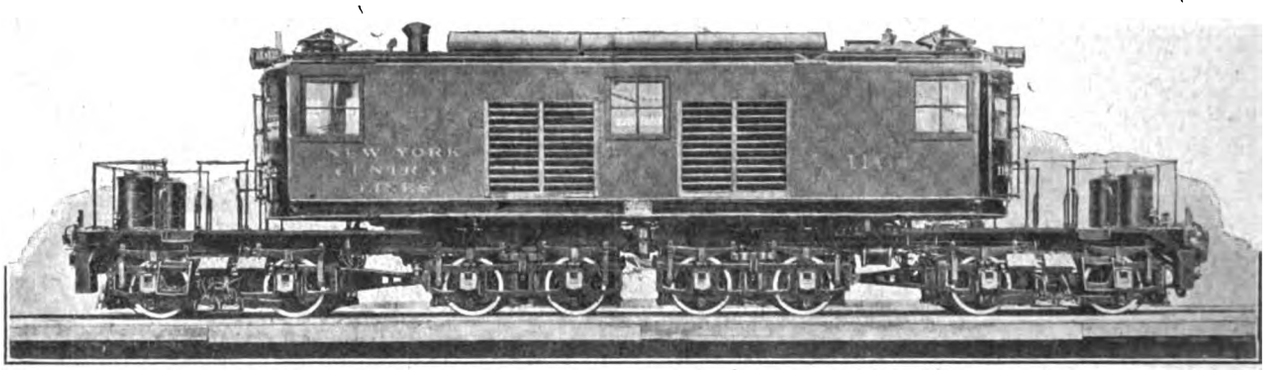

Fig. 1.—High-Speed Electric Locomotive, New York Central and Hudson River Railroad.

These locomotives are used in operating to a distance of forty miles outside the city of New York, and are capable of operating at long distances. We are indebted to the Chief Engineer of the New York Central and Hudson River Railroad Co. for the above particulars.

THE BRITISH EMPIRE—AND OUR WORK IN IT.

By FRANK BAILEY, M.Inst.C.E.

(*Abstract of Presidential Address to* Association of Engineers-in-Charge, *Oct. 14th*, 1914.)

Some useful purpose may be served if we consider the position of the engineer-in-charge, the possibilities of his profession, and the opportunities which occur, or which he may be able to create, to justify his claim to be a useful member of a great empire.

The work of maintaining plant or of superintending works of construction involves details of management, specialised experience, and therefore a knowledge of men and of many handicrafts. These requirements can be fulfilled satisfactorily only by the happy combination of theory, practice, and experience. Theory is useless for this purpose unless applied to practice; and practice becomes only a blind imitation of possibly obsolete methods unless controlled by theory. If practice were always perfect there would be no room for theory; and if theory were always correct and unlimited by considerations of practice, everything would be perfect with no room for improvements, and the engineer-in-charge would become merely a watch dog.

Theory cannot progress without bold flights of imagination stimulated by scientific research; then comes constructive effort and creative skill involving practical experience, and finally the verdict of success—more or less work for the engineer-in-charge.

If the theory has been correctly based on facts, verified or suggested by complete research and applied to practice by the best form of design and construction, it is possible that the engineer-in-charge may relieve the monotony of his existence by keeping things clean and pouring oil into the right place, confident that all is perfect and free from the possibilities of antiquation.

We like to believe that all sources of power in nature have been unfolded to us, but there may be possibilities of future discoveries beyond out present comprehension, and we know that the path of knowledge when industriously pursued inevitably leads to improvements in conception, design, and construction; sometimes amounting to revelations which humble our pride, and prove that our former satisfaction was merely ignorance. The possibilities therefore of initiating new methods, better design, improved processes, etc., should relieve the work of the engineer-in-charge from any tedious monotony, even if ordinary repairs and breakdowns or failures, which may appear mysterious in origin, do not absorb all his energies.

The position occupied by an engineer-in-charge must depend on his own efforts. If he is content to make no progress, or improvements on existing methods, and to make no real attempt to fully grasp the requirements of the plant under his charge, he is not likely to increase the earning power of a factory by securing a larger output or an increased profit by working at a higher efficiency. If, however, a determined effort is made to secure a comprehensive grasp of the main principles of his work, coupled with a special knowledge of the smallest detail of the process of manufacture, he is able to apply skilled judgment on the performance of his plant and to suggest and carry out improvements, or to advise on the replacement of the plant. The necessary courage to condemn

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plant is not easily acquired, as this courage must subsequently be justified by performance verifying promise. The asset value of the scrap heap will not atone for only a partial success of the improved plant, hence the engineer must be prepared to accept the full responsibility of his advice, and be blamed for any defects; in any case, he must not expect praise, for if the replacement exceeds expectations he may have to explain why such an obvious improvement did not receive earlier attention.

If improvement in process or plant results in profitable expansion of output, the wealth of the nation must be increased, and the engineer-in-charge will occupy a recognised position, even in a humble capacity, as a worthy member of the Empire.

Expansion of output is necessary not only to meet the ever-increasing needs of the Empire, but also of the open markets of the world, and the demand on this output will increase as the cost of production is reduced. We must admit that low cost of production, combined with excellence of quality, constitutes the strongest weapon against competition; the persuasive eloquence of the salesman may assist, but the initiation of improvements in manufacture should be part of the life work of the engineer.

The weakest link in our chain of progress appears to be the method of ascertaining the right way of going to work; sometimes it is achieved by actual experience, or, in other words, by trial and error, but rarely by systematic examination. In such an investigation the services of the chemist are generally of great value, although they are seldom appreciated except in chemical factories. Industrial chemistry can assist the engineer by defining the composition of substances, and when combined with some knowledge of engineering requirements the advice of the chemist is a good investment. In this matter the industrial chemist, with a slight knowledge of mechanical engineering, is capable of giving better assistance than the engineer with a rudimentary knowledge of chemistry; but it is essential that the engineer should place implicit faith in the chemist, and adopt the whole of his advice, as otherwise a partial remedy may introduce new troubles.

In the selection of metals or alloys for particular work the chemist can specify the most suitable material, and in the case of steel very small quantities of impurities exercise such an important effect that chemical analysis should be made on samples of the steel as delivered. If, for example, we are working with mild steel the presence of even 0.05 per cent. of phosphorus would be injurious; and with nickel steel the addition of about 3 per cent. of nickel is sufficient for armour plate and guns, and for railway tires and projectiles the addition of an equally small amount of chromium is sufficient.

For brass, bronze, gun-metal, and white metal, the expert assistance of the analytical chemist is most valuable. Many bearings of high-speed machinery give trouble owing to the use of metal which drags, shrinks, or cracks, and is therefore defective for this purpose.

In the selection and use of lubricating oils we have to consider not only the flash point but also the purity of the oil, as any liability to oxidise thickens the oil, thus increasing its viscosity and the temperature of bearings, and in circulating oil systems it is sometimes difficult to prevent the oil from mixing with a certain amount of moisture, thus increasing the risk of oxidisation, and when any fatty oil is present the resulting decomposition releases fatty acids which are highly corrosive.

All this provides useful work for the chemist, in addition to the usual tests on water and fuel, in cases where a factory has the misfortune to be placed somewhere away from a supply of electrical energy.

In large power works the chemist can specialise on important problems which frequently threaten to defeat the skill of the engineer, such as dissolved oxygen in condensed water, due to aeration by condenser pumping gear, causing excessive corrosion; also deposits on turbine blades; both these problems appearing especially under modern conditions of high steam pressures.

Before leaving this inadequate appreciation of the work of the industrial chemist some mention should be made of the discouragement caused to some industries by the action of the Excise Authorities in restricting the supply of methylated absolute alcohol. The ordinary oilshop article contains, in addition to 10 per cent. wood spirit, from 5 per cent to 10 per cent. paraffin oil to render it unpalatable. The paraffin cannot be removed by any simple process, and its presence is very detrimental for many purposes. Up to about the year 1870 methylated absolute alcohol, without the addition of heavy or viscuous petroleum, could be freely obtained without irritating restrictions, and much valuable work was carried out by technical experimentalists, particularly in fine coal-tar products, aniline colours, etc., but any hope that these industries would become part of our national trade was ruined by the mineralising of methylated spirit. We can only envy other nations who are free from these vexatious restrictions, and must expect to find that they will develop the use of alcohol for motor traction purposes, while we are grumbling at the action of our Excise Authorities.

It may be urged that engineers-in-charge ought not to bother themselves about chemical work, but wait until the perfecting of any process reduces the work of the manufacturer to mechanical repetition. This suggestion implies that man, gifted with intelligence and the ability to think, should be content to remain a machine of beef and muscle and probably be guilty of a crime against tradition if he suggested any improvement. A pernicious doctrine of this kind cannot be beneficial to the members of this Association, or to the welfare of the country, and it would be better to risk incurring the ridicule and displeasure of those who prefer stagnation than to perpetuate antiquated or obsolete methods. So much information can be obtained by simple means of investigation that it is surprising how little encouragement is given by many business firms to practical research, or even in assisting their technical officers to collect information from kindred industries either at home or abroad.

Assuming that we have improved our plant and methods there are other matters of domestic interest which require attention. Prosperity generally creates trade disputes, labour unrest, and possibly strikes. We deplore war between nations as a crime against civilisation, and in a lesser degree we must feel that something is wrong when labour declares war against capital, and refuses to work, or to allow work to be done, with the resulting penalty of poverty and consequent privation and misery to women and children. Engineers-in-charge may find in the solution of this problem a task worthy of their efforts. The skilled workman or the labourer is understood and appreciated by them, and when a claim for consideration receives a refusal, that refusal becomes a grievance soon magnified into a dispute, with ill-will and bitter feelings culminating in the senseless coercion of strikes. Some of our Colonies have had experience in the statutory suppression of strikes, and probably the most successful result has been obtained in Canada, under their Industrial Disputes Investigation Act of 1907, which provides for arbitration under facilities favourable to conciliation.

Legislation has also frequently been suggested to provide for the compulsory examination and certification of those in charge of steam boilers, etc., on land. Probably the general use of electrical power has now made this question of less interest as affecting the safety of life; but as a matter of national importance any proposal which secures encouragement for efficiency, or an incentive to progress, is worthy of serious consideration. In our marine service certificates are granted by the Board of Trade after examination, but on land the only statutory provision is contained in the Boiler Explosion Acts of 1882 and 1890, which provide for an inquiry by the Board of Trade into the cause of any accident in connection with the use of steam or explosion of steam boilers. In these inquiries it is assumed that reasonable care should be exercised in placing steam boilers, etc., under the control of qualified and competent attendants, and that the design and manufacture of steam appliances have received proper attention.

It is not clear that examination and certification of engine drivers and stokers would enable the Board of Trade to report in favour of any alteration in the present procedure, and it is probable that many competent attendants would have difficulty in passing such examination.

It is more reasonable to expect that membership of this Association would be accepted as the necessary qualification of those in charge, and as a guarantee that they can be trusted to select competent attendants for steam plants.

A TRANSMISSION SYSTEM SUITABLE FOR HEAVY INTERNAL-COMBUSTION LOCOMOTIVES.

By HEDLEY J. THOMSON, M.I.E.E.

(*Abstract of paper read before the* British Association, *August*, 1914.)

A considerable portion of this paper is devoted to an investigation of the operation of the Thomas transmission system, which was illustrated and described in the Electrical Review, May 5th and June 23rd, 1911, and has subsequently been referred to.

The Thomas transmission is an electro-mechanical system, comprising:—

(*a*) A planetary casing in which are mounted duplex pinions of different diameters, one meshing with a large and the other with a small sun wheel (mounted respectively on the "load" and "auxiliary" shafts), the casing and the two sun wheels forming three independent members of a differential planetary gear.

(*b*) Two electrical machines, one driving or driven by each of the shafts on which the sun wheels are mounted.

(*c*) An electrical controller, by which the electrical condition of the two electrical machines can be varied at will.

In practice the planetary casing is driven by the prime mover; by first taking power from the auxiliary shaft, and, later, by putting power into it, its speed can be varied, with the result that the load shaft speed varies from zero up to the speed of the prime mover.

This object is secured by utilising the torque on the auxiliary shaft to drive an electrical generator, the current from which is taken to a motor on the load shaft. By means of field control, first of the generator, and subsequently of the motor, the speed of the load shaft (attached to the motor) is varied from zero to the inter-

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mediate mechanical ("intermec") speed—the generator field and armature being then short-circuited and the armature revolving slowly backwards due to the gearing.

At this point the electrical functions of the two machines are reversed; the motor, now a generator, energises the other machine, reverses its direction of rotation so that it runs in the same direction as the engine, and through the gearing gradually increases the speed of the first machine and load shaft until a stage is reached when all three members of the system attain the same speed, when any two of them may be coupled together; after which the generator field can be again weakened until its voltage falls below the back E.M.F. of the motor, when the current will die to zero.

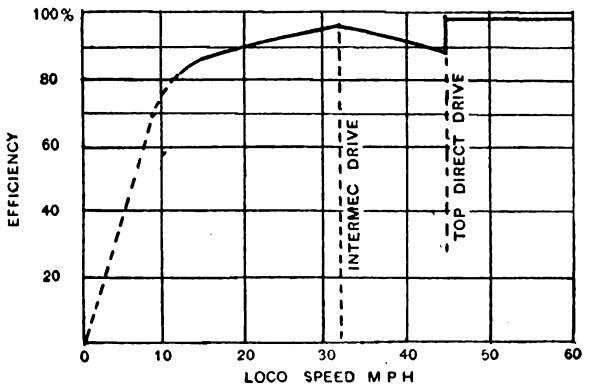

FIG. 1.

The power dealt with in the electrical system is a maximum when the load shaft is rotating at a slow speed. It gradually decreases to almost zero at the "intermec" speed, after which it again gradually increases until the top electro-mechanical speed is reached, when the power dealt with electrically seldom exceeds one-half of the total power developed by the prime mover. This speed is not a running speed, but a temporary speed introduced with the object of bringing all three members of the planetary system to a common speed, when by a mechanical coupling together of any two of them, and proper manipulation of the fields, the electrical transmission is eliminated, and thenceforward the power is transmitted solely mechanically, while the planetary system and gears rotate with no relative motion.

A measure of the extent of the departure of the system from an ideal variable speed torque transformer will be found in the losses in the gearing and bearings, in windage and in the two electrical machines and controller, the only possible avenues for the dissipation of energy in the system. The losses in the gearing are a maximum when starting, because there is then a maximum relative movement between the gears, but under no conditions with properly made gears should these exceed 6 per cent. As the load shaft speed increases, the relative motion in the gearing gradually becomes less and less, until finally it reaches zero, when the "top direct" drive is reached. Losses in the electrical machines are a maximum also for the first few controller positions, but, as the load shaft speed increases, so the auxiliary shaft speed decreases, a change accompanied by a corresponding decrease in the amount of power dealt with by the electrical system. At the "intermec" speed the total electrical losses are of the order of 4 per cent. After passing this speed they begin to increase again, and, if it were not for the introduction of the "top direct" drive, they might become serious.

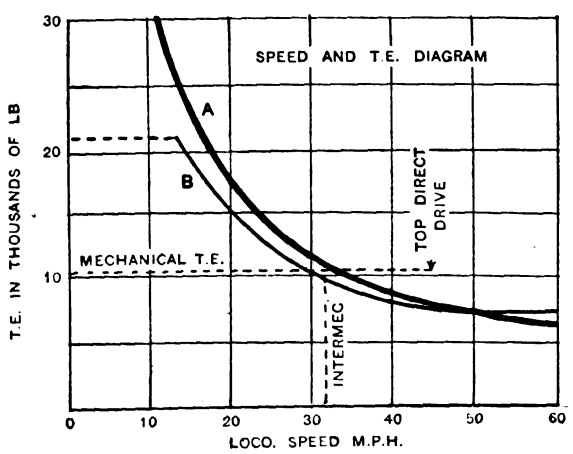

FIG. 2.

Fig. 1 shows the characteristics of the efficiency curve obtainable with this system. It will be seen that for a very considerable range on each side of the "intermec" drive the efficiency is practically as high as might be obtained from fixed reduction gear, and yet, throughout the whole variable range of the apparatus there is as much flexibility as would be available from a much more costly, heavy, and less efficient purely electrical installation.

Important features of the system are well shown by fig. 2, which is a tractive effort diagram set out along lines familiar to railway engineers. The case taken is that of a locomotive equipped with two engines, each capable of developing 500 H.P. at 550 revolutions. The curve A is the characteristic curve for 936 H.P., the total power delivered by the engines at the normal speed of 515 revolutions. Immediately below curve A is curve B, showing the tractive effort that would be delivered at the driving wheels if there were no gearing or bearing losses in the final drive to the axles. The difference between the ordinates of these two curves, therefore, indicates the losses at any given speed, due solely to the Thomas transmission. It will be seen that a horizontal line has been drawn parallel with the base from a point corresponding with a tractive effort of 10,500 lb., and that it cuts the tractive effort curve B at a point corresponding with the "intermec" speed. This horizontal line represents the constant tractive effort derived mechanically from the large sun wheel of the planetary gearing. That part of any ordinate of the tractive effort curve above this line is a measure of the tractive effort obtained by electrical means. It will be seen that this addition has a maximum value at starting, and that at a point corresponding with 14 miles per hour it begins to decrease and reaches zero at the "intermec" speed; also that after that speed the effective tractive effort is gradually diminished, due to the amount of power circulated electrically, till at a speed of 45 miles per hour the "top direct" drive clutch is operated and the electro-mechanical drive cut-out altogether, when the final tractive effort becomes at once that due to the engines alone. When running in direct drive further variation of the locomotive speed is possible by simple throttle variation, and by this means the locomotive now under consideration might be run up to close upon 70 miles per hour for short periods, provided the engines could be run at speeds approaching 700 R.P.M.

From the point of view of the traction engineer two important features of the system are:—

1. That for practically all running speeds below the top direct drive the losses in the transmission are small, because such a large proportion of the power is transmitted mechanically.

2. That if the power of the prime mover be correctly chosen the direct drive can be in use and the electrical losses altogether eliminated during the greater portion of the running time.

The special value of the first feature is that the speed on grades approaches the maximum possible with the power available.

The second feature, on the other hand, has a very marked effect on the overall economy, as can be easily gathered from the fact that under general passenger locomotive conditions for well over 90 per cent. of the total running time it will be possible to utilise the direct drive, and during the remaining 10 per cent. of the running time the losses in the Thomas gear will not, on an average, exceed 10 per cent. of the power dealt with.

It is worth while here comparing these losses with those that would have to be allowed for in a pure electric transmission system in which the total power of the prime mover is transformed by means of a generator into either direct or alternating current and delivered by cables to motors on or driving the wheels. With such a system, when runnning even with full load, the overall electrical efficiency will seldom exceed 80 per cent., and when running on the level at high speed; but, as would normally be the case, at about two-thirds load it will probably be often as low as 65 per cent. Further, when running on steep grades with increased current to provide increased tractive effort, the efficiency will be still lower.

But, quite apart from the important question of speed on grades and overall economy, electrical machines that have to deal with the whole power for considerable periods, and with a large proportion of it continuously, are necessarily large, heavy and costly if the power dealt with is large. With the Thomas electro-mechanical system, since the electrical units never deal with more than a portion of the total power, and even then are in operation only for short periods (*i.e.*, only when starting and when on steep grades) they can be small as compared with the power of the prime mover without risk of their overheating. Thus, instead of 500-H.P. machines being necessary, machines of approximately 90-H.P. continuous rating would be sufficient with this system as applied to the locomotive just referred to.

The rapid development of the internal-combustion engine and the enormous advances that have been made recently in the manufacture of high-power gearing that will run continuously at the high speeds and pressures called for in marine turbine reduction gearing, coupled with the years of experience gained in electric traction, have at last opened up the way for the application of such a system as that described to heavy rail traction. With the help of the progress thus made in other fields of engineering, every one of the essential features of the powerful internal-combustion locomotive of the future can be embodied in a practical locomotive which will have many points in its favour as compared with the steam locomotive, even in countries where the supply of coal and water is not the serious question that it must be in many parts of Australia.

Lowering Fly-wheel into Pit.—Installing a large Corliss engine in an out-of-way place, with but few tools, is a trying ordeal. I know it. A few pinch bars and a jack borrowed from a section boss constituted the entire equipment. All went fairly well until it came to lowering the one-piece fly-wheel into the pit. It occurred to me to fill the pit partly with dry sand. Then the wheel was rolled down easily and the shaft put into it. On digging the sand out the wheel settled down until the shaft rested in the bearings.—PHILIP R. DUNTON, in *Power*.

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CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Street Lighting in Chicago.

With reference to the extract from the *Electrical Review and Western Electrician* appearing on page 504 of your issue of the 9th inst., giving an account of the street lighting in Chicago, we would state that it is most misleading.

The article mentions that the maximum candle-power of the 450-watt flame lamp is only 1,150 by laboratory test, whereas a modern flame lamp would give a maximum candle-power of about 4,000, and the deposit on the inside of the globes would be practically *nil*, even after 300 hours' burning.

It is stated that an average maximum of 600 C.P. would be obtained from each 300-watt nitrogen-filled tungsten lamp, but surely this is incorrect, as there must be *some* loss from "Alba" enclosing globes even before they become dusty or dirty.

Again, the claim of 600-C.P. for 300 watts is also incorrect, for in no cases where practical tests have been made of so-called "half-watt" lamps has the candle-power been two candles per watt. "Half-watt" is therefore a misnomer, and most misleading to the public, as they will very soon find out when the accounts for electricity consumed come in.

We believe that in Chicago both enclosed flame and magnetite lamps are employed, and neither of these can be called an efficient lamp in any way for street lighting.

It seems to us that the municipal authorities of Chicago are taking a retrograde step in introducing metal-filament lamps for street lighting; possibly the reason for this is there is no efficient flame arc lamp made in the U.S.A. Changes in street lighting in Chicago, we hear, are numerous, and therefore we hope to hear before another year or two has passed that the authorities have discovered a flame lamp which is as efficient as the best productions of this country, and will again revert to flame arc lamp lighting, and, by so doing, adopt a forward policy.

Per pro. **Engineering and Arc Lamps, Ltd.**
WM. M. D. PELL, *Director.*

London, E.C., *October 23rd*, 1914.

The Trade War.

With reference to your leader and notes about your canvass of the home manufacturers, I am glad to see that there is some tendency to start the trade war by beginning where the enemy's pitch met ours in peace time, almost as I suggested in my letter in your issue for September 11th. If I may have a further say in this matter, may I point out that as nearly all the home manufacturers have either branches, agents, or other connections in either the Colonies or South or Central America, it would only be a matter of about six or eight weeks to collect statistics relating to Austro-German electric imports, and from these plan the 1915 output of goods and the necessary advertisement and publicity literature. As a man who has either travelled or lived in France, Belgium, Austria, Germany, Spain, Turkey, Russia and the U.S.A., and who has worked for three different trade associations (one of them an American), I would suggest that after receiving the particulars relating to the overseas business territory, and reviewing the same, the makers here should only reckon to capture from 30 to 50 per cent. of the abandoned enemy business, as this would allow for competition and the activity of the American makers in the particular localities.

Against your suggestion of a Royal Commission on the subject, may I urge that in the main individual effort will only succeed in securing an acceptable percentage of the abandoned enemy trade? Royal Commissions and most of the deliberations of Trade Associations are nothing short of horrors to the man who knows his job and wants to get on with it. Besides, the former are always collections of gentlemen who generally succeed in spending anything between £15,000 and £30,000 incomplimenting each other for a few hours per day for a period covering, perhaps, several months, and then conclude by arriving at decisions which are about 14 years out of date. Further, in the present instance the war will most likely be over by mid-winter, and be it empire or republic, Germany will rapidly rise again, so that six months' deliberation would, in my opinion, be fatal.

As Mr. Coates half suggested in your previous issue, I have found that the man who has been outside the British Isles would sooner take German or American money, as it is generally earned under more agreeable conditions than British remuneration, and there is an element of friendly generosity in the payments which always enthused me to further activity. This is good from both points of view, *i.e.*, the employer and employed—and in respect of the former lays the foundation of future business. These conditions are seldom found—never in my experience—in British industries, and I have sampled the rubber, petrol motor, technical journalism and electrical businesses in my time. I quite endorse the objectionable inter-departmental note item mentioned by Mr. Coates, as while in charge of a small department I frequently found notes on my desk from a higher (?) authority which would have been an insult to an office boy. Another apology for a "boss" would sign almost anything that a certain female typist put before him, provided the matter was detrimental to my department or offensive to myself. Another unique experience, although I had been used to slim treatment in three other industries, arose on my accepting a post at a moderate salary on account of the sudden death of an American partner of mine. Although one of the firm expressed doubt as to whether the new branch could be worked at all—the work was little short of slavery—the salary at which I was engaged was reduced by 15s. a week because I could not run the affair without additional staff. After being assured that the matter would be adjusted "after Christmas" and an advance on my original allowance made, I got an "advance" of 5s. a week on the 15s. a week arrears which had been piling up since the previous October, and this after a certain notable had pointed out at the official dinner the previous evening that "the prosperity of the industry was inseparably bound up with the prosperity of the employés." In the light of this, which is not unusual at home, even the most embryonic intellect can well imagine that many of us do not look to the home industries for either congenial or remunerative employment.

Arthur Mallord Turner.

Wimbledon, *October 26th*, 1914.

I was recently connected with a company promoted to push the sales, and protect the interests generally, of British manufacturers in Morocco, and while the requisite number of agencies have now been secured, it surprised me to see the slowness with which manufacturers made the best of an excellent opportunity to increase their business.

If the United Kingdom is to secure an appreciable share of the business which for the moment is lost to Germany and Austria, much less retain it after peace is declared, we must not sit down wrapped up in the idea that, with Germany and Austria out of the market, orders will simply find their way into the factory letter-box. The United States and other neutral countries are making every possible effort to reap the benefit of the present opportunity to replace German and Austrian goods, and it behoves British manufacturers, agents and merchants, to do likewise.

I shall be very pleased to place manufacturers and others in touch with a progressive London export house, who know the Egyptian and Sudan markets thoroughly, and who are determined to make the best of the present situation by sending out a representative to Egypt and the Sudan, and also to Aden and Massowah.

Leonard E. Boxall.

London, E.C., *October 26th*, 1914.

Commutator Bars.

Can any of your readers aid me in the securing of commutator segments or commutator bars, or give me the names of any firms in Great Britain or friendly countries who satisfactorily supply them?

Arthur Bergthell, M.I.E.E.

London, E.C., *October 23rd*, 1914.

Armorduct v. Defries.

In view of the publicity which has been given by you and other journals to the decision which was given by Judge Atherley Jones in the City of London Court recently, I think it desirable and necessary that I should state certain facts which have an important bearing on the matter.

These facts are:—

(*a*) Immediately on the issue of the Royal Proclamation forbidding payments to alien enemies, we gave verbal and written instructions to our bankers to refuse the payment of all bills of exchange which were issued by us to alien enemies before the declaration of war, and in the case of one bill which was presented we refused payment and reacceptance in spite of the fact that the holders, the London Joint Stock Bank, professed to be "holders for value." Being threatened with legal proceedings by them we submitted the matter to counsel, and upon his advice we reaccepted this bill, which, however, has not been presented for payment since. We also instructed our bankers to refuse the payment of a large cheque which, in the ordinary way of business, we had paid to certain German suppliers some days before the declaration of war. We have, in other words, not remitted one single penny to alien enemies since the outbreak of the war, we have no intention of making any such payment, and we shall in due course supply proof of our absolute *bona fides* in this direction.

(*b*) We, on the other hand, have paid all our ordinary liabilities, apart from liabilities to alien enemies, as they became due, and we have every intention of continuing to do so, and we may say we have ample funds in hand for the purpose.

(*c*) Our business is now practically limited to our own manufactures, apart from which, however, we continue to handle on a large scale certain goods which we purchase, and always have purchased, in this country.

(*d*) We manufacture, and have for approximately seven or eight years manufactured, on a substantial scale at Bathurst Works, Witton, Birmingham.

(*e*) By far and away the largest amount of the capital engaged in our business is invested in these works, the lock-up approximating £50,000.

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(*f*) We continue to employ a substantial number of hands at Bathurst Works, Witton, and have in hand large Government contracts, the most important of which cover goods which we do not manufacture in the ordinary way; we have taken these contracts in order to keep our staff and workmen together.

(*g*) Approximately 40 of our employés are with the Colours—their positions are kept open for them with a view to reinstatement on the conclusion of hostilities.

(*h*) There is not a single alien enemy in our employment.¶ (The writer is a naturalised subject of some years' standing.)

If these facts are confronted with the judgment referred to above, the obvious unfairness and absurdity of the situation will be apparent.

W. Schmahl, *Managing Director.*

London, E.C., *October 26th*, **1914.**

TRADE STATISTICS OF NEWFOUNDLAND

The following figures, showing the imports into Newfoundland during 1912-13 of goods which are of interest to electrical contractors, are extracted from the recently issued trade statistics. The figures for 1911-12 are added for purposes of comparison, and notes are given of any increases or decreases.

Dollar = 4s. 2d.

	1911-12. Dols.	1912-13. Dols.	Inc. or dec. Dols.
Belting.—			
From United Kingdom ...	1,000	4,000	+ 3,000
,, Canada	1,000	6,000	+ 5,000
,, United States ...	12,000	11,000	− 1,000
Total	14,000	21,000	+ 7,000
Gutta Percha manufactures.—			
From United Kingdom ...	19,000	21,000	+ 2,000
,, Canada	59,000	48,000	− 11,000
,, United States ...	59,000	66,000	+ 7,000
Total	137,000	135,000	− 2,000
Iron and steel railway bars and fittings.—			
From United Kingdom ...	2,000	—	− 2,000
,, Canada	2,000	5,000	+ 3,000
,, United States ...	3,000	3,000	—
,, Other countries ...	—	1,000	+ 1,000
Total	7,000	9,000	+ 2,000
Radiators, electric light material, etc.—			
From United Kingdom ...	24,000	31,000	+ 7,000
,, Canada	8,000	8,000	—
,, United States ...	36,000	64,000	+ 28,000
Germany	—	1,000	+ 1,000
,, Other countries ...	—	1,000	+ 1,000
Total	68,000	105,000	+ 37,000
Machinery for mining purposes.—			
From United Kingdom ...	44,000	34,000	− 10,000
,, Canada	148,000	267,000	+ 119,000
,, United States ...	58,000	92,000	+ 34,000
Total	250,000	396,000	+ 146,000
Machinery for local industries.—			
From United Kingdom ...	4,000	3,000	− 1,000
,, Germany	—	4,000	+ 4,000
,, Canada	5,000	2,000	− 3,000
,, United States ...	16,000	8,000	− 8,000
Total	25,000	17,000	− 8,000
Materials for Western Union Telegraph Co.—			
From United Kingdom ...	1,000	4,000	+ 3,000
,, United States ...	—	1,000	+ 1,000
Total	1,000	5,000	+ 4,000
Material for Direct U.S. Cable Co.—			
From United Kingdom ...	1,000	500	− 500
,, Other countries ...	—	500	+ 500
Total	1,000	1,000	—
Goods for Anglo-American Telegraph Co.—			
From United Kingdom ...	1,000	3,000	+ 2,000
,, United States ...	2,000	1,000	− 1,000
Total	3,000	4,000	+ 1,000
Scientific instruments.—			
From United Kingdom ...	1,000	500	− 500
,, United States ...	1,000	1,000	—
Total	2,000	1,500	− 500
Materials for wireless telegraphy.—			
From United Kingdom ...	4,000	1,000	− 3,000
,, United States ...	—	2,000	+ 2,000
Total	4,000	3,000	− 1,000

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

20,875. "Process for the production of nickel-coated sheets." S. O. Cowper-Coles. October 12th.

20,876. "Process for the recovery of tin from tinned iron and the like." S. O. Cowper-Coles. October 12th.

20,896. "Electric automatic tumbler switches." H. C. Heath & J. P. Keith. October 13th

20,906. "Apparatus for magnetizing permanent magnets." S. C. Newton. October 13th. (Addition to 24,327/13.)

20,908. "Arrangements for synchronizing apparatus having similar periodic movements." W. P. Thompson (Soc. Anon. des Telegraphes Edouard Belin, France). (Complete.) October 13th.

20,924. "Apparatus for use in the recovery of tin from tinned iron scrap and the like." S. O. Cowper-Coles. October 13th.

20,925. "Process for the production of rustless nickel-coated sheets and the like." S. O. Cowper-Coles. October 13th.

20,927. "Electro-magnetic switch." Robert Bosch (firm of). October 13th. (Convention date, June 8th, 1914, Germany.) (Complete.)

20,931. "Electrical batteries." F. R. Marshall. October 13th.

20,958. "Automatic electric fuse." O. Johnson. October 14th. (Complete.)

20,959. "High-tension windings for electrical apparatus." W. H. Wilson & F. W. Wright. October 14th.

20,999. "Interchangeable bioscope arc-lamp carbon-saving attachment for direct current and for alternating current." L. Hughes. October 15th. (Complete.)

21,009. "Ignition devices for explosion engines." A. H. Midgley & C. A. Vandervell. October 15th.

21,012. "Process for the recovery of tin from its ores." S. O. Cowper-Coles. October 15th.

21,033. "Automatic contact mine detractor bowsprit." S. R. D. Mundy. October 15th.

21,042. "Multiple point control electric light switch." E. W. C. Kearney. October 16th.

21,046. "Magnetic lock for miners' lamps." J. Davis & Son (Derby), Ltd., & W. H. Davis. October 16th.

21,079. "Electrically-heated boiling or cooking plates." R. Downe & W. Travis. October 16th. (Complete.)

21,083. "Joints for pipes and electrical conduits." J. S. Enright. October 16th.

21,090. "Electro-magnetic perforators." E. Thomson. October 16th. (Complete.)

21,096. "Alternating electric current circuits in which condensers are employed." British Insulated & Helsby Cables, Ltd., and H. Higham. October 17th.

21,143. "Electrically-actuated tools." W. J. Mellersh-Jackson (Commonwealth Electric Tool Co., United States). October 17th. (Complete.)

21,145. "Electrically-actuated tools." W. J. Mellersh-Jackson (Commonwealth Electric Tool Co., United States). October 17th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

21,931. Selecting Device for Electric Bells and the like. W. E. Muntz. September 29th.

22,023. Method of and means for Mounting Electrical Resistances on to Supports for Electric Apparatus such as Heaters and Lamps. C. O. Bastian. September 30th.

22,024. Electric Glow Lamps. C. O. Bastian. September 30th.

22,224. Electric-pneumatic Air-brake Systems. British Thomson-Houston Co. (General Electric Co.) October 2nd.

22,246. Driving of Road Vehicles. The Thomas Transmission, Ltd., and J. G. P. Thomas. October 2nd.

22,348. Method of and Apparatus for the Control of Electric Supply Plant. H. J. Read and W. J. Bransom. October 3rd.

22,394. Alternating Current Transformers. D. K. Morris, Morris & Lister, Ltd., & J. P. Cateaux. October 4th.

22,405. Lamp Annunciators for Telephone Switchboards. Western Electric Co., G. N. Nash, & B. B. Grace. October 4th.

23,333. Means for Indicating Deflections of Rails or Beams when subjected to Transverse Stress. W. R. Sykes Interlocking Signal Co. & R. W. Tarrant. October 15th.

28,915. Electric Lamp Holders. A. H Brackensieck. December 15th.

1914.

4,294. Electric Hoists, Cranes, Winches, and the like. D. Wilson. February 19th.

6,953. Electrical Relay Apparatus. J. Gardner. March 19th.

8,456. Combination Electric Switch and Fuse. A. H. Short. April 3rd.

10,415. Electric Resistance Furnaces. J. Davies & A. Gallenkemp & Co. April 27th.

10,480. Electro-mechanical Starting Gear for Internal-combustion Engines. J. A. Boursin. April 28th. (May 22nd, 1913.)

13,567. Intercommunication Telephone Systems. British L. M. Ericsson Manufacturing Co. & A. Brookes. June 4th. (Addition to 22,253/12.)

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Vol. LXXV.] CONTENTS: November 6, 1914. [No. 1,928.

	Page
A Review of the Electrical Industry	609
In Darkest London	610
More about the Russians	610
Rubber	611
The Government Electric Power Station of Bangkok, by F. B. Shaw (*illus.*)	612
The Electrical Trades and the War	614
New Electrical Devices, Fittings and Plant (*illus.*)	615
Legal	617
War Items	619
Reviews	621
Electrostatic Ore Separation (*illus.*)	623
Powdered Fuel (*illus.*)	624
Atoms and Electrons	626
Business Notes	626
Notes	630
City Notes	633
Stocks and Shares	634
U.S.A. Safety Rules for the Operation of Electrical Equipment and Lines (*concluded*)	635
The Practical Training of Engineers	636
Import Trade of Sweden	638
The Institution of Electrical Engineers (*illus.*)	639
Heating and Insulation Deterioration of Current-Carrying Conductors	643
Correspondence—	
War and Science	643
Cable Censorship	644
Who Can Help?	644
Capturing German Trade	644
New Patents Applied For, 1914	644
Abstracts of Published Specifications	644
Contractors' Column	Advertisement page xviii

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1914 EDITION

H ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

A REVIEW OF THE ELECTRICAL INDUSTRY.

THE comprehensive address with which Sir John Snell inaugurated his occupancy of the presidential chair of the I.E.E. cannot be said to be lacking in breadth of view, or in affording abundant scope for comment. We cannot hope in the space at our command to deal with more than a few of the many points arising out of his remarks; but we may say that, as a whole, the address leaves the impression that the new President is inspired with a spirit of optimism, zeal and devotion to the interests of the industry of which he is now at the head in this country.

Sir John remarked that it was difficult to write an address without invading the region of controversy, and it can hardly be said that he was successful in avoiding this danger, though nothing that he said could be regarded as provocative in any way. His complimentary allusions to the Incorporated Municipal Electrical Association were well deserved, and remind us that the Association's influence bids fair to rival that of the Institution; as a body it is certainly in close touch with mundane affairs, and is free from the charge of having its head in the clouds, an accusation which is often levelled at the older Institution. That it should be more coherent and homogeneous is the necessary consequence of its constitution; on the other hand, there is no inherent reason why the members of the Institution should not pull together better, placing the common welfare above their individual interests. A former President strove earnestly to bring about this most desirable consummation, and we have no doubt that Sir John Snell will aim at the same goal, though it is a thankless task—for, of all people, electrical engineers seem least able to grasp the true significance of loyal co-operation.

A reference to the late Industrial Committee was unavoidable, and here the President was treading on thin ice. He adopted the position that the existence of separate representative bodies for the different sections of the industry was inevitable and even salutary—a perfectly reasonable attitude, within limits. How difficult it is, however, to maintain a sound position with regard to this question is well illustrated by the President's own remarks. For instance, he said that "to give decisions on controversial subjects affecting two sections of the industry which may happen to be opposed in their views must necessarily involve serious, and sometimes insuperable, difficulties"; yet in the next paragraph he said that the Institution must be prepared to arbitrate between them. Again, Sir John said that the Institution had to consider electrical progress as a whole, while each Association had its own particular sectional interest to advance, and he cited a hypothetical case of the B.E.A.M.A. opposing the introduction of some improved design of machine, while the I.E.E., desirous of advancing electrical interests generally, "would be rightly expected to encourage any such improvement." That is precisely where

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the scheme breaks down; past experience tells us with rigid certainty that the Council of the Institution would discreetly murmur ponderous platitudes about taking such action in respect of industrial matters as might conduce to the general advancement of electricity and its applications, and giving full consideration to any representations, &c.—and would fold its hands and do nothing. The Council is mortally afraid of "taking sides"; it cannot act judicially, for fear of the wrath of the party adjudged to be in the wrong, so, like Justice only in this one respect, it blindfolds its eyes.

The President's suggestion that a standing Advisory Committee should be formed is interesting, in that it so accurately follows the career of the unfortunate Committee that was snuffed out by the Council. "Suppose a difficulty were to arise between two sectional Associations, and suppose the Council were invited to compose the difficulty. The Advisory Committee would again invite certain members fully experienced in the subject in dispute to join them. . . . Conferences with both parties would be held . . . . a fair compromise would be arranged or a direct report made to the Council that some definite attitude should be adopted by them"—so far so good; it is a beaten track. But—"The ultimate power to act must of course rest with the Council, who clearly cannot delegate their powers and responsibilities to another body." Exit the Ind—Advisory Committee.

We are glad to see that Sir John warmly espouses the cause of the ill-paid junior members of the profession, who, having an association of their own, are now becoming articulate and will increase in strength and influence as time goes on. Their cause is just, and ought not to have had to wait for recognition till the time approached when they could compel it. It has been pleaded many times in our columns. Sir John's appeal to heads of departments—with whom it rests to bring about reform, and upon whom rests the shame—is well timed and well expressed. The I.M.E.A. in this respect heartlessly abdicated its position as a body representing the municipal branch of the profession.

The admirable response of the electrical engineers to the call of their country has been abundantly manifested in our pages, and we need only endorse the President's praise and his sure confidence that they will do their duty and reflect credit upon their profession.

The President, referring to the opposition of the Electrical Contractors' Association to the Electric Lighting Bill, assumes towards it the same attitude as we have adopted—namely, that their action is contrary both to the public interest and to the interests of the contractors themselves; and he also advocates a reasonable compromise.

Turning to technical matters, Sir John says he is unwilling to discuss the question of bulk supply controversially, and will deal only with what he thinks are facts. There is a terrible suggestion here as to what he would do if he did enter into controversy—but the matter is too delicate for further comment! We perceive, with dismay, that we have as yet turned over only half the pages of the address, and while there are many inviting topics in the remaining [illegible]ociety, we must defer consideration of them to another [illegible]ion, occas[illegible].

In Darkest London.

A number of articles are appearing as to the wisdom or otherwise of the present arrangements for artificial lighting in the metropolis and other important cities, a peculiarity about the matter which has not attracted attention is that the whole responsibility for regulating the lighting rests with the police, and thus very largely with individual constables who patrol the streets. Now the questions arising as to sufficiency or insufficiency of illumination, glare or its antithesis, are not simple matters which can be mastered in a day (or a night) by a layman whose educational qualifications are not his strong point; we have seen constables drilling in the early days of their career, we have read of constables being complimented by experienced K.C.'s on the rapid way in which they decide to act or not to act on the spur of the moment where some abstract reading of the law is the determining factor, but we can hardly imagine that any members of the force have studied the subject of artificial illumination—suddenly thrust upon them—in sufficient detail to ensure election to, say, the Illuminating Engineering Society. Moreover, individual constables are not granted the use of discretion, and therefore they attempt to apply, as far as their intelligence enables them to do, the interpretation of the Commissioner's order to all parts of the Metropolitan Police area—from Potter's Bar to Purley, and from Staines to Gravesend—regardless of circumstances, regardless of weather conditions, regardless of the citizens' comforts and prejudices. Perhaps a more co-ordinate system might be arrived at if the Chief Commissioner had at his disposal the assistance of some men with knowledge and experience of the Metropolis and of the subject being dealt with. No doubt abundant assistance would be forthcoming if an application were made through the learned societies, or a batch of special constables enrolled to deal with the problem under a more carefully-planned scheme, drawn up under favourable conditions, than it can have been possible for the police to work out under the pressure of their ordinary duties.

We are by no means inclined to belittle the importance of the matter—rather we consider it far too important a matter for the police (unaided) to handle; a Zeppelin load of explosives (say about two tons) distributed over London, would quickly convince the people of London that there are inconveniences even greater than those caused by subdued artificial illumination.

More About the Russians.

In our last issue we quoted some observations by one of His Majesty's Consuls in Russia on the reasons for German success in connection with the machinery trade of that vast country, and in obtaining contracts for electric lighting, tramway, and other public works for municipal authorities. We are quite sure that the advice contained in the report will receive all the attention that it deserves at the hands of any British electrical firms or organisations who take an interest in the possibilities of the Russian market, and we hope that it will assist them in the preparation of plans that may be contemplated. We have so often drawn our readers' attention to the vastness of this field, that it is almost needless to refer further to the matter now, beyond suggesting that our previous comments might be read again with some profit. The name of M. Basile de Timiriazeff, President of the Russo-British Chamber of Commerce in Petrograd, is not unfamiliar in these pages, for we have quoted his words before to show the readiness of Russia to increase trading relations with us. We are not sure whether it was M. Timiriazeff—we think

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it was—who tried to make us understand that Warsaw so much desired British goods in preference to all others that German firms made it their business to purchase here and sell in Warsaw. Warsaw has been very much in our minds lately—it was in the mind of the Kaiser until ten days or so ago as winter quarters for the Crown Prince's army. If Warsaw showed the above preference for British manufactures before the war, and would have dealt direct with us had proper facilities been in existence, what will be the feeling of the people now? We trust British firms will remember such points as these and note how great will be the desire in many places to deal first hand with us in the future instead of through the medium of present enemies. M. de Timiriazeff has sent to England a letter, which has been published in some of the daily papers, drawing attention to the "altogether exceptional conditions which now obtain for English trade with Russia, and which promise to continue for some time to come, and the desirability of co-operative action in both the countries concerned." He refers to the enormous gap created at this time of rapid economic development by the "almost wholesale withdrawal of German trade from Russia." "*The change has brought us in Russia face to face with an entirely new position.*" His Chamber of Commerce is receiving requests from all sides for assistance in the establishment of trade relations in every branch with Great Britain, and Committees have been appointed to deal with many questions arising out of the present position. Though their work is partly occasioned by the prevailing special war conditions, they aim at providing a permanent basis for normal times. "The question," he continues, "is all the more urgent because of the immediate annulment of the Commercial Treaties of Russia with Germany and Austro-Hungary, so that at the end of the war it will be necessary to revise and establish on a new basis the whole international commercial policy of Russia." The language difficulty, to which we have alluded on previous occasions, is mentioned by the writer, and he hopes that it may be possible to develop on both sides the facilities for acquiring the languages and the special knowledge necessary for Anglo-Russian trade. We quote one further sentence:—

I am at one with many public men in Russia in thinking that economic co-operation is one of the strongest bonds of friendship; and in the case of England and Russia, where the question is not one of commercial rivalry but of mutual supply, this consideration has a special force.

We hope that British electrical and engineering firms who have in the past treated Russia as a market in which it was impossible for them to do great things in presence of the machinations of German financial industrial organisations, with Russian electrical concessions slipping into German hands, and with German electrical factories existing in several Russian centres, will take a more hopeful view of the situation.

Clearly it is not the English engineer who is inefficient, for, as we reported a few years ago, there were so many of our engineers in authoritative posts in Russia, that even the Russians themselves instituted an inquiry to find out the reasons for the preference. Nor is it British manufactures that are at fault. It seems to be little else than a case of success due to Germany being on the spot with the most competent representatives commercially, technically, and linguistically, backed with strong financial ability which enabled large operations to be conducted, including the setting up of manufactories—the last named being, we believe, a stipulation imposed by the Russian Government. Whatever may result from the new position which M. Timiriazeff says now faces the country, we must at the moment anticipate that Germany will not lack equally competent representatives in her export markets. She may—we think will—be crippled financially, and it seems fairly certain that neither the Russian Government, the Russian municipalities, nor the Russian people, will be anxious to deal with German works or financiers if Britain, Belgium, or France can anyhow manage to meet their requirements.

Rubber. The market has had a firmer tendency since last writing, and the unfettered activities of the German cruiser *Emden* and the sinking by her of the *Troilus* with a large cargo of rubber on board, have had no small influence in determining the course of values. The latest escapade of this boat at Penang will certainly not add to the confidence of shippers and shipowners in the effective patrol of the seas in Eastern waters by the Allied Powers, and people are beginning to wonder when we are going to have a "go" at some of these German freebooters. There can be no security on the Eastern trade route till the position is cleared up. Leading Eastern ship owners have intimated that their vessels will not run in the infested waters till the *Emden* is accounted for. The price of rubber for November and December delivery is very firmly held as the result of the shipping position, and buyers in hopes of the stiffness being only temporary, are holding back as long as may be possible, but there are several influences operating to prevent the rapid handling of consignments arriving from the East. It is a matter of general knowledge that Germany is beginning to get short of rubber, and it is interesting to note that rubber and also motor tires are now on the absolute contraband list issued by the Government within the last few days. This is a direct blow aimed at Germany's great fleets of motor vehicles, and there is not the smallest doubt that a rubber famine would do much to reduce the efficiency of transport of the Huns, who have been making desperate efforts to procure the necessary supplies from neutral ports and countries. It is even stated that America has been shipping rubber freely in Dutch, Italian and Scandinavian liners, from New York, with the intention that it should be transhipped to Germany. We can only put an end to this state of things by exercising all our rights at sea, and we have no doubt now got a man at the head of affairs who will have no scruples in doing what war demands. These are not the days for mealy-mouthed respect for the feelings of people who are out to assist our enemies. Hence it is to be hoped that the most rigorous supervision will forthwith be undertaken for the purpose of ensuring that no material whatever likely to be of use in prolonging the war shall be permitted to reach Germany. The closing of the North Sea is a step in the right direction.

The position of supplies from Malaya is shown in the following official statement of exports for the nine months ended with September:—

	1912.	1913.	1914.	
January	253	784	1,181	tons.
February	274	743	1,703	,,
March	427	858	1,285	,,
April	387	762	1,548	,,
May	431	814	1,309	,,
June	398	812	1,480	,,
July	380	1,120	1,584	,,
August	729	1,315	1,325	,,
September	597	1,057	1,602	,,
Total	3,876	8,305	13,017	,,

The F.M.S. output of plantation rubber for last year is given officially as 23,719 tons against 15,506 tons in 1912, this being about 50 per cent. of the world's supply, which is returned as 47,000 tons. The total estate production of Malaya is, however, given as 28,214 tons, an increase of 9,266 tons on the previous year. The largest increase outside of the F.M.S. came from Malacca. The area planted in rubber during last year was only 34,127 acres, compared with 54,105 acres in 1912, and 107,200 acres in 1911. This increase is, however, larger than might have been expected under the circumstances.

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THE GOVERNMENT ELECTRIC POWER STATION OF BANGKOK.

By FRANCIS B. SHAW, A.M.Inst.C.E., A.M.I.E.E., Electrical Engineer to the Government of Siam.

Introduction.—In view of the great strides that electricity has made throughout the Far East, a short account of the municipal power station in Bangkok, Siam, may be of interest.

At the present time there are two power stations in Bangkok. The first, owned by the Siam Electricity Co., Ltd., is situated at Wat Liep, about 300 metres from the river. This station was started in November, 1899, but previously to this electric tramways were in use in Bangkok, supplied from another small station, which was closed when the Wat Liep station started.

The second station is the Government electric power station in the Samsen district, and is situated in a favourable position near the river. The primary reason for this station being built was that the waterworks pumping station then being built required a considerable amount of electric power. This could have been supplied by the Siam Electricity Co., Ltd., but their station was at a considerable distance, and it would have been an expensive transmission line to construct. Further, it was considered that electricity could be produced at a much lower cost by a modern station situated on the banks of the River Menam, and at a point fairly close to the waterworks. A further advantage was to be gained by having the waterworks and the power station under one authority.

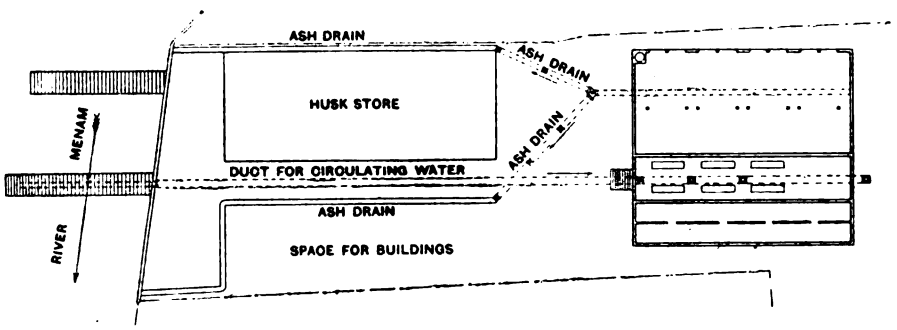

Fig. 1.—Bangkok Electricity Works: Plan of Site.

Site and District of Supply.—The site chosen for the power station is the nearest point on the river to the waterworks pumping station, and is also within a short distance of a district in which the consumption of energy, both for lighting and power, has increased by very rapid strides during the last few years, and there is every indication that the increase will be maintained. Consequently, it was decided to put down a station to supply the whole of this district. It is hoped to obtain a very good load factor, since the power load is, if anything, slightly in excess of the lighting load. The load is made up as follows: —

Day Load.—Waterworks pumping station, full load during the day, and 25 per cent. load during the night. Opium farm, day load only. Cement factory, full day load, with a continuous load of 50 per cent. full load during the whole of the 24 hours. In addition, a small load from fans and small pumps.

Night Load.—A large lighting load nearly equal to the above day load, together with the night power load, as already stated.

Fuel.—Siam is a large producer of rice, and in Bangkok alone there is a large number of rice mills. Large quantities of rice husk are produced in the processes of milling. A certain amount of this is used by the mills to produce the power they require, but there is always a considerable surplus. In appearance it closely resembles the husk of wheat; it is a very bulky fuel, and its usefulness is very much affected by its being wet or dry.

The following figures relating to the calorific value of paddy husk were supplied by the assayer to the Royal Mint, Bangkok. They were obtained from an ordinary sample of husk:—

Loss at 100° C. (moisture), 8 per cent.

Weight per unit volume of paddy husk: From 7·2 to 7·9 lb. per cb. ft, depending on whether the husk is shaken during filling or not.

Ash (inorganic residue on ignition): In moist husk, 19·3 per cent.; in dry husk, 21 per cent.

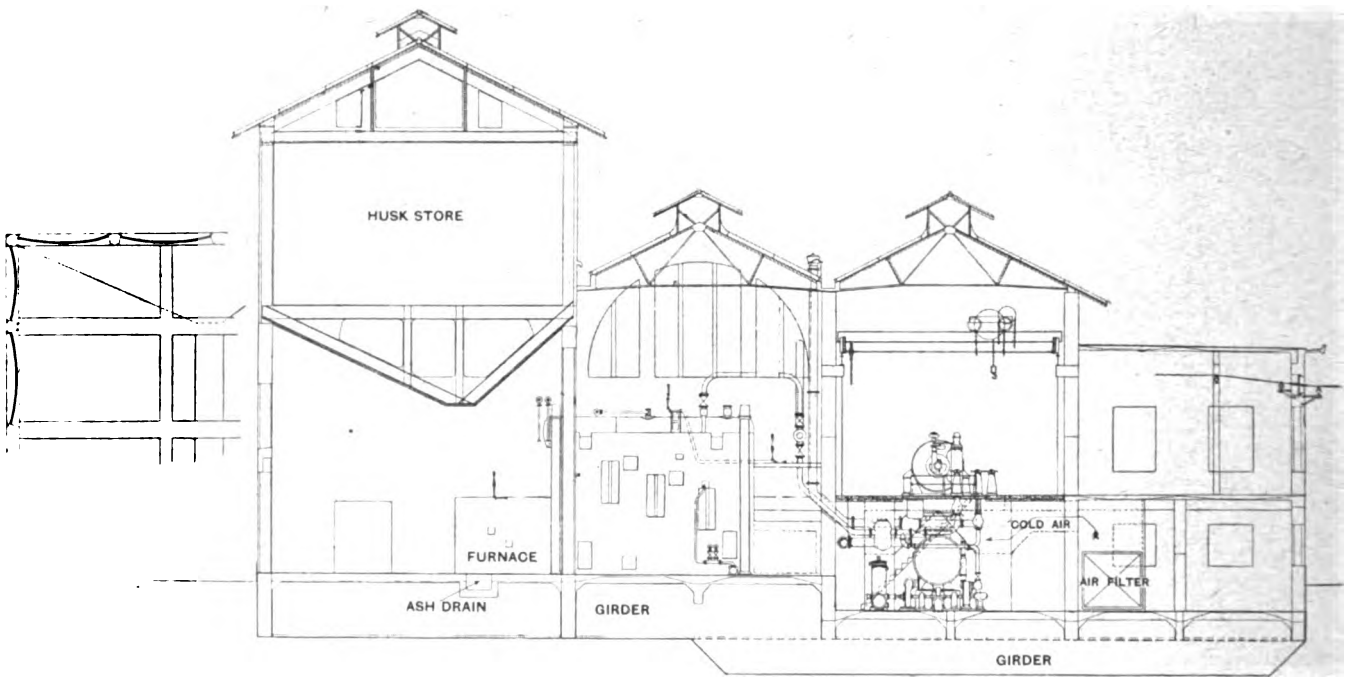

Fig. 2.—Sectional Elevation of Power Station Buildings.

Calorific power (by Thomsen's calorimeter): (*a*) Dry paddy husk: 1 gramme on complete combustion will produce 3,850 gramme calories. (*b*) Paddy husk as received (moist): 3,766.

Evaporative power: (*a*) Dry paddy husk: 1 lb. on complete combustion will evaporate 7·17 lb. of water at 100° C. to form steam at 100° C. (*b*) Paddy husk as received (moist): 7·01.

These figures point out the advantage of using dried husk. If the paddy husk is very wet it is of no use as a fuel.

The supply of rice husk falls off during three months of

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the year—October, November, and December—as very little rice comes down to Bangkok during those months.

For this reason we have arranged to store as much as possible, and have a large store for paddy only, between the station and the river; the store over the boiler house is sufficient for 10 days' continuous steaming on half the full load of the station. Further, to provide against a total failure of husk fuel, we have a store of liquid fuel between the husk store and the station. Three connections to the supply pipe line are on each wharf, and a motor-driven oil pump takes the oil through these from the oil-tank barges and delivers it to the oil tank. Since it was impossible to place this oil tank in any other position, and a fire at this point might be serious, a special arrangement for the use of live steam has been adopted.

Both husk stores have a complete system of Grinnell fire extinguishers, supplied in the first instance by two tanks on the top of the husk store over the boiler house, and partly under pressure from a 75-B.H.P. motor-driven fire pump, by Messrs. Mather & Platt. This pump is housed in a small shed near the filter well in the supply culvert, and takes its supply of water from the latter. Fire mains run round the compound, and hydrants are situated at each corner of the two main buildings.

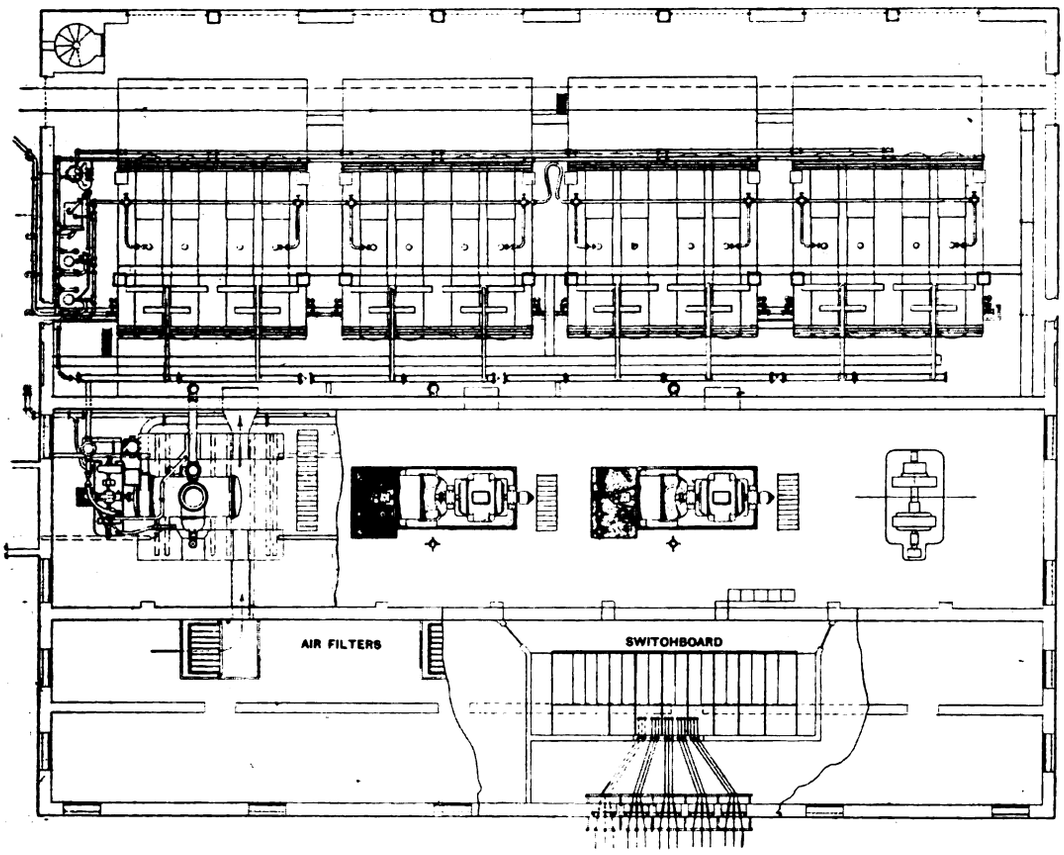

Fig. 3.—Plan of Power Station.

Returning to the question of husk fuel, one of the chief problems was the efficient conveying of so bulky a substance. Conveyors have been installed of the Archimedean screw type, and although this system has been in vogue for a long time and has been used for conveying husk horizontally, for inclined conveyors of so large a diameter it is rather a novelty.

Rice husk, although so light, is yet found to be very abrasive, and many types of conveyors that have proved quite successful with other material have failed when used for husk. This specially applies to conveyors of the suction type.

The four conveyors were supplied by the New Conveyor Co., Ltd.; they are all of the screw type and of 3 ft. diameter, but differ in that the inclined conveyors, Nos. 1 and 3, are of complete spirals, *i.e.*, enclosed to the shaft, whereas the horizontal spirals are only 4-in. ribbons attached by driving arms to the shaft. Of course at bearing points the screw is broken, but the husk heaps up slightly at this point and flows over to the next spiral and thus forward.

A teak wharf about 80 ft. long carries the hopper end of No. 1 conveyor, the husk being emptied into this hopper from the boats alongside the wharf. The upper end of this conveyor is anchored to the end wall of the husk store, and is driven through worm gearing by a 10-H.P. motor. From this point the husk is delivered into No. 2 conveyor, which is a U-shaped trough with a 4-in. deep ribbon spiral of 3 ft. diameter revolving in it. This conveyor is placed horizontally along the top of the husk store and supported by ferro-concrete pillars. At intervals of 10 ft. there are doors fitted to the bottom of the trough for the purpose of discharging the paddy husk into the store as desired.

At the end of this conveyor there is a discharge shoot similar to that on No. 1 for discharging into No. 3 conveyor, and at this point a platform is combined with the end wall to carry the 10-H.P. motor for driving this section.

No. 3 conveyor is 150 ft. long, and being inclined is of similar construction to No. 1, being carried on a lattice girder bridge. Its lower end rests on the floor of the husk store, and its upper end is attached to the end wall of the boiler house at a height of 55 ft. from the ground level. At this point it is driven by a 10-H.P. motor through worm gearing.

About halfway up its length No. 2 conveyor discharges into No. 3 conveyor through a shoot, in which case only the top half of No. 3 conveyor is required, and the lower half is disconnected by means of a clutch. When, however, it is required to take husk from the store to the store over the boiler house, then the whole length of No 3 conveyor is used, and the husk enters through a hopper with regulating slide at the lower end. A tunnel is provided under No. 3 conveyor inside the husk store for regulating this slide and oiling the thrust and shaft bearings.

The thrust is taken by Hoffmann ball bearings, and so far no trouble has been experienced with them. The speed of all four conveyors has been kept down to 60 revolutions a minute, in order to avoid excessive wear. At this speed the guaranteed output is 250 cb. m. an hour.

No. 4 conveyor is similar in all respects to No. 2 conveyor, and is placed horizontally over the boiler hoppers, any of which may be filled by opening the corresponding door under the conveyor. The boilers beneath are arranged in four banks, each half-bank having its separate hopper and shoot. The capacity of these hoppers and the store is about 7,000 cb. m.

The method adopted in feeding the boiler furnaces from the hoppers consists of a simple arrangement of cones and shutters, whereby the supply of husk may be regulated as the demands for steam arise.

The husk store is constructed of half-brick horizontal arches between ferro-concrete pillars, the arches being so constructed as to transmit the thrust of the husk outwards on to these pillars when the store is full (see detail, fig. 2).

Water Supply.—From the foregoing description it will be seen that the husk store is between the power station and the river bank; this, while obviating the necessity for conveying the husk over the boiler house to the store and back again from the store as required, is for yet another reason.

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Owing to the nature of the ground, which is no more than a sea of liquid mud under a sun-dried crust about 1 m. thick, the question of foundations was a most serious one, and it was deemed advisable to place the power station as far from the river as practicable.

For this reason, and in order to avoid a long suction-pipe line or auxiliary pumps on the river bank, it was decided, first of all, to construct a culvert right from the river and underneath the site of the turbine and condenser room of the power station. This culvert, of cross-section 1 m. × 1·25 m. deep, terminates near its river end in a circular well in which the filter screens are placed. There are two filter screens, the lower half being of heavy iron-wire netting and the top half of punched metal plate. These screens run in teak wood guides, and are raised for cleaning and lowered by means of a pulley block and jib.

From the filter well to the river the supply is by an iron pipe supported from the main wharf, the top of the pipe being 4 in. below the lowest known tide. From the filter well to the power station the culvert is given a downward slope of 1½ m, and it is carried to a point beyond the station, where it terminates in another well from which certain auxiliary pumps take their supply. The culvert may be closed at the river filter well and pumped dry from this end well for inspecting and cleaning.

The condensers for the three turbo-generators take their supply from uptakes from this culvert inside the station.

It is hoped that by reason of the slope on the culvert there will be less liability for mud to interfere with the action of the foot valves, &c., of the circulating pumps, as the river water contains a lot of matter in suspension, and that the requisite flow of water at low tides will be maintained sufficient for full load. For a similar reason the filter well has been made considerably deeper than the culvert, to allow any deposit to settle at this point. It would have been a very difficult and expensive matter to construct the culvert at any greater depth at the river end, owing to the porous nature of the ground and the increased pressure of the water at high tides.

Regarding the wharves and husk store, provision has been left for adding a similar store and wharf on the down-stream side.

Power Station Building.—As previously mentioned, great care had to be taken regarding the foundations of this building, and a network of ferro-concrete beams, the chief of which are 2·20 m. in depth, carries the main raft or platform; one of these massive girders is shown in fig. 2. This platform is at ground-level for the boiler house, but is brought down to 1·20 m. below ground level for the floor of the basement of the turbine room, air filter room and store room. This portion has been very carefully lined with bituminous sheeting, and a reinforced layer of cement has been placed over it.

The ground was more than usually bad owing to there being several canals or ditches cutting across the site. So far, however, no serious subsidence has taken place, although the building has been completed for more than a year.

The system above-mentioned of horizontal arches in half-brick with ferro-concrete pillars is used for the husk store over the boiler house, and the sloping floor of this is constructed of ferro-concrete. This is probably one of the first instances of hoppers of this type being constructed entirely in ferro-concrete—certainly it is in the East. Three doors give access to the turbine room from passageways between the four banks of boilers. The turbine room had to be reduced in width as much as possible, as the land available for the station was very much restricted in width. Consequently it was decided to place the three turbines lengthwise to the boiler house.

Large windows at each end give ample light, and even under tropical conditions the room remains comparatively cool, all steam pipes being kept below the turbine floor in the basement. The overhead travelling crane runs on rails on ferro-concrete girders the length of the building. The switchboard is set back slightly, and the back is enclosed in a brick chamber, entrance being by two doors of expanded metal. To the right of the switchboard is the battery room, and to the left the engineer's office and meter testing room. Below these, corresponding to the condenser room, are the air filter and store rooms. A motor-generator is placed at the end of the turbine room farthest from the river.

(*To be continued.*)

THE ELECTRICAL TRADES AND THE WAR.

(*Continued from page* 583.)

Litholite, Ltd.

All the questions are answered in the affirmative, except that a little difficulty is experienced in obtaining an adequate supply of labour.

E. Brook, Ltd.

We have sufficient orders to keep our works fully employed, and up to the present have found no difficulty in obtaining the labour necessary. New orders are coming in at a satisfactory rate, and we have been fortunate in securing several orders which had formerly been placed with Continental firms, but no orders that we can trace that have been previously placed with neutral countries.

We are getting all the raw material we require, and the financial conditions are such as to enable us to accept orders freely, but we are sorry to say there are quite a great number of firms hiding behind the moratorium.

We are starting to manufacture several articles that have previously been purchased from other firms and abroad.

Mawdsley's, Ltd.

Orders.—We have experienced no falling-off whatever in orders since the war broke out, and have sufficient in hand to keep our works running full time.

Labour.—We have experienced some difficulty in obtaining this, as something like 16 per cent. of our staff and employés have joined the Colours in one capacity or another.

New Orders.—These appear to be coming in quite as freely as before the war, and with regard to new business which formerly went to Continental firms, we have received a number of inquiries from firms who were previously buying German material, some of which have matured, and we anticipate that when exchange difficulties disappear there will be a considerable influx of business from this source, from abroad and the Colonies.

Re Materials.—We have found no difficulty whatever in filling our requirements.

Financial Conditions.—With the exception of the question of the foreign exchanges, these, as far as we are concerned, are quite satisfactory.

New Lines.—We have been, and are, so well placed at present as regards standard lines, that, especially in view of the difficulties in obtaining labour, we have not entered into any extensions in this respect.

The Edison & Swan United Electric Light Co., Ltd.

1. We have at the present moment, and have had ever since the war started, sufficient orders to keep our works fully occupied. In fact, as previously reported, we have for some weeks had to take on extra labour.
2. Whilst the supply of labour in our locality offered some difficulty at the onset of the war, things are improving daily.
3. Yes, quite satisfactory to everyone.
4. We are getting new business and inquiries from the Colonies and our Continental Allies.
5. The supply of raw material is naturally somewhat restricted, but in no way has it, so far, seriously inconvenienced us.
6. No complaint regarding financial conditions.
7. We hope eventually to put on the market lines of manufacture which were previously peculiar to the Continent, but at the present time we are quite busy enough with all our usual "All-British" products. If things continue as at present, we shall have to extend even further than is being done to meet immediate demands.

Metallic Seamless Tube Co., Ltd.

We have sufficient orders in hand to keep our works fully employed, although our staffs are depleted considerably owing to a great number having joined the Forces.

Re Supply of Labour.—This at the moment is rather a sore point with us, but we are glad to say that we are gradually overcoming this.

Re New Orders.—Orders are coming in very satisfactorily at the moment, and in many lines, the demands are really greater than the supply.

Re New Business.—We are pleased to say that we are getting new business, which formerly went to Continental firms, from our Allies and the British Empire.

Supply of Raw Material.—We are pleased to say that at the moment the supplies of raw materials are sufficient for our requirements, although prices fluctuate considerably.

Financial Conditions.—We are meeting this in the spirit which we hope the whole of the trade will admit is for the benefit of the country, inasmuch as we are giving, in many instances, extended

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credit to allow our customers an opportunity of overcoming financial difficulties where possible.

Starting New Lines of Manufacture.—We are starting to manufacture new lines, formerly dealt with only by Continental firms.

We do not think that we can make any comments upon the replies, but we might mention that we are experiencing considerable difficulty in getting English manufacturers to fall into line to compete with Continental materials; this is particularly so in the glass trade, the replies that we get being that the expense in putting down plant to compete would not be compensated, the fear being that if the war was to end suddenly, the country would be flooded with the present Continental stocks.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

B.T.H. Ironclad Switchgear.

The British Thomson-Houston Co., of Rugby, has recently developed a special line of three-phase oil switchgear for mining and industrial work, on the "draw-out" principle—the various parts, switch, instruments, &c., being mounted on a sliding carriage and connected to the bus-bars or cables through plug contacts.

The gear is provided with all the ordinary attachments, and some novel combinations of automatic devices to meet different requirements of service.

The switches have two ratings, 120 and 500 amperes for up to 650 volts, and 50 and 120 amperes for up to 3,300 volts. On withdrawing the switch and removing the oil tank, the contacts, delaying devices, overload adjusting devices and fuses are fully accessible; by taking out four screws the contents of the switch body can be removed in one piece; and removal of a back cover gives access to the connection chamber. The switches can be mounted on common pedestals and coupled to common bus-bars.

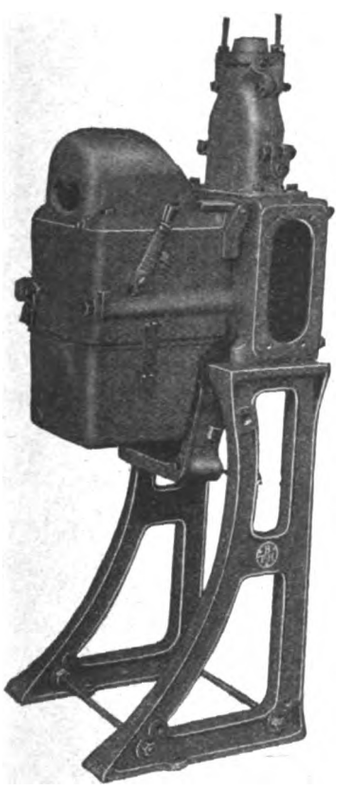

Fig. 2.—Draw-out Switch with Ammeter Hood on Pedestal.

Fig. 3.—Switch, showing Carriage Withdrawn and Cover Open.

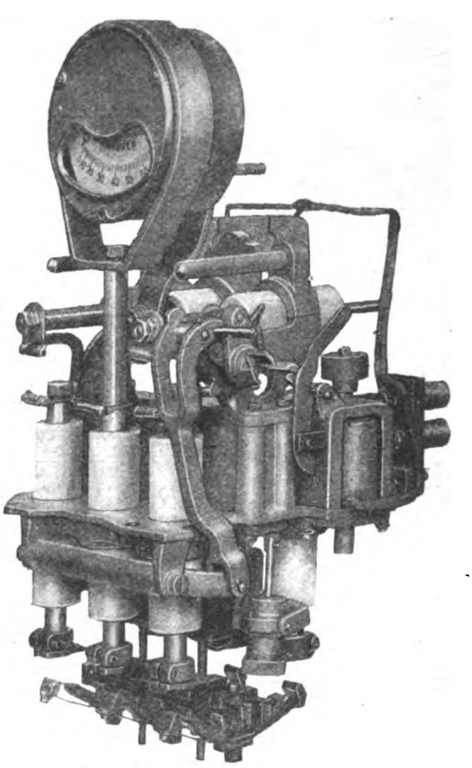

Fig. 4.—Switch Mechanism with Ammeter, Fuses, Low-voltage Release, and Slow-motion Starting Attachment.

B.T.H. Ironclad Switchgear.

Interlocks and catches are provided to ensure safety when withdrawing or inspecting the switch, and the latter is closed and opened through independent toggles and trips free of the handle. The tripping device is of the dash-pot type with a suitable delaying action.

The cable connecting boxes can be mounted on the top, bottom or sides of either size of switch, and suitable connections are provided for coupling up to the cable armouring or lead.

Continuity of the earth connection is ensured by the large flanged joints of the castings, but it is desirable, where necessary to meet Home Office requirements, to use the usual copper bonds between armouring of incoming and outgoing cables.

By means of the company's patent electrical interlock, these switches can be interlocked with motor starters and controllers, the connection being made by means of a flexible armoured conductor with a plug contact for insertion in the side of the oil switch.

Full particulars of these switches are contained in list No. 4,160.

Simplex Dimmer Fittings.

Messrs. Simplex Conduits, Ltd, of 116, Charing Cross Road, W.C., are now supplying a line of fittings in which a dimming effect is not obtained by the insertion of resistance in series with the lamps, and consequent waste of current.

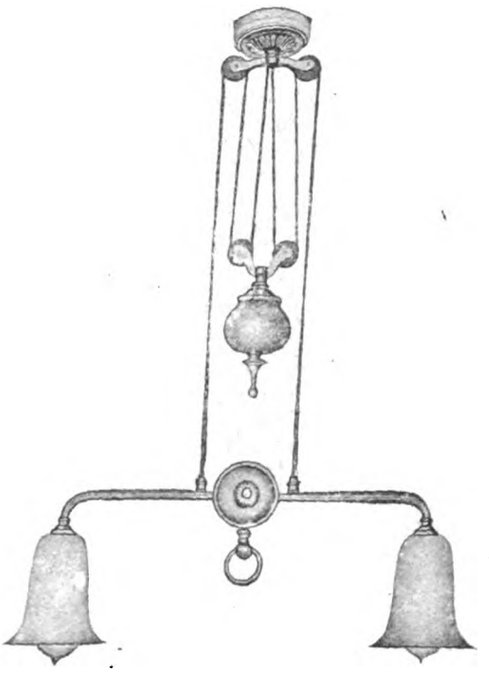

Fig. 1.—Simplex Pendant with Dimming Switch.

In the pendant shown in fig. 1, a patent switch is fitted in the body, by means of which it is possible to have (1) both lamps on full; (2) one lamp on full; (3) both lamps dim; (4) both lamps off.

The current consumption is in direct proportion to the light emitted at any time.

These fittings are supplied in brass or copper, polished or bronzed, in the pendant or wall patterns.

Copes Feed-Water Regulator.

The above-named regulator for boiler feed-water, which has achieved a considerable success in the United States, is now being introduced to this country by Messrs. Scholey & Co., Ltd, of Queen Victoria Street, E.C., who have acquired the English rights. A notable feature of the device is that it is based upon the principle

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of a variable water level, the latter being maintained at the upper limit during light load periods, so that the boiler stores the maximum amount of water and heat, and the level being allowed to fall, when a heavy load comes on, to the lower limit. Thus, when the demand for steam is pressing, the heat of the furnace is utilised only for evaporating water, and not for heating cold feed. When the water level reaches the prescribed lower limit, the regulator increases the rate of feed until it is equal to the rate of evaporation, thus maintaining the water level.

The regulator, which is shown in fig. 5, is entirely outside the boiler, and consists of an inclined special metal expansion tube supported by heavy angle-iron base and an upright fork so as to form a triangle. The upright fork acts as a fulcrum for a bell-crank lever, which magnifies the motion of the expansion tube. Openings are provided in the fittings at the ends of the tube for the pipe connections to the boiler. Two stiff braces with a triangle base to the expansion tube strengthen the latter and prevent buckling. The lever of the thermostat is connected by a vertical chain or a stiff strut to the lever of a control valve of the balanced type. It will be seen, therefore, that the regulator is of the thermostatic tube type.

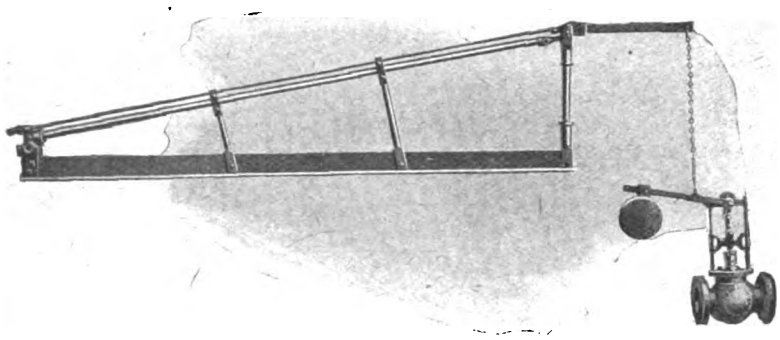

Fig. 5.—Copes Feed-water Regulator.

Previously all such types of instrument have sought to maintain constant water level, which the makers of the Cope's regulator consider to be entirely wrong from the point of view of a variable load.

Fig. 6 diagrammatically represents the arrangement of the regulator. The maximum and minimum heights at which it is deemed safe to carry the water levels are first decided upon, and then the thermostat is installed with sufficient slope so that when the water level is at its minimum height there is no water in the expansion tube, and when the level is at the maximum height, the tube is filled with water. When in service the level is between these extremes, and the expansion tube is partially filled with

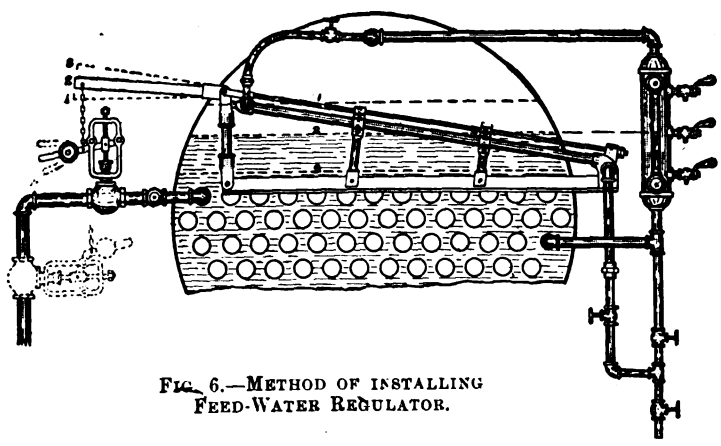

Fig. 6.—Method of installing Feed-Water Regulator.

water. The level in the tube fluctuates with the level in the boiler. The part of the expansion tube filled with steam is maintained at the temperature of the steam, since as fast as it radiates heat it causes condensation and the liberation of latent heat at steam temperature.

On the other hand, the lower part of the thermostat is at some temperature below steam temperature, since the radiation of heat from this part of the tube can only take place at the expense of the sensible heat of the water. When the water is at its minimum level and the thermostat is filled with steam, the metal is at the highest temperature, and expands to its greatest length; when it is filled with water it contracts to its shortest length. This length, and the feed valve opening operated thereby, thus varies with the amount of water in the tube and the height of the water in the boiler.

When an increased load comes on, the first thing that happens is a slight drop in steam pressure, accompanied by a more rapid liberation of steam from the entire body of water within the boiler, which causes a corresponding increase in its volume, and a rise in the boiler water level. This at once slightly raises the level of the water in the expansion tube, decreases its temperature and causes it to shorten, decreasing the rate of feed to the boiler.

As the heavy load continues, the evaporation of water causes the level to drop, and this in turn causes expansion of the thermostat and gradual opening of the feed valve. The level in the boiler drops and the feed valve opens until a point is reached where the rate of feed equals the rate of evaporation and equilibrium is restored, the water being at a new level. In the case of a decrease in load the converse takes place.

Every load on the boiler has some corresponding proper water level which the regulator maintains.

"Comfy" Electric Fire.

The Attracta Electrical Co., of 75, Fetter Lane, E.C., have introduced an electric fire for use in small rooms, offices, &c., which is shown in fig. 7. This consists of a polished copper case

Fig. 7.—The "Comfy" Electric Fire.

with a 500-watt rod heating element arranged horizontally in the best position for radiating the heat rays. This apparatus is portable and can be used from a lampholder; a larger size containing two such elements is also supplied.

Carron Cooking Apparatus.

Through the courtesy of the Carron Co., of Carron, N.B., we are able to illustrate some recent examples of electric cooking apparatus introduced by them.

Grillers and toasters for hotel and restaurant use are supplied in five different sizes, and can be built up in sets of two or three

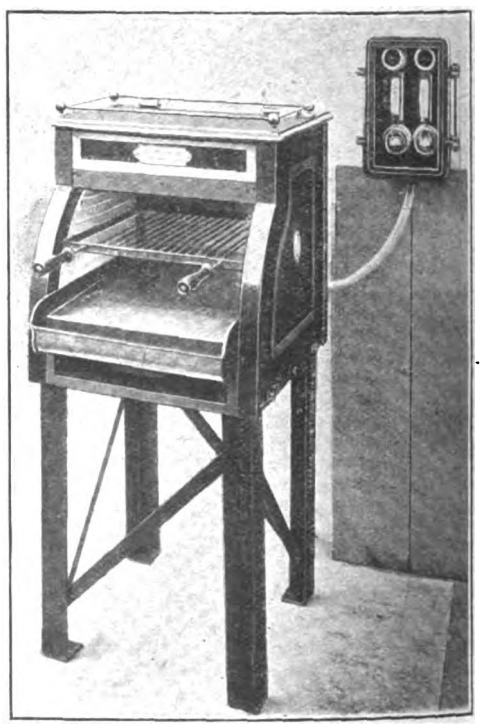

Fig. 8.—Ship's Electric Grill.

when required. The smallest size is loaded up to 5 kw., and fitted with indicating switch control for various temperatures.

A development of this type specially designed for use on ships, where strength and utility are of prime importance, is shown in fig. 8.

This apparatus is built up of heavy steel plates and the connections are carried to the switches, fuses and pilot lights, which are enclosed in a special cast-iron water-tight box. The latter is white porcelain enamelled throughout, and fitted with a substantial

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glass door. The gravy tin and well are of copper, well tinned. Standard Carron heating elements are fitted, and the griller shown is loaded to 5 KW.

Fig. 9 shows a double oven range, in which type four sizes of ovens are available.

The loading of the ovens ranges from 3,000 to 3,500 watts; four hot plates are fitted—a 6-in. (500 watts), two 8-in. (1,000 watts),

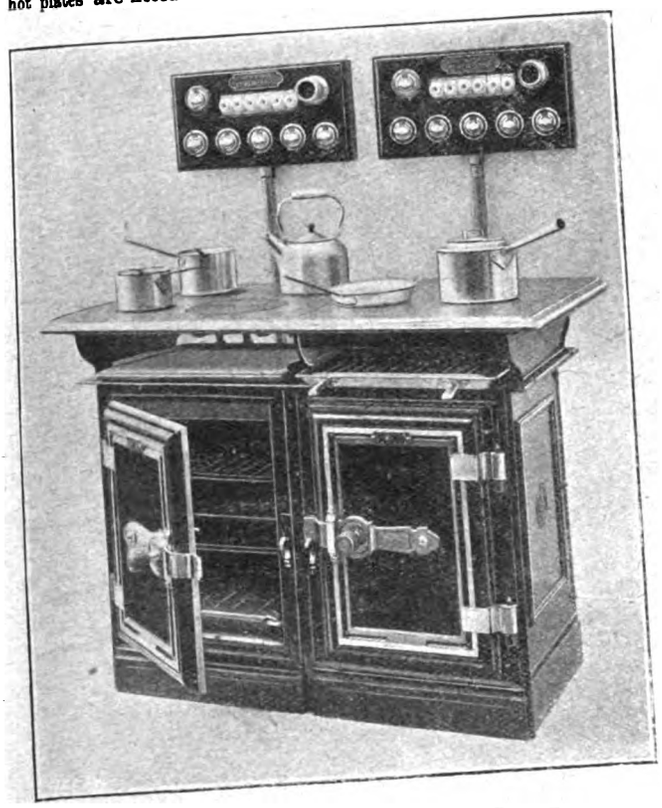

Fig. 9.—Double Electric Oven Range.

and a 10-in. (1,600 watts), also a 22 in. × 14-in. grill (3,000 watts). All the heating elements are separately controlled by special indicating switches giving various degrees of temperature, and each circuit is supplied through a Zed fuse and pilot light, all of which are mounted on a separate switchboard.

A further view, fig. 10, shows a hot closet and carving table with a polished top and copper water bath underneath the hob, fitted with a draw-off cock.

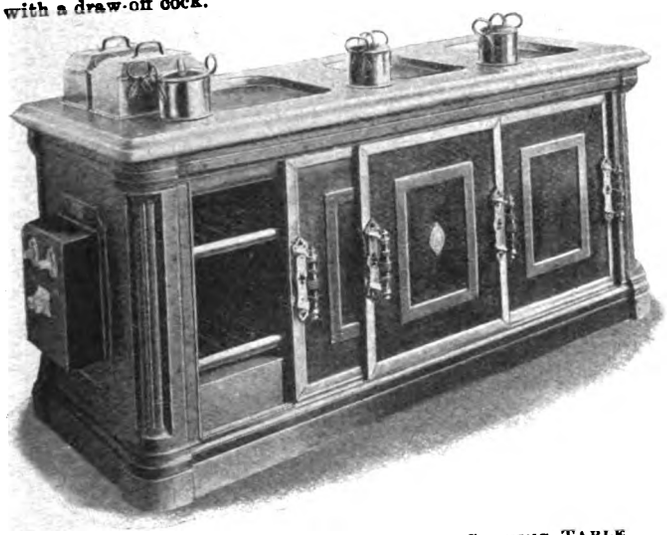

Fig. 10.—Electric Hot-Closet and Carving Table.

The hob is fitted with three carving recesses, also gravy wells and vegetable warmers, these being made of heavy-gauge copper, tinned inside.

Sliding doors are provided to the cupboard, which is fitted with adjustable grid shelves, and top and bottom are independently heated and controlled.

The maximum loading, 7·5 KW., can be reduced to 750 watts.

"Woolwich" Tape (Improved Type).

Messrs. Siemens Brothers & Co., Ltd., Woolwich, London, S.E., are placing an improved type of "Woolwich" tape on the market, superseding the "Woolwich" tape which for a number of years has been widely used. The improved type is manufactured of a very fine quality fabric entirely free from pinholes, and is expected to give even more satisfaction than the old type. Samples will be forwarded to electrical contractors on request.

LEGAL.

Nottingham Corporation v. H. W. Cox.

At Nottingham County Court on October 28th, before Judge Allen, an action was heard in which the Nottingham Corporation sued Mr. H. W. Cox, of Park Row, claiming 9s. 6d. as the cost of a terminal box and an electric line at defendant's house.

Mr. J. Williams (Town Clerk's department) was for the plaintiffs, and Mr. A. M. Bramall (London) defended.

On behalf of the Corporation, Mr. Williams said they based their claim on the Nottingham Electric Lighting Order, 1900. It was not a question of the amount, he explained, but of the principle involved.

Mr. H. J. Talbot, the Corporation's electrical engineer, said the charges had been paid by all consumers hitherto.

Mr. Bramall's case was that the terminal box was to prevent excess of supply, and for the protection of the mains, and not of the consumer. He urged that the consumer should not have to pay for its installation, and that Nottingham was the only large town in the country which made such a charge.

His Honour reserved judgment.

The Attorney-General at the relation of Long Eaton Gas Co. v. Long Eaton Urban District Council.

This case came before the Court of Appeal, composed of the Master of the Rolls and Lords Justices Kennedy and Swinfen Eady on Thursday, October 29th, upon the appeal of the defendants from a judgment of Mr. Justice Sargant in the Chancery Division, the question raised being whether local authorities, companies and persons authorised to supply electricity had power to give preferences to some of their customers.

By the action the Attorney-General, on the relation of the Gas Co, sought an injunction to restrain an alleged breach by the defendant Council of the provisions of Secs. 19 and 20 of the Electric Lighting Act, 1882. The case was fully reported in our columns, and the judgment was published in our issue on May 22nd, 1914.

That which gave rise to the present proceedings was a circular issued by the Council in September, 1911, which stated that the Committee recommended "that the present scale of charges remain in force where power and lighting are both taken exclusively from the Council's electricity mains, but in cases where electricity supply is taken for power only, or for power and partial lighting, the lowest scale of charges where the number of units consumed during any quarter exceeds 4,000 shall be 1d. per unit, and otherwise according to the existing scale. Such amended charge to commence January 1st, 1912."

It was alleged that the differentiation expressed in this circular was a breach of Secs. 19 and 20 of the Electric Lighting Act, 1882. Mr. Justice Sargant held that there had been a breach of both sections, and that the plaintiff was entitled to a declaration accordingly, with liberty to apply for an injunction if necessary. Hence the present appeal of the Council.

Mr. Vesey Knox, K.C., Mr. Martelli, K.C., and Mr. Courthorpe Munroe appeared for the appellants; and Mr. Mark Romer, K.C., and Mr. Percy Wheeler for the respondents.

Mr. Vesey Knox said that the case raised a very important question as to the interpretation of Secs. 19 and 20 of the Electric Lighting Act, 1882, which dealt with equality and undue preference.

Putting it roughly, the short point was this:—The Council and the electricity undertaking had in force a tariff according to which larger factories were supplied at the price of ¾d. per unit for power, and, roughly, 3d. per unit for energy used for lighting those factories — that was reducible in certain circumstances. The Council decided that after a certain date factories not wholly lighted by electricity should pay 1d. instead of ¾d. for power. The action was brought by the Attorney-General on the relation of the gas company, and not on the relation of any consumer who had suffered from the undue preference. It had been decided by the learned Judge that this was contrary to the provisions of the Electric Lighting Acts.

In the course of his judgment, the learned Judge said this:—"It would seem that A must not be charged less than B, merely to overcome a greater reluctance on the part of A to become a customer, or to induce A to become a customer in respect of another supply, although either of these reasons might be a good commercial reason for charging less to A were the public undertakers merely carrying on any ordinary commercial business. On the other hand, any circumstances which render it less costly or otherwise more profitable to supply A than B constitute a legitimate reason for making a lower charge to A for the same supply. And if the Court once came to the conclusion that some such circumstance existed then proof would not be required that the diminution in the charge was precisely equivalent to the diminution in the cost of the supply."

Mr. Justice Sargant's judgment, said the learned Counsel, was regarded throughout the country by electrical undertakers with consternation, and if the law was as was laid down by his Lordship, the law must be altered, as otherwise electric supply could not be continued. A second consideration which he thought the learned Judge had overlooked was, that this business was an extremely competitive one, and was very difficult to get. The appellants had the gas company competing with them for the supply of light, and in a less degree for power. Then, in the case of power, there was a competition with steam, and in that particular district a large number of manufacturers gave up steam

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and took electricity. Those were things which could not be overlooked in connection with the supply of electricity, and if they were overlooked the result would be bankruptcy.

Continuing, Mr. Vesey Knox said he did not shirk from justifying the circular as a whole, but the question was whether anyone had been unduly preferred.

The Master of the Rolls: You must stand or fall by the circular.

Mr. Vesey Knox: I say in considering whether a preference is due or undue any commercial reason is a circumstance to be considered. The point of the judgment of Mr. Justice Sargant is that you are not to take competition into account at all.

Lord Justice Swinfen Eady: In your circular you say: We supply current to two persons under exactly the same conditions subject duly to this—that one of the two is a man who works a gas engine; we will charge him more. Is the fact that one customer has a gas engine a reason why you should charge him more than anyone else?

Mr. Vesey Knox did not contend that there might not be cases of hardship. But what the Council did in the hard cases was not to enforce their circular.

Lord Justice Swinfen Eady: Is that difference not illegal?

Mr. Vesey Knox submitted not. In making rules you had to regard all the customers that would be profitable to the undertaking having regard to the difficulty of getting contracts. He submitted that the appeal ought to be allowed.

Mr. Martelli having followed on the same side, their Lordships, without calling on the other side, dismissed the appeal.

The Master of the Rolls said: This is an appeal from the judgment of Mr. Justice Sargant, who has made a declaration that the defendants, in making the differentiation referred to in the circular of September 25th, 1911, were acting in breach of the Electric Lighting Act of 1882. Before going further I wish to deal with one point Mr. Martelli raised. He says the error the circular made we never have acted upon. That seems to me to be an absolutely irrelevant remark. If a man threatens and intends to do something, and asserts the right to do it, the Court will grant an injunction to restrain him. It is irrelevant to consider whether he has, or has not, done it. The Long Eaton Urban Council on September 25th, 1911, issued the circular complained of. By their defence they say it was quite right, and I cannot listen for a moment to the suggestion that though the circular was wrong the declaration was improper, because they, in fact, have chosen not to enforce it. They had no right to threaten, and intend to do that which the circular states, if the circular is wrong. As to whether the circular is right or wrong I have difficulty in treating the matter seriously. It seems so plainly wrong that I am not going to waste words on it. The Judge has decided that in making the differentiation the Council are acting in breach of Secs. 19 and 20. In my opinion it is impossible seriously to doubt that that declaration is perfectly correct. In my opinion it is right, and this appeal must be dismissed, with costs.

Lord Justice Kennedy: I am entirely of the same opinion.

Lord Justice Swinfen Eady: I agree.

Smoke Nuisance.

At the Manchester City Police Court on October 28th, Messrs. Connolly Bros., cable manufacturers, of Blackley, were fined £5 and costs for neglecting to comply with an order made upon them to abate a nuisance caused by the emission of black smoke. A representative of the firm said they were at work every week-end trying to minimise the trouble, had experts on the work, and were getting new machinery and carrying out other improvements.

Herbert Morris, Ltd., v. Saxelby.

In the Chancery Division on Friday, October 30th, Mr. Justice Sargant delivered his reserved judgment in this action, which was brought by Herbert Morris, Ltd., of Loughborough, for an injunction to restrain an alleged breach of covenants in a service agreement made between the parties. The case was argued by Mr. Walter, K.C., and Mr. Kerly K.C., for the plaintiffs, and Mr. Mark Romer, K.C., and Mr. Sheldon for the defendant, and was reported in the Electrical Review, October 23rd, page 553.

His Lordship, in delivering judgment, said that by the action the plaintiffs sought to restrain the defendant, a former servant, from selling, manufacturing, or dealing in, either by himself, or in conjunction with, or as servant or agent of any other person, any pulley blocks, overhead runs, electric overhead runs, overhead tramways or overhead cranes, and from using or disclosing any confidential information he might have obtained while in the plaintiffs' employ. There was no evidence to show that the defendant had committed any breach of any obligation not to disclose confidential information, and, in fact, the plaintiffs at the trial offered none and abandoned that part of their case. The plaintiffs were very successful makers of the class of goods mentioned, and, in fact, such manufacture formed about three-quarters of their whole business. For it they had a special class of machinery, and the trade extended all over the United Kingdom. They had branches at London, Manchester, Birmingham, Sheffield, Newcastle, and Glasgow, and offices in other towns. They had a very thorough organisation of their business both from a manufacturing and commercial standpoint. They had arranged in a careful systematic manner a number of cards showing the strength and elasticity of metals and a mass of technical knowledge useful for this particular branch of their business, and also carefully tabulated information as to the requirements of their customers and of probable customers. All these cards were shown from time to time to their employés, but care was taken that they should be returned, and he did not think it was possible for any employé to carry the detailed information away in his head. The only knowledge that could be retained would be the general principle of this elaborate scheme. The defendant, who was now 29 years of age, when between 15 and 16 entered the plaintiffs' employment as draughtsman, and before he was 21 had obtained the position of leading draughtsman. He had been engaged in connection with overhead travellers, but up to that time had had nothing to do with electric overhead runways. His salary then was 50s. a week, and on attaining 21 he entered into an agreement dated July 16th, 1906, containing covenants similar to those sued except that it did not mention electric overhead runways. He went to manage a branch the plaintiffs then had at Cardiff, and remained there until February, 1909, when he went to the London branch and took part in the selling. In 1910 he left London to take charge of the selling department at Loughboro', where he remained until he left the plaintiffs' employ in April, 1913. On March 17th, 1911, he entered into the agreement sued upon. Under this his salary was to be £3 a week, and his engagement was for two years certain. The prohibitive clauses of that agreement upon which the present action was brought were as follows:—

Clause 6.—The employé shall not, during the continuance of the agreement, divulge to any person or persons any information received or obtained by him while in the company's employ, and any drawings, orders, &c., obtained by him shall be the exclusive property of the employer.

Clause 7.—He will not, during a period of seven years from his ceasing to be employed by the company within the United Kingdom, Great Britain and Ireland, either alone, or jointly with any other person or persons, be engaged in the sale or manufacture of pulley blocks, overhead runs, electric overhead runs, overhead travelling cranes, or any parts thereof.

In March, 1913, the defendant being unable to obtain such an advance in his salary as he considered adequate, went to France, and entered into the employment of a French firm, who were the plaintiffs' French agents. The defendant could honestly employ his trade to the best advantage within the terms of his agreement, and he could not find that he had gone further than to use for the French firm the qualifications he had acquired from the business training he had received from the plaintiffs. He, however, did not find his surroundings congenial, and left in 1914. In March of that year he took employment with Messrs. Vaughan, who did sell some of the articles mentioned in the agreement. This, of course, was a clear breach of the covenant, but the defence was that the covenants were unreasonable and in restraint of trade. From the point of view of the employer, he (the Judge) was not prepared to say that they were unreasonable. He thought that competition in any part of the United Kingdom might result to the disadvantage of the plaintiffs. On the other hand, he had to consider the matter from the point of view of the public. It was of importance to consider that this restraint was practically universal, and it was for a considerable period, a period of seven years. It was practically for all the defendant's life, because for seven years he would have to earn his living at some other business, and he could not hope after that lapse of time to return with any success to his original employment. He (the Judge) was satisfied that if the injunction was granted as asked, the public would be deprived of the amount of application to business, skill and experience the defendant had acquired in the course of his training at the plaintiffs' works. He would have to make a start in a fresh kind of business, but his efficiency and power of earning must be materially impaired. It was necessary for the Court, therefore, to consider the kind of knowledge that the defendant had acquired from the plaintiffs. He had not acquired any private connection with the customers of the plaintiffs, and no damage to the plaintiff company could be put on any ground of that kind. Any damage to them must be due to the severe competition in this kind of business. A most material point was that the defendant had been called upon to sign an agreement before he was 21, when his experience was merely that of a draughtsman, and when he had had no connection with the commercial side of the business. For the plaintiffs to deprive the defendant from earning his living by the work for which he had been specially trained for a period of seven years was pushing their policy of preventing competition to an unreasonable extent, and the covenants were therefore bad. The action must accordingly be dismissed with costs.

Torpoint U.D.C. v. Torpoint Electric Supply Co., Ltd.

The arbitrator appointed to settle this dispute has given his award against the company on all points submitted to him, and ordered the company to pay the costs. The dispute was chiefly concerning two clauses in an agreement of April 2nd between the company and the Council for the supply of electric light, stipulating that the company should submit plans for the approval of the Council, and that if the light were not supplied by September 30th the agreement should be at an end, and the company should pay the Council £100 by way of damages.

Moreland & Son, Ltd., v. Bosch Magneto Co., Ltd.

In the King's Bench Division on October 30th Mr. Justice Rowlatt concluded, after four days' hearing, an action brought by Richard Moreland & Son, Ltd., builders, of 80, Goswell Place, against the Bosch Magneto Co., Ltd., of 40 and 42, Newman Street, Oxford Street, in which the plaintiffs claimed £2,639 13s. 2d., for work done and materials supplied. The case raised questions between the building owner, the builder and special tradesmen.

Many witnesses were called on both sides, and in the result his Lordship gave judgment for the defendants.

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Baillie v. Oriental Telephone and Electric Co., Ltd.

In the Chancery Division on Tuesday, Mr. Justice Astbury heard a motion on behalf of J. R. Baillie, against the defendants for an injunction to restrain the company and four of the directors from paying to themselves an increased remuneration as directors of another company called the Telephone Co. of Egypt, Ltd.

Mr. Frank Russell, K.C., who appeared with Mr. H. E. Wright for the plaintiff company, said the motion was to restrain the defendants paying a certain remuneration in excess of a total sum of £800 a year, and from otherwise acting on two special resolutions passed at an extraordinary special meeting of the company held in July this year. The defendant company held a large block of shares in the Telephone Co. of Egypt, Ltd., and four of the five directors of the defendant company were sole directors of the other company. On June 15th, 1914, a notice was issued convening a meeting of this company. It was called to ratify certain votes given by the directors increasing their remuneration of the other company. The meeting was held on June 24th, and there were present only 15 to 20 shareholders. No statement was made at the meeting as to what the remuneration was which these people had been getting, and when the chairman was asked about that, all that he replied was, that they had sufficient proxies to carry the resolution. The resolution was then put to the meeting, and carried.

Sir Chas. McNaghten, K.C., for the defendants: That statement is contradicted.

Mr. Russell said a confirmatory meeting was held on July 15th, at which six shareholders were present. Again the amount involved was not disclosed. The plaintiff protested, but again the proxies came rolling up, and the resolution was carried. Counsel went on to state that the directors had actually drawn a sum of £44,876 out of this company, and, in addition, they had a little nest-egg of undrawn remuneration of £7,100. The plaintiff's case was that the notice convening the meeting was insufficient and misleading, and therefore the resolution was not duly carried.

Sir Chas. McNaghten took the point that an individual shareholder could not maintain an action without the defendant company being made co-plaintiff.

His Lordship sustained this point, adding that the plaintiff was not entitled to maintain the action without joining the company as plaintiff. The motion, therefore, failed.

Beck Engineering Co. v. The Foster Engineering Co.

On Tuesday, Mr. Justice Eve, sitting in the Chancery Division, heard an adjourned summons in this action. The proceedings, said Counsel, were taken at the instance of the plaintiff company to raise a question on the terms of an agreement for the supply of about 250,000 carbons for use in the Beck flame electric arc lamp, of which the plaintiff company held the letters patent. The carbons were at present in charge of a Receiver appointed by the Court. Plaintiffs and defendants were parties to an agreement that the defendant company should, as agent of a German manufacturer, supply the carbons at a stipulated price which was set out on the agreement. On the declaration of war the question arose between the parties as to the price at which the carbons should be sold by defendants to plaintiffs, and failing an agreement, the matter was taken before Mr. Justice Sankey, who appointed a Receiver of the goods. The plaintiffs now contended that they were entitled to be supplied with the carbons at the rate current during the last six years, while the defendants argued that they were only entitled to be called on to sell the carbons at the current price. Having regard to the fact that the war was in progress and practically all the carbons were manufactured in Germany, the price had gone up about 50 per cent.

After some discussion, the matter was allowed to stand over for an early date to be fixed for the trial of the action.

A question was also raised on a further summons whether an order made by the Master in Chambers should be reversed. The Master had directed the Receiver to sell to the Lancashire and Yorkshire Railway Co. 4,000 sets of carbons as part of an agreement between the parties. It had been arranged, said Counsel, that the railway company should be supplied with carbons at a price which was a considerable advance on that ruling before the war. After consultation it was arranged that half the quantity should be supplied to the railway company, the residue to remain with the Receiver until after the trial of the action.

McDonald v. Fyfe, Wilson & Co.

In the Court of Session, Edinburgh, the action has been settled in which plaintiff, of Leith, sued defendants, wholesale electrical agents, of Glasgow, for £105 12s. for alleged breach of contract. Pursuer is lessee of the Drill Hall Picture House, Loanhead, and he entered into a contract with the defenders for the hire of certain electrical plant in connection with the picture house. The machinery was to be delivered on August 22nd, 1913. On this date the pursuer paid the first instalment of hire, but the plant was not then delivered. A temporary set was delivered on August 29th, but the complete set was not delivered until September 10th. Lord Anderson, before whom the case came, had held that the defenders had broken their contract, and he allowed a proof as to the amount of damages due to pursuer. On Friday his Lordship was informed of the settlement, a joint minute being put in. It is understood that the defenders have made a payment of £40 and expenses to the pursuer in settlement of his claim.

WAR ITEMS.

Board of Trade Reports.—In connection with the Board of Trade campaign and the large number of inquiries received for names of sellers or buyers of articles, of which the sources of supply or markets have been interfered with by the war, the Commercial Intelligence Branch has prepared lists of articles which inquirers desire (*a*) to purchase and (*b*) to sell. The third list, in which is incorporated the first and second lists, was published on October 14th; the fourth list, which is a supplement to the third list, is now ready, and may be obtained, together with copies of the third list, on application to the Branch.

No. 86 of the special series of campaign pamphlets issued by the Board of Trade deals with Germany's textile machinery exports. Report No. 87 relates to sanitary ware.

Government Assistance.—The Chairman of the Birmingham Chamber of Commerce said last week that trade was much better than might have been expected. Government work was assisting very much, but there was a great deal being done outside that. Many articles previously made in Germany and Austria were now being made in Birmingham. The question of the best way of ensuring continuity of that trade had been under consideration, and the Government might be asked to step in and assist in some form. In due course some recommendation would be made to Government.—*Times.*

The Birmingham Chamber of Commerce has approved a proposal to the Government in favour of advances being made to British traders on the security of approved foreign debts, pending the restoration of normal conditions in the foreign exchanges, so far as neutral countries and the Allies are concerned, and the termination of the war so far as Germany and Austria are concerned. Such arrangement is stated to be urgently needed to facilitate the operations of merchants and manufacturers in meeting the demands they are now getting from colonial and neutral countries owing to practical cessation of the German and Austrian export trade.—*Financial Times.*

The Treasury announces that a committee, consisting of representatives of the Treasury, the Bank of England, the joint stock banks, and the Association of Chambers of Commerce of the United Kingdom, has been formed, to whom is delegated the authorisation of advances in approved cases to British traders carrying on an export business in respect of debts outstanding in foreign countries and the Colonies, including unpaid foreign and Colonial acceptances, which cannot be collected for the time being.—*Times*

Oldham Council and its Contracts.—Another discussion on trading with firms having German capital took place at a meeting of the Oldham Town Council on October 28th. Councillor Dixon said he believed inquiries which had been made regarding the Tudor Accumulator Co., Ltd., had shown that out of £50,000 capital, £47,000 was German. If he was correct in that, he hoped that the Corporation would not go on with their contract with that firm. He was one of those who believed that every penny paid to the Germans now was an extra bullet to shoot our soldiers. Councillor Hardman (chairman of the Electricity Committee) said that it was true that £47,800 of the £50,000 capital in the firm mentioned was held in Germany. Steps were being taken by his Committee regarding the matter, and he was in communication with the Board of Trade with regard to the accounts which ought to be paid to the firm. Alderman Greaves asked whether the Corporation had a right to withhold payment of the accounts, and said he had understood the Town Clerk to say they had. The Town Clerk said he had not advised that payment could be refused. These firms were not alien enemies. A writ had been issued against the Corporation in a case which was referred to at the last meeting. Councillor Frith and Councillor Stanbury expressed the hope that contracts would not be entered into with firms that had a German appearance. Answering Councillor Low, Alderman Isherwood said he was willing to take back the account referred to. Further discussion took place upon the Town Clerk's statement, and the Town Clerk said there might be good reason for the Corporation not entering into any new contracts with a firm of this sort, but as a matter of law the Corporation had had the goods and they would have to pay for them. The money, he added, was not going to Germany. Alderman Isherwood, in closing the discussion, said he proposed to hold the account back until there had been some definite ruling given. With regard to another account held back at the last meeting, the Corporation had received a writ for the money, and until the point was decided he did not propose to pay any of the accounts.

Birmingham Electricity Department Employees.—According to a Birmingham paper, 147 of the staff and workmen of the Birmingham electricity supply department, out of a total of 645, were on active service. Allowances were being made to them in accordance with a resolution of the City Council. The total amount paid at the present time was at the rate of £4,500 per annum. A certain number of temporary men had been taken on to replace those who had gone, and, with a few transfers of labour from one section to another, the work of the department was being carried on satisfactorily.

London Electric Firm.—This Croydon firm asks us to state that it is entirely British in its proprietorship, capital, staff, workmen, and the whole of the materials entering into its manufactures. A number of the staff and workpeople have joined the Services, whilst all remaining eligible ones are being urged to do so, with the assurance that their posts will be kept open for them, and half pay made during the period of the war.

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CONTRABAND OF WAR.—In a new Proclamation dated October 29th the following articles are included :—

Schedule 1.—Absolute Contraband—

Sulphuric acid.
Range-finders and their distinctive component parts.
Hæmatite iron ore and hæmatite pig-iron.
Iron pyrites.
Nickel ore and nickel.
Ferrochrome and chrome ore.
Copper, unwrought.
Lead, pig, sheet, or pipe.
Aluminium.
Ferro-silica.
Barbed wire, and implements for fixing and cutting the same.
Motor vehicles of all kinds and their component parts.
Motor tires : rubber.
Mineral oils and motor spirit, except lubricating oils.

Schedule 2.—Conditional Contraband—

Railway materials, both fixed and rolling stock, and materials for telegraphs, wireless telegraphs, and telephones.
Fuel, other than mineral oils. Lubricants.
Field glasses, telescopes, chronometers, and all kinds of nautical instruments.

The Amsterdam correspondent of the *Times* says that the latest lists of conditional contraband issued by the Netherlands Government contain the following :—On the French side—Iron, steel, oxide of iron, sulphate of iron, carbonate of iron, copper, lead, nickel, ferrochrome, glycerine, hides, leather, inside and outside motor tires and material of which the tires are made. On the German side—Crude copper, block lead, lead plates, and lead tubes.

The *Times* correspondent at Ottawa says that the Canadian Government has passed an order prohibiting the export of nickel ore to Europe, except to Great Britain. The export to the United States is permitted, but under regulations forbidding its use for manufactures for Germany or Austria.

NATIONAL DEFENCE.—At a meeting of the Naval and Military Defence Standing Committee of the London Chamber of Commerce resolutions were adopted urging upon the business community the importance of continuing until the end of the war to assist by every means in their power the enrolment for the war of further recruits for Lord Kitchener's army, in view of the vital attack against the security and existence of the Empire, and having regard to the need for strengthening home defences, strongly supporting the movement initiated in connection with the Central Association of Volunteer Training Corps for enabling the civil population to gain instruction in drilling and the use of arms.

THE TRADE WAR.—A report has been adopted by the Manufacturers' Section of the London Chamber of Commerce relating to competition with German and Austro-Hungarian trade. A considerable amount of information has been collected on this subject relating to a very large number of industries and a number of constructive and critical suggestions have been received from manufacturers and from merchants. In cases where manufacturers have intimated that they are open to manufacture new articles hitherto largely imported from Germany and Austria they have been put into touch with merchants and inquirers for such commodities through the Statistical and Information Department of the Chamber. One of the appendices to the report, which has been sent to the Local Government Board, shows that as a result of the dislocation of business caused by the European war and the abnormal conditions of trade, there has been a general and substantial decrease in the manufacturing industries and only a very small increase in certain special trades, but, on the other hand, the number of cases in which business is practically suspended is infinitesimal. Naturally, unemployment has resulted to some extent, and the number of employés joining the Colours has not quite counterbalanced the decrease in employment. In a large percentage of cases supplies of raw material which has previously come from abroad could be obtained in this country or from new sources, and so far as can be ascertained no very great difficulty has been experienced in connection with transport by rail, road or sea. Industry has been very largely affected by the financial conditions and the reduction in orders both from abroad and from home, but it is not generally considered that orders at home have diminished as a result of the failure of credit but rather from other causes. Various suggestions have been made to assist trade, and special attention is called to the desirability of the bankers being induced to give greater financial facilities to employers of labour and others in connection with the development of existing manufactures and the establishment of new industries in order that the country may be in a position to take full advantage of the change in the economic conditions brought about by the war. The Emergency Committee of the Manufacturers' Section has been re-appointed to give effect to the suggestions relating to allotment of army contracts, code facilities for cable communications, the relaxation of excise duties on alcohol, Government assistance for firms having large uncollected assets due from belligerent and neutral countries, the re-establishment of foreign exchange operations on a satisfactory basis and the relaxation of the Factory Acts to allow for more elasticity in the hours and conditions of working arrangements.

B.T.H. RECRUITING.—The British Thomson-Houston Co., Ltd., of Rugby, has received the following telegram from its agents in Melbourne, the message having been dispatched upon reading a recent notice in our pages regarding recruiting at the B.T.-H. works :—"Congratulations your sending over 900 fighters to front. We are proud of them. God speed and victory!" We understand that the number of B.T.H. recruits is now considerably over 1,000.

LIVERPOOL CITY COUNCIL AND ITS CONTRACTS.—At a meeting of the Liverpool City Council, Mr. Gates moved the following motion of which he had given notice :—"That the Tramways and Electric Power and Lighting Committee cease all dealings with Thermit, Ltd., regardless of consideration for any legal question which such action may involve." He argued that they should view this question from the point of view of expediency, rather than from a business standpoint. The Tramways Committee had been too much obsessed with the sense of their legal responsibility. He was asking the Council to relieve them of that responsibility, and to say that this trading with the Germans should cease. Alderman Smith said he would readily vote for the motion if Mr. Gates would take the risk. He emphasised that they were not trading with Germans, but with a company which, by the law of England, was registered as an English company and endowed with an English patent. He, for one, was not going to act foolishly by giving any company largely owned by Germans a right to damages which the Corporation could not resist. Mr. J. L. Rankin moved the following amendment, which, he thought, would carry out what Mr. Gates desired :—"That the balance of the order with Thermit, Ltd., be immediately cancelled, and also that the contract with Tudor Accumulator Co. be terminated forthwith." The Town Clerk, replying to a question, said that whilst the contract with the Tudor Co. was finished, they were under an obligation to the Corporation to maintain the work in connection with the joints for a period of 12 months. Alderman Smith said that surely the Corporation was never going to place itself in the position of relieving this firm of their responsibility for maintaining the work to the extent of £700. That would be so according to the terms of the amendment. Mr. Rankin's amendment was carried by 47 votes to 6, and on the amendment being put as a substantive motion it was agreed to.

BRITISH FIRMS AND GERMAN AGENTS IN CHINA.—The *Times* correspondent at Pekin states that the practice of some important British firms of confiding their representation in China to German firms is now bearing bitter fruit. The Chinese Government is declining to recognise newly-appointed British agents as qualified to receive or deal with payments in respect of contracts entered into through German houses. The correspondent says that : "The British Government would render a service by officially notifying the Chinese Government that German agencies of British firms have ceased, and that therefore no communications on behalf of British firms should be addressed to German agents."

Mr. W. Brayton Slater writes to us as follows :—"Manufacturers in this country should overhaul their agencies abroad, especially in the Far East, to make sure they are not being represented by Germans. Several manufacturers—including a big British armaments house—have for long been represented by Germans in China, and to-day they are decidedly, and most people will say deservedly, at a disadvantage. The Official British representatives are enforcing the prohibition against trading with the enemy in all British Colonies and settlements, and in Hong Kong and the treaty ports of China this is seriously interfering with the business of German firms. Some of them have taken temporary shelter under British names, but that device will not serve for long.

"There are numbers of reliable British or Chinese firms ready to handle any goods suitable for the market, provided their activities are adequately supported by the British manufacturer in a market that requires careful study, but which will be second to none in the world if developed with energy and intelligence."

MARYLEBONE MEN.—The Marylebone electricity supply department is represented in the National Services by the following—53 all told :—

Generating Station.—Messrs. — Batten, A. Baynton, J. Butler, F. Gates, B. Hartopp, J. W. Wood, A. P. Grover.

Mains Department.—Messrs. — Angell, E. G. Baker, A. Baxter, F. Boyall, — Curtis, J. M. Day, W. Higgins, H. Huggins, W. Leary, F. H. Noyes, A. L. Oliver, — Percy, E. V. Scammell, — Springall, A. W. Turner, — Ward, H. C. Winterford, J. P. Cleary, W. F. Gregory, A. G. Marshall, N. Bainfather.

Sales and Publicity Department.—Messrs. A. Alcock, H. Bulley, S. J. Chidwick, R. A. Cooney, W. H. Cummins, E. C. Rix, W. Rolfe, C. J. Rummey, A. J. Snow, E. Bennion, F. S. Bailey, G. H. Taylor, J. Ford.

Head Office.—Messrs. C. G. Adams, J. Atwill, C. H. Beechey, A. H. Bowen, S. E. Butcher, L. M. Howlett, S. King, W. Murray, A. R. Rayner, A. J. Scott, G. Sell, S. P. Younge.

TRADE WITH RUSSIA.—H.M. Consul-General at Moscow reports that a firm in Ekaterinoslav desires to get into touch with manufacturers in the United Kingdom, or preferably their local agents, who can supply the following articles :—Electric motors and parts, lathes, drilling machines, wood-working machinery and benches, steam engines, materials for electrical installations, iron and steel implements and tools, belting, furnace bricks, tool steel compressors, Manila hemp ropes and steel ropes. Firms can obtain the name and address of the inquirer on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C., but they should address any further communications regarding the inquiry to the British Consulate-General, Moscow, furnishing the names of their local agents (if any).—*Board of Trade Journal.*

Mr. R. A. Lenski, of 114, Fenchurch Street, London, E.C., writes to say that one of the reasons why Russia imports so little from Great Britain is the difficulty experienced by Russian firms in learning the names of British manufacturers. He is preparing a directory of British manufacturers in the Russian language and wants to hear from firms who desire to export their goods to Russia

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Northampton Tramway Manager.—The controversy at Northampton over the retention of the tramway manager, Mr. J. Gottschalk, who is of German birth, was not quelled by his suspension and the voting of £300 as a solatium. Five of the candidates, representing the anti-Gottschalk faction, withdrew from the municipal contests at the last moment, as we stated last week, but Mr. W. Smith, who was selected for the Castle Ward, refused to do so. He stated in his election address that his sole object in forcing a contest was to give the electors "the opportunity of expressing their opinion on the Gottschalk question through the medium of the ballot box." Mr. Smith was returned by over 200 votes on Monday in preference to Mr. A. G. Whitlock, the old member, who voted for Mr. Gottschalk's retention.

Burnley Tramwaymen.—Some 103 employés of Burnley Corporation tramways have rejoined the Colours or enlisted since war broke out. This, it is stated, gives the biggest percentage of any tramway system in England. To each man, the manager, Mr. Hy. Mozley, has sent a letter and, in many cases, the soldiers have replied to them. In addition to allowances made to the men by the Corporation, the fellow workmen and friends have subscribed and provided each man with a pipe and tobacco.

German Contract re-let in England.—A contract for three pairs of new dock gates required by the North-Eastern Railway Co., in connection with new entrances at the Hartlepool docks, which was orginally placed with the Gutehoffnungshutte Coal, Iron, Steel and Engineering Co., of Oberhausen, Rhineland, has been rescinded, and the work has been re-let to Sir W. G. Armstrong, Whitworth & Co., Ltd., whilst the sluice and gate machinery will be supplied by the Hydraulic Engineering Co., Ltd.

Personal.—The Bispham U.D.C. has undertaken to make up the difference between the army pay and the full salary of Mr. George Ollier, assistant electrical engineer, who is now serving with the Royal Engineers.

Private T. E. King, of 3, Greenwood Street, Burnley, a local tramcar conductor, has been wounded in the foot and is in hospital at Chatham.

Private B. C. Parker, an Accrington tram conductor, has been shot in the breast but is recovering.

Private Chas. Lawson, of Castle Street, Stalybridge, a conductor on the Joint Board tramways, has been taken prisoner by the Germans whilst serving with the R.A.M.C. at the front.

Roll of Honour.—Private Peter Liptrot, a Wigan Corporation tramguard, has been reported killed in action.

REVIEWS.

Electric Traction. By Lionel Calisch, A.M.I.C.E., &c. London: The Locomotive Publishing Co., Ltd. Price 2s. net.

Mr. Calisch has produced a little book on a large subject which should prove useful and instructive to railwaymen in general. It was written originally in the form of articles in the "Great Eastern Railway Magazine," and could have been improved in style and arrangement as a volume by editing with a greater regard to the requirements of a book intended for consecutive reading and permanent reference, as contrasted with a succession of articles contributed to a magazine. If such discrimination had been exercised, probably Chapter VII, "The Economic Aspect of Electrification and its Advantages over Steam," would have been inserted as Chapter II after Chapter I, "Historical Notes: Classification of Railway Traffic." There is a curious innovation in the make-up of the book. Each chapter is headed, at the top of the page, "Chapter I," etc., without further title or description. The titles of the chapters, and a list of the subjects discussed or described, are given in the "Contents" only, and there is no index.

This unceremonious way of starting chapters produces an impression of want of finish, as though the book were made up of "galley sheets," snipped to length. Perhaps this is only an expression of conservatism as to appearance. It seems convenient, though, that a reader should see the subject title at least at the head of each chapter, if only to prepare his mind; and certainly if he wants to refer to something he remembers to have read, the want of an index makes the book less handy.

If the book were not good and useful it would not be worth while to criticise these matters of form and arrangement, which detract sensibly from the attractiveness of the work.

The author has compressed into the book a large amount of information well selected to give a general knowledge of how electric traction is applied to railways, what it has done, and what it may be expected to do in the near future for railway working. It would be easy to point out where he has gone too far into technical matters, and yet not far enough, but a reviewer who has had similar tasks sympathises with the difficulty of drawing the line in descriptions and statements of a technical character. The statements of the traffic and economic advantages of electric traction are well put, and supported by a great number of quotations from railway authorities at home and abroad.

At several places the author seems to be a little uncertain what he wants to say, and leaves a confused impression as to his own views on the subject. This may be due to a desire to present both sides of a controversy, but it is not quite the same thing. A particularly striking example is his presentment of the question of the effect of height of centre of gravity upon the riding qualities of a locomotive, and the side-wear of rails, commencing at the bottom of p. 56 with the words: "Mr. Aspinall was one of the first to draw attention to the fact that, in his opinion, the serious side-wear of rails . . . . on the curves of electrified railways is due to the low centre of gravity of motor trucks." This is a sentence the author will wish to re-write. Mr. Aspinall's opinions are worthy of the greatest consideration, but he will hardly draw attention to them as facts. As the author a few lines further down says that it is not at all certain that these theories (as to the relation of side-wear and low centre of gravity) are correct, gives some evidence tending to show that they are not, reverts to other evidence supporting them, and ends up with the statement: "Experience has shown that electric locomotives with a low centre of gravity will not increase the track maintenance provided that" certain other matters are properly co-related in the design, the general reader may wonder at the end why the last quoted sentence, or a more general statement that the matter is unsettled, and is a question of design involving other points, would not have sufficed.

There is room for criticisms of style, mostly in respect to redundancy and loose choice of words suggesting hasty writing and inefficient revision, which the author will be well advised to rectify when a second edition is called for, as may happen within a reasonable time. No doubt some more material items will then call for revision and addition too.

Chapter VII sets out the advantages of electric traction on surburban lines, showing that the net result is an increase of profit, and how the result is made up, with numerous examples from electrified lines of that class. It is, perhaps, the best chapter in the book, marred by some of the defects of style and order already referred to, and ending with a pair of apparently contradictory statements calculated to perplex.

Chapters VIII and IX deal with main-line electrification in a fair and temperate way, putting the case for goods traffic and for electrification as an alternative to widening lines and increasing terminal accommodation in a way which must come home to railway men who know what a steam line working up to its utmost capacity means, and will sooner or later command the assent of the highest authorities and even the capitalists who will have to find the money.

The following sentences on p. 105 seem open to question, or at least to explanation: "The electric locomotive has a longer life than the steam locomotive, but owing to its first cost being greater the actual depreciation charge per locomotive is greater. As, however, the number required to handle a given traffic is much smaller than the number of steam

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engines in use, the total depreciation is generally higher for steam operation." One dimly feels what the author means. In fact, however, the depreciation of a steam locomotive is a purely fancy figure on British railways, and its life may be anything from that of its first firebox to that of its number plate, as successive locomotive superintendents may determine. Electric locomotives and motor-cars will doubtless be treated in the same way, and the proper comparative figures will be those of repair, maintenance and building new units sufficient to keep the service running.

We can recommend the book to railway men and others interested in the subject; and to the author, to take in hand and turn into a much better one.

Questions and Answers about Electrical Apparatus. By J. W. Craig and W. P. Woodward. London: S. Rentell & Co. Price 6s. 6d. net.

This small book is the third edition of an American publication which is supposed "to bring out many interesting features of the more important types and classes of electrical apparatus and the general points of a useful and practical nature which come up in the testing and operation thereof." Undoubtedly some useful information is given, but it is difficult to understand for what class of reader the book is intended. For example, the first question is: "What are the principal uses of direct current?"; one about the middle is: "Why are transformers used?"; and the last question is: "What storage arrangements for coal are advisable?" There are many more of the same character.

Scattered through the book are 44 advertisements, and there is a small collection of them at the end. The only index provided is one for the above-mentioned advertisements.

The reviewer considers the price to be expensive beyond all reason.

The Mechanical Design and Construction of Generators. By R. Livingstone. London: *Electrician* Printing and Publishing Co., Ltd. Price 9s. net.

The mechanical design of electrical machinery has hitherto received far less detailed consideration than the electrical side of the problem—at least, as regards text-books. While several books dealing with the principles of electrical design do not altogether ignore the question, it is usually dismissed with a very brief and practically useless chapter. The book under review has been specially written to fill this gap.

The opening chapter deals with pulleys, gearing and couplings. While the part dealing with pulleys and gearing is what might be more or less obtained in a pocket book, the design of couplings is entered into at considerable length. The author's style is not such as can easily be followed. A mistake occurs on p. 29, where $4\,t\int_0^{\frac{\pi}{2}}\left(\frac{A}{2}\cos\theta\right)^2 A\,d\theta$ is put $=\frac{A^3\,t\,\pi}{8}$ instead of $\frac{A^3\,t\,\pi}{4}$, which vitiates the results which follow.

Chapter II discusses rotor hubs and end plates. In the opinion of the reviewer, all formulæ for hubs that are based on the thin cylinder assumption are worse than useless—they are actually misleading, and he agrees with the author that the only satisfactory way to estimate the forcing pressure required, or the clearance, is to rely upon practical experience. At the same time, a method of dealing with this problem by the method of thick cylinders was developed several years ago, and this is much more rational than the one given. The strength of armature end plates is then dealt with in a manner which is not conspicuously clear to say the least. A mistake appears on page 43, in which $\int_0^{\frac{B}{2}}\frac{16\,\pi\,x\,\delta\,E\,t}{B\,D}\,dx$ is put $=\frac{2\,\delta\,\pi\,E\,t\,B^2}{D}$ instead of $\frac{2\,\delta\,\pi\,E\,t\,B.}{D}$ This error again makes the deduced formulæ faulty. On page 51 the allowable tensile stress in cast iron is given as 8,000 lb. per square inch, which seems too high, considering the treacherous nature of the material.

Unbalanced magnetic pull receives attention in Chapter III, in which a number of well-known formulæ are given.

Chapter IV is devoted to shafts and bearings. The method of calculating the reactions and bending moments in a single beam, as given in every elementary text-book on applied mechanics, is dealt with at length. Surely this is unnecessary in a book of this description. Deflections are calculated by means of the curves developed by the author. Ordinary bearings are treated in detail, but ball-bearings do not receive anything like the attention they deserve in view of their increasing use, and roller-bearings are ignored altogether.

Chapter V discusses the important subject of shaft alignment, and a large collection of formulæ are given.

The strength and stiffness of alternator and direct current stator frames are then considered as thin metal arches fixed at the ends. The long and complex analysis of this type of arch as given in books on the theory of structures is reproduced and applied to the design of stator frames. A formula for the deflection at the top of the arch is given, and it involves a numerical co-efficient of .0062. The author states that in getting this a log table must be used, since the ordinary slide-rule is not accurate enough. The reviewer thinks this statement rather ridiculous since he obtained .0061 without any special care on an ordinary 10in. rule, and, moreover, the value of this constant is of less importance than the other terms in the expression, *e.g.*, it would be practically impossible to get the moment of inertia of the cross section of the frame (and this is required) with this degree of accuracy.

Chapter VII deals with the stresses in rotors. A formula for the force in the binding wires of armatures is given on page 144, but the reviewer is unable to get the constant given in the denominator of the author's expression. The value of the acceleration due to gravity is given on page 149 as 32·19078, and used in calculating a centrifugal force formula. This kind of thing is misleading, since the other quantities required cannot be obtained to anything remotely approaching this degree of accuracy.

Poles and end clamps are next discussed. The salient pole type of machine only is considered, and a large number of formulæ are given, some empirical, and some derived from considerations of elementary mechanics.

The next two chapters—consisting of 13 pages total—deal with field coil supports and with rotor bodies. Several tables are given which should prove useful.

Chapter XI deals with cylindrical rotors in a fairly satisfactory manner. Certain very important formulæ are quoted without any attempt to establish them from first principles.

High-speed bearings and critical speeds are dismissed in half a dozen pages, and the reader is referred to Dunkerley's Royal Society Paper for further information regarding whirling speeds. Much more space could have been devoted to the latter with advantage.

The remainder of the book consists of 18 pages devoted to general details, types of high-speed motors, and an appendix, the most noteworthy feature being several illustrations of turbo-alternators by well-known makers.

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There are obvious misprints on pages 36, 49, 87, 134, 188, and 194.

The general impression of the book upon the reviewer is that it contains a good deal of information, but at the same time he would strongly recommend any buyer to check the mathematical expressions before he uses them. The price also seems excessive.

ELECTROSTATIC ORE SEPARATION.

The well-known phenomena of electrostatic attraction now receive practical application in a number of ore-separating equipments, most of which are installed in the States. So satisfactory are the results obtained, that the electrostatic process is certain to be adopted extensively in an ever-widening field. That separation of minerals is possible by electrostatic means depends on the great difference between the electrical conductivities of various minerals. Metallic sulphides are generally good conductors, while gangue-forming minerals are usually poor conductors. Pyrites, galena, argentite, tellurides, magnetite, hematite, hornblende, graphite, and most minerals of copper, iron, silver and manganese, among others, are good conductors, but quartz, sandstone, granite, feldspar, slate, fluorspar, limestone, dolomite and most siliceous materials, carbonates and sulphates are poor conductors.

If a mixture of (electrically) uncharged minerals containing good and poor conductors be allowed to fall upon a conducting surface charged to a high potential, the good conductors will at once become charged with like polarity and repelled, but the poor conductors will either fall off the surface by their own weight or be but weakly repelled, since they become charged but slowly. If the mixture be charged oppositely to the separator plate, the high conductivity particles will reverse their polarity on touching the conductor plate, but the materials of poor conductivity will be strongly attracted till their initial charge is lost (after a considerable time). Impurities frequently vary the conductivity of minerals very considerably, and this point must be borne in mind, since clean separation can only be made electrostatically between minerals having marked difference in conducting power. Some minerals may be changed from poor to good conductors by electrochemical action. According to the *Engineering and Mining Journal*, this fact is applied in practice at Ouray (Colorado) where zinc sulphide is immersed in copper sulphate solution till a light deposit of copper forms on the ore, which then behaves as a good conductor, since the electrostatic charge and action is a surface effect. Carbonates of poor conductivity can be changed to oxides of good conductivity by heating.

The principle of the Huff separator, which is used almost exclusively in electrostatic ore separation, is illustrated in fig. 1. The framework and casing of the separator are made of iron, which is carefully bonded and earthed to prevent accidents and to secure as high a P.D. as possible between the fixed baffle plates and neutral electrodes (fig. 1) and the high-tension bars, which are charged to 20,000 volts or so. Between the high-tension and neutral electrode bars, there is established an intense electrostatic field, and as mixed minerals pass through the separator by gravity from an overhead roller feed hopper, conducting materials are repelled forcibly to the left while poor conductors fall straight through, before any appreciable repulsion takes place. From some mixtures three or more "splits" can be made, but generally it is possible to make a clean separation only between two products at a time.

To distribute the work of separation down the separator column and to allow for the different composition and nature of various ores, the electrodes are made adjustable. Those at the top are set rather far apart, those at the bottom—where an intense field is required to expel the last traces of conducting material—are set quite close together. This arrangement also reduces the risk of sparking and short-circuit at points where the ore is still rich in conducting materials; at these points the electrodes are comparatively far apart.

In early designs of electrostatic separators, wood-encased steel wires were used as electrodes. Abrasion of the wood was heavy, and the protecting coat of shellac varnish became gummy, under heat produced by friction, electrostatic stress and the warm minerals themselves. As a result, the electrode rods became foul and sparking troubles and imperfect separation followed. Steel pipe electrodes, suspended and insulated by wooden plugs, are now generally employed. Constant attention is required to keep the electrodes free from grease and dirt, since a single grounded electrode places the whole separator out of action.

In order to secure satisfactory separation, it is imperative that the mixed ores be dry and warm before admission to the separator. The ore is necessarily ground fairly small before separation, and, apart from moisture making all ingredients sufficiently conducting to upset the separating action, endless trouble is caused by clogging and short-circuiting if the ore be moist. The mixed crushed ore should be dried at 300° to 600° F., depending on atmospheric conditions and the nature of the minerals treated. From the drier, ore should be passed as quickly as possible to the separators. The feed being warm eliminates condensation troubles and, by keeping dry the air within the separator, reduces the risk of sparking troubles.

A considerable percentage of minerals separated electrostatically is finer than 200 mesh, and when falling between the electrodes the finer particles have an excellent opportunity to float away. At best, the machine room of an electrostatic mill is a very dusty place, and operators

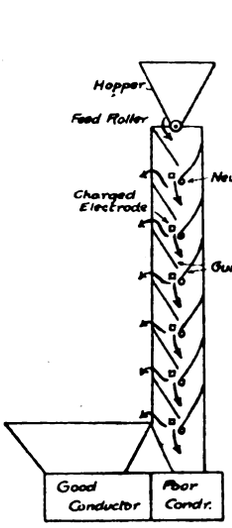

Fig. 1.

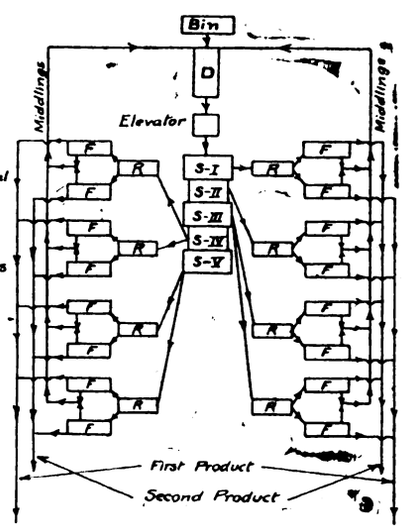

Fig. 2.

generally wear respirators. To reduce the nuisance and eliminate the wastage of mineral otherwise entailed, a ventilator is placed over each machine and connected to a central suction fan, where dust is collected in filter bags, 30 ft. or so in length and 12 in. in diameter. A dust chamber is also arranged below the fan which maintains draught in the drier.

Immediately after leaving the drier D, fig. 2, ore is elevated on to a series of screens S, which should sift the material into four or six sizes before passing it to the appropriate separator. Finely crystalline ore needs more initial crushing than an ore of coarse structure. Suitable sizings for different grades of material are as follows:—

Coarsely crystalline.	Medium texture.	Finely granular.
Through 4, on 8 mesh	Through 20, on 40 mesh	Through 40, on 60 mesh
,, 8, on 20 ,,	,, 40, on 60 ,,	,, 60, on 80 ,,
,, 20, on 50 ,,	,, 60, on 80 ,,	,, 80, on 100 ,,
,, 50, on 100 ,,	,, 80, on 100 ,,	,, 100, on 150 ,,
Through 100 mesh	Through 100 mesh	Through 150 mesh

Unless sizing be fairly accurate, a large particle of good conductor may carry with it mechanically several small poorly conducting particles, and a large piece of non-conducting ore may obstruct the flight of small repelled pieces. Generally it is necessary to treat the products of each roughing separator R in finishing machines F, forming two or more finished products and a quantity of middlings, which are either returned to the main drier to pass through the whole plant again, or preferably reheated and passed through small middlings separators. For an ore containing the following sizes of pieces in the stated proportions, the

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desirable roughing and finishing equipment would be as shown in fig. 2 :—

Size of pieces.	Percentage of feed.	Separators. Roughing.	Finishing.
1.—Through 30, on 40 mesh	10 per cent.	1	2
2.— ,, 40, on 60 ,,	15 ,,	1	3
3.— ,, 60, on 80 ,,	20 ,,	2	4
4.— ,, 80, on 100 ,,	25 ,,	2	4
5.— ,, 100	30 ,,	2	4

The electrical equipment necessary comprises a motor-driven high-tension generator set, with regulating resistance in the motor field, and a rectifier, which is so connected that the live electrodes receive only a positive charge. The cost of this installation is very small.

The above process was introduced for use on zinc ores, and the separation of blende from pyrites is still its most frequent application, but among the materials which can be satisfactorily subjected to electrostatic separation may be noted :—Zinc, lead and iron middlings, chalcopyrite in quartz, pyrite and chalcopyrite in various gangues, chalcopyrite and bornite in granite, zinc, iron and silver ores, native copper in sandstone, pyrite concentration for sulphur, silver ores from a quartz gangue, molybdenite from gangue minerals, mica from graphite flake, slate from coal, and so on. The only limitation is that the materials treated must be sufficiently different in electrical conductivity.

POWDERED FUEL.

At the Spring Meeting of the American Society of Mechanical Engineers held at St. Paul, Minneapolis, the use of pulverised coal for fuel purposes formed the subject of three papers, which dealt respectively with its application to the cement industry, to steam making and to industrial furnaces. These papers are of considerable interest to the central station engineer, for although the use of powdered fuel for ordinary steam raising purposes may not be a commercial proposition at the moment, the future undoubtedly holds great prospects of developments especially at the "fuel" end of electrical generation.

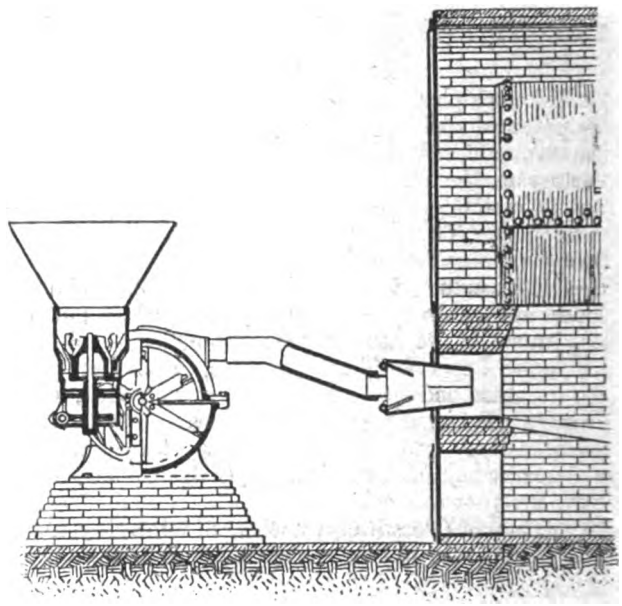
The ideal boiler plant, so far as simplicity of apparatus and operation are concerned, is generally considered to be one using oil fuel, which has the merit of being easily stored outside the station, conveyed to the furnace and automatically adjusted as to quantity supplied to the special burners employed.

Such a plant is in great contrast with that employed in the modern coal burning boiler house, in which costly elevated bunker structures are provided, and every ton of fuel usually has to be lifted to a considerable height by mechanical appliances in order to allow of its falling by gravity into another mechanical appliance —a hand regulated mechanical furnace—under the boiler; the ashes, moreover, require special appliances for their removal, and usually a specially constructed basement for the appliances. The coal is frequently crushed to a uniform size before it enters the bunkers, and while this rough attempt at grading, no doubt, helps towards efficient combustion on the grates, yet a percentage (frequently 3 or 4 per cent.) falls through as riddlings, and cannot be efficiently burned with the other fuel. However perfect the individual fuel equipment of the modern boiler house may be, as a whole it seems crude and complicated for its purpose, and although perhaps the best available at the moment, it cannot be regarded as final.

At first sight the use of pulverised coal would seem to offer a means of simplifying present day methods, in fact, of attaining more nearly the oil fuel ideal, but although sufficient progress has been made in this direction to give promise of future success, at present the use of powdered fuel under boilers is restricted to special cases.

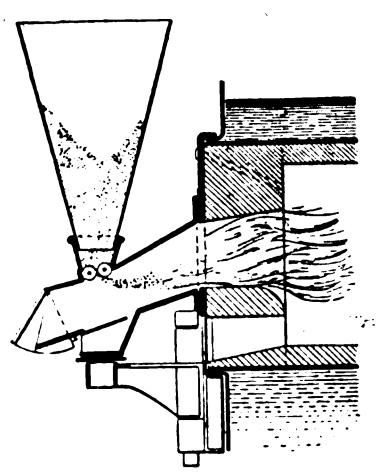
In the paper by R. C. Carpenter on pulverised coal burning in the cement industry, the author mentions that for more than 30 years various schemes for burning powdered coal under boilers have been suggested, and numerous patents have been taken out without any marked success, but in the Portland cement industry commercial success was obtained more than 15 years ago, although the type of furnace employed—the rotary kiln—had much to do with the practical success attained.

The burning of powdered coal differs from the burning of solid fuel from a theoretical standpoint, principally in one particular.

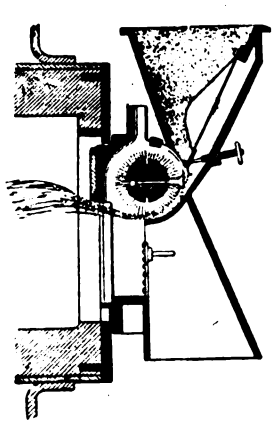


Day or Ideal Apparatus and Burner.

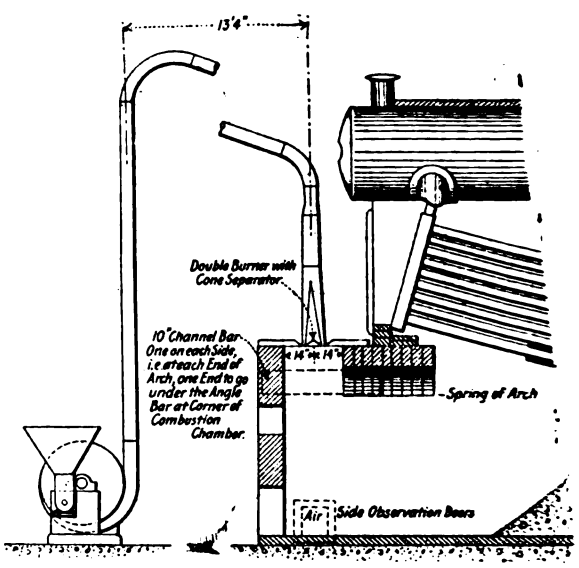
With ordinary commercial fuel on the grate, the air for combustion passes between the pieces of coal and the products of combustion pass off to the flues. In the case of coal dust, the particles are so fine that sufficient air for combustion does not reach the coal through the crevices. To burn such fuel successfully it must be burned while in suspension in the air, each particle being surrounded by air, which supports combustion. The furnace used in cement making is favourable to such combustion, as it is very long, affording plenty of room.



Pinther Apparatus.



Schwartzkopff Apparatus.



Doelger Powdered Fuel Installation.

Contact of coal particles with other bodies results generally in a lowering of temperature to such an extent as to make combustion impossible, and results in the virtual loss of any fuel which falls on to the lining, &c.

The time of combustion depends on the size of particles and the finer the grinding, other things being equal, the quicker and more perfect the combustion.

Failure to recognise that powdered coal must be burnt while in suspension, and the radiant heat of combustion utilised without substantial impingement of the flame, accounts in this author's opinion for the practical failure to use powdered fuel in boiler furnaces, although the form and proportion of the latter make the problem difficult. In nearly all cases where tried the burning coal dust has impinged on the furnace sides or bridge before combus-

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tion was complete, resulting in waste, destruction of fire-brick linings, &c.

For cement burning the coal is crushed to break large pieces, passed through rotary cylindrical dryers (utilising waste heat) and passed into pulverising machines, being reduced to such a state that not less than 95 per cent. will pass a sieve of 100 meshes per lineal inch. Screw, belt and pan conveyers and dust-proof bucket elevators are used for carrying such fuel, the requisite for safe conveying being the prevention of an explosive mixture with air, so that if it should catch fire it will burn slowly.

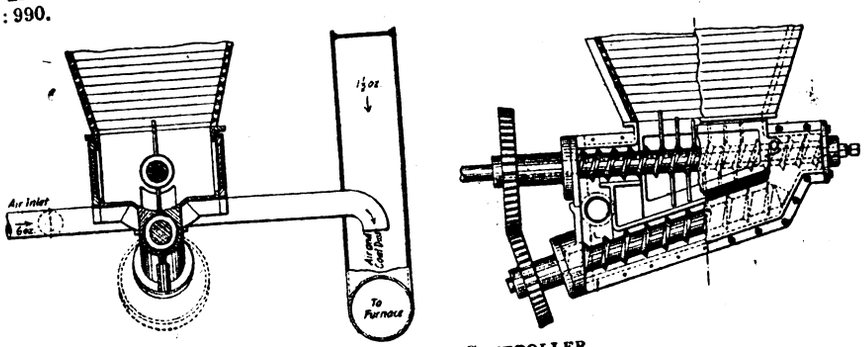
The paper by F. R. Low on the use of pulverised coal for steam making gives a good indication of the lines along which practical experimental work has been carried.

Three broad types of apparatus have been produced—the Pinther, in which the fuel is fed into a hopper above a feed control mechanism, and carried into the furnace by natural draught; mechanical feed apparatus, such as the Schwartzkopff revolving brush apparatus; and that in which coal is blown into the furnace as in the Day or Ideal apparatus.

With the first type efficiencies of from 75 to 80 per cent. were obtained, but the capacity was limited.

When fuel is introduced into a powdered fuel furnace at a rate which will give the full rated capacity of the boiler, a particle will remain in the combustion zone of an ordinary furnace less than half a second.

The relative volumes of equal weights of coal and air are about 1 : 990.



CULLINEY FEED CONTROLLER.

Not much less than 15 lb. of air per pound of coal would be required, so the relative volumes of coal and air introduced would be 1 : 14,850, and the diameter of the globe of air which would accompany each fuel particle into the furnace would be over 24 times the diameter of the particle, so that plenty of air may be used for fuel injection purposes without exceeding the supply required for complete combustion. In all the systems at present in use, the fuel is introduced in this way, the blower usually being so combined with the pulveriser that the powdered fuel is blown into the furnace as soon as it reaches the necessary degree of fineness.

In the late nineties Wegener tried in the States a natural draught system, and obtained boiler efficiencies of 75 to 80 per cent.

In 1910 Blake equipped a 300-H.P. water-tube boiler at Pittsburg; the pulveriser served as its own blower, sending the mixture of fuel and air into the furnace through a series of nozzles extending across the furnace front. A little less than the rated boiler H.P. was obtained with an efficiency of about 79 per cent.

In a later Blake apparatus installed recently at the Peter Doelger Brewery, New York, the coal was delivered into an extension furnace and smokeless combustion and high efficiency were obtained, but trouble with slag accumulation on the roof and furnace sides, entailing shutdowns for removal and excessive maintenance, also the cost of pulverising, led to the plant being shut down after eight weeks' trial.

In practice the boiler evaporated as much water from 1,000 lb. of powdered coal as from 1,400 lb. of natural coal.

In the Culliney feed controlling device, patented in 1905, the powdered fuel falls from a hopper on to a horizontal screw conveyer, which delivers it so that it falls past the blast pipe opening and a cross current of air in the latter carries a portion of it to the furnace pipe where another air current carries it to the furnace. Fuel falling past the blast opening is picked up by the lower screw conveyer (of coarser pitch) and returned to the upper conveyer.

Radial arms, fitted to the latter, agitate the fuel in the hopper and push any foreign material to the sides. This controller system has been applied to a 300-H.P. Franklin boiler and has resulted in complete smokeless combustion, no slag, several furnace linings melted down but inability to get full boiler capacity, this latter due to limited controller capacity.

In the Bettington boiler (made by Messrs. Fraser & Chalmers) which has been introduced into South Africa, Great Britain and Canada, the fuel is fed upwards through a water-jacketed nozzle in the centre of a vertical furnace. The pulveriser acts as a blower, and the air supply is preheated by the escaping products of combustion.

From the pulveriser the coal passes to a separator, the finer fuel passing to the burner. The blast opposing gravity tends to keep the fuel in suspension; the flame does not lift more than 10 per cent. under the highest rate of feed. The tubes round the furnace are covered with refractory material to within a short distance of the lower (mud) drum, and this wall tends to become coated with molten ash and slag, any ash carried with the draught falling into the pit.

A user of these boilers says that despite the cooling effect of the tubes, furnace linings quickly burn away; the makers claim that they will last two years. The pulveriser beaters and liners require renewal at each 1,500-2,000 tons of material handled.

The use of heated air allows coal of 15 per cent. moisture being satisfactorily handled, and 2 or 3 per cent. of the boiler capacity is allowed for pulverising.

A boiler of 2,600 sq. ft. heating surface has been running for over four years at the maker's works, evaporating regularly 14,000, and occasionally 22,000 lb. of water per hour. Tests of a Rand boiler of this type show an efficiency of 82·6 per cent.

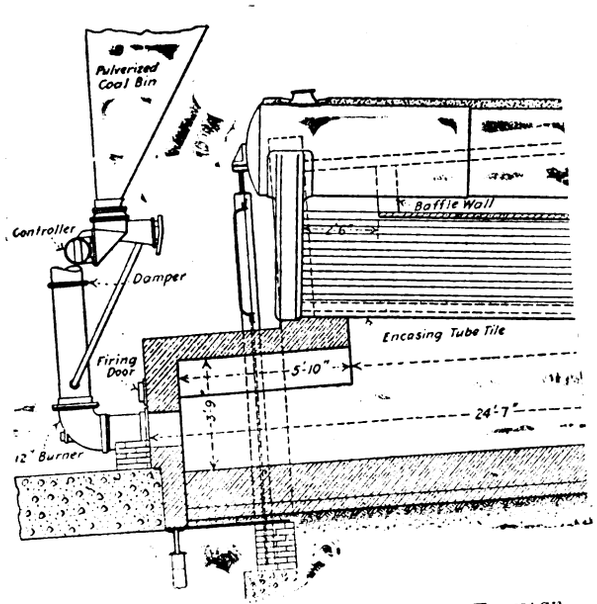
With ordinary methods of coal burning, the grate with its bed of incandescent fuel offers a varying resistance to the passage of air, rejects the incombustible residium with difficulty, and allows unburned fuel to sift to the ashpit and be fused in the clinker.

If fuel can be burned in suspension many of these difficulties disappear, and the draught producing apparatus is reduced to that which will remove the products of combustion and allow enough air to enter to burn the fuel.

There remains the difficulty of getting rid of incombustible, which if in pulverised form, is carried into the flues and out of the chimney, and if fused, attaches itself to the furnace sides, &c., damaging brickwork, and needing lay-offs for cleaning. Perfect and smokeless combustion can be obtained, but with the rates of combustion demanded in present practice, the result is a high temperature with erosive and reducing characteristics, which are not suited to a boiler furnace. Pulverised coal can be safely conveyed *en masse* in suitable holders, screw conveyers, &c. In those systems where the pipe back of the blower is filled with an explosive mixture of coal and air, the rate of flow must exceed that of the propagation of flame in such a mixture, and in shutting down, the coal supply must be shut off first. The pulverised mass will run like water, so that the pitch of chutes, conveyors, &c., must provide against the flowing of their contents.

Anthracite dust burns more slowly than coal having a higher percentage of volatiles, and must be very finely pulverised. With an ordinary fire-brick furnace well heated up there is no trouble in maintaining a steady flame, and this will re-ignite after having been turned out for several minutes. The cost of pulverising and the large initial cost of drying, pulverising, conveying and feeding plant, together with the fact that coal of practically all grades can be burned with a tolerable degree of smokelessness in the cheaper apparatus in common use with a degree of efficiency which leaves little margin to cover the increased expenditure, have combined to restrict the use of pulverised coal to boilers for special purposes.

The paper by Messrs. Dalton and Quigley deals with the substitution of powdered coal for oil in furnaces for heating blanks for



FRANKLIN BOILER AND POWDERED FUEL FURNACE.

forgings, and describes the coal milling and distributing plant employed.

The Culliney fuel-feed controller is used, and the results show a saving of over 50 per cent. in operating cost as compared with the use of oil.

From a discussion in connection with this subject, which took place on certain selected topics, it appears that storage bins fo

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coal dust should have steep sides to prevent bridging over of the contents and stoppage of the flow; from 12 to 24 hours' storage is regarded as sufficient and absolutely safe, and one contributor finds by experience that at the end of 96 hours spontaneous combustion is likely to take place, while another mentions 10 days. A lighted match will often ignite the dust, but it simply smoulders away harmlessly.

The coal can be safely stored if thoroughly dry and at a comparatively low temperature. The bin should be as air-tight as possible and of a triangular cross-section, in the form of a trough with the conveyer in the bottom.

The coal should be dried to 1 per cent. or less before pulverising, and ground so that 95 per cent. will pass a 100-mesh screen.

The rough cost of grinding 150 tons per 24 hours may be taken at 40 cents a ton, and a contributor mentions that 17 H.P.-hours per ton were required for grinding, &c.

The danger of particles of dust floating in the air is pointed out, and, therefore, the need for enclosure to prevent escape of dust.

The coal should be handled as a solid material, not in the shape of a dust cloud; aerial propulsion for transfer of powdered fuel should be avoided. One contributor points out that a powdered fuel furnace should have a temperature of at least 2,000° F. throughout, and a combustion space of at least 1 cb. ft. for each 3 lb. of coal burned per hour.

The boiler, is, however, essentially a low temperature furnace, seldom going over 1,500° F., and it does not offer the requisite combustion space out of contact with boiler surface. Moreover, the cost of grinding eats up any small advantage in economy over ordinary mechanical stoking. It is suggested, however, that powdered fuel would be of great value for peak loads in central stations, the furnaces being made automatic.

Slag is formed more easily at high than low temperatures, and serious results can be avoided by control of the burning mixture; furnace temperatures can be varied from 1,800 to 3,500° F., and with preheated air it is suggested that lower temperatures can be controlled provided the temperature of the furnace is above the kindling temperature of the fuel.

Summarising the matter in regard to furnaces generally, the saving by the use of powdered coal, according to one contributor, is due to practically perfect combustion, no handling of coal or ash, no poking or clinkering, and a constant and uniform heat resembling a gas fire, and as easily controlled.

The chief item of expense is the cost of preparing the coal; the all-round labour cost is much reduced.

It is further suggested that the trend of experiment should be to develop a furnace and a refractory material to withstand heat; under such conditions the ash would be slagged, and the design should provide for its removal. Then high capacity and efficiency would be obtained.

Past investigators have, no doubt, considerd this impossible, but that does not prove that it will not be accomplished.

ATOMS AND ELECTRONS.

At the meeting of the British Association in Sydney, Sir Ernest Rutherford, himself a New Zealander, gave a lecture on "Atoms and Electrons." We are indebted to a local newspaper for the following particulars:—

Science, the lecturer began, believed that everything on earth was ultimately divisible into tiny particles called atoms. The atom was considered the one permanent thing in the whole universe. But now it was discovered that the atoms themselves were divisible into collections of still smaller particles—electrons. First came Crookes's experiment, in which electricity was passed through a tube from which the air was gradually exhausted. The lecturer repeated the experiment.

Crookes considered that the rays produced consisted of matter in a new or fourth state. In 1897 Sir J. J. Thomson found that they consisted of a stream of negatively charged particles shot out at enormous speed—as much as 50,000 miles per second. He also found out that the mass of these flying particles was only one eighteen-hundredth of that of an atom of hydrogen. They were the electrons of which the atoms were made up. They were liberated from substances in various ways. Every electric lamp liberated electrons, and they were thrown out at enormous speeds by radio-active substances. An electron was simply a unit of electricity apart from matter. It had nothing of the ordinary atom of matter associated with it.

This discovery altered all existing ideas of the structure of things, and of the connection between matter and electricity. But the atom itself remained the same—even after an electron had left it. With atoms of certain substances, however, such as radium, it was different. Their life was limited; they tended to break up and disappear. Radium shot off, among other things, a stream of tiny particles—"alpha particles"—which travelled at about 10,000 miles a second, and consisted of a particle of the rare gas helium, together with a charge of electricity. Helium and radium being different, this amounted to a transmutation of elements. When the radium atom had fired off its particle of helium, it became a quite different substance, and that in turn became another through a long series of changes, beginning with uranium. Some of the links in the chain had a life of only a few minutes, whereas uranium would last as long as five thousand million years. Most of these "transition elements" were discovered in Sir Ernest Rutherford's laboratory, by himself and his assistants.

It was possible, Sir Ernest went on, that the atoms of every substance had a similar tendency to break down, but their life was so long that no change in them was noticeable. The tranformations of the atoms of radio-active substances could not be controlled by man, though the energy set free was enormous—from three to 10 million times as great as by our most powerful explosives.

It had been thought that we should never be able to reach the atom—it was so small. But actually the tracks of some atoms had been registered in various ways. The alpha particles shot out of radium—atoms of helium—caused a gas to conduct electricity, "ionised" it, and by several ingenious contrivances the setting up of this ionisation was used as a means to register the passage of the alpha particles through the gas. One means—a string electrometer—had been invented by Prof. Laby, a Sydney University graduate. The ionisation of the gas caused by the passage of the alpha particles caused this string to vibrate, and thus a record was set up, in which each vibration represented an atom.

Sir Ernest went on to the structure of the atom. At the centre, he explained, was a nucleus, almost as tiny as an electron, and containing a positive charge of electricity. Round about it, in concentric rings, circled the electrons, with their negative charges. The nucleus was so small and the electrons were relatively so far from it that if it were taken as represented by an ordinary table glass, some of them would be miles distant from it, so that the atom was actually very far indeed from "solid" in the ordinary sense. The arrangement of the electrons in an atom depended on the charge carried by the nucleus; and it had been suggested that the smallest atom—of hydrogen—consisted of one charge and one electron, and that gold, for instance, consisted of 79 charges and 79 electrons.

Hitherto the ground had been familiar to the scientific members of the audience. But now Sir Ernest reached a boundary line, over which, he said, some of his scientific friends would not follow him. He said that the element lead might have either of two origins, and, according as it originated in one way or another, its atomic weight might vary. There might be, apparently, a couple of pieces of lead, which looked just the same, and yet their physical qualities would be quite different. That, perhaps, would not be believed now, but it would be later on. The nucleus of an atom might differ in different atoms, though their chemical and physical properties were the same. And gravitation itself was most probably a property of the nucleus. In a heavy atom it would be most complex, and bound together by most powerful forces. It would be the work of the future to explore it, as the rest of the atom had been explored.

A vote of thanks was carried with enthusiasm, on the motion of Sir Oliver Lodge, who said that Sir Ernest Rutherford had described what might be called the astronomy of the atom, and it was found that through it, as through the visible universe, law reigned. Personally, he did not think that, apart from the relation to the body of man, there was such a thing as "great" or "small."

BUSINESS NOTES.

Book Notices.—"Useful Arts Catalogue, 1903-1914." The Public Libraries Committee of Newcastle-upon-Tyne has just issued this new catalogue, edited by the public librarian, Mr. Basil Anderton, M.A. The catalogue is based on the decimal system, and is admirably arranged and classified; the sections relating to engineering naturally occupy a large proportion of the volume, and a very useful collection of books on electrical subjects has been brought together during the past 11 years. We commend to the notice of other librarians the excellent example of the Newcastle Committee and librarian; every large city should be provided with a library containing a complete series of works on arts and industries, which are immensely more valuable to the community than a vast accumulation of novels and light literature.

"The *Mechanical World* Pocket Diary and Year Book for 1915." Manchester: Emmott & Co., Ltd. Price 6d. net.

The Telegraph and Telephone Journal. Vol. I, No. 2. November. The Editing Committee, G.P.O., North London, E.C.

A special number of the *Asteroid*—the official magazine of the B.T.H. Social Club—contains a Roll of Honour occupying many pages, and containing the names of about 1,000 employés of the company, who have joined the Colours. This is a remarkable record, and does credit to the patriotism of the staff. The issue contains a variety of amusing items, including the illuminating discovery that B.T.H. is "the backbone of BriTisH!"

Dissolutions and Liquidations.—Stellar Signs, Ltd.—This company is winding up voluntarily, with Messrs. A. C. Hutchins, of 11, Pancras Lane and V. G. Morris, of Wardrobe Chambers, Queen Victoria Street, E.C., as joint liquidators. A meeting of creditors is called for November 11th.

S. Pontifex & Co. & T. S. Borradaile, electrical engineers and contractors, Regnart Buildings, Euston Street, N.W.—Messrs. Frederick Wm and Thomas Wade-Lennard have dissolved partnership. Mr. F. W. Lennard will attend to debts.

Canada.—An Ontario agent wishes to represent British manufacturers of electrical, contractors', and engineers' supplies. Firms should write to H.M. Trade Commissioner for Canada, 3, Beaver Hall Square, Montreal.

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Catalogues and Lists.—BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Price list No. 8,112 contains a brief illustrated description, with dimensioned diagrams and prices, of the B.T.H. combined switch and fuse for tramcar lighting.

MESSRS. KRUPKA & JACOBY, LTD., 39, Victoria Street, London, S.W.—Two price leaflets, one relating to 600 megohm cable, and the other to English lampholders and ceiling roses.

BRITISH PROMETHEUS CO., LTD., Salop Street Works, Highgate, Birmingham.—Twenty-four-page booklet containing half-tone views of the various departments at the works, with the manufacture of electric heating and cooking apparatus in progress. Alternate pages give illustrations and prices of irons, toasters, liquid heaters, kettles, hot cupboards, "Simplicity" cookers, radiators, and other apparatus.

MESSRS. HOGAN & WARDROP, 2, Grasham Buildings, Basinghall Street, London, E.C.—Thirty-page well and fully illustrated catalogue of electric fans (desk, bracket, ceiling, punkah, porthole, &c.), automatic shutters and regulating resistances, small power motors, grinding and polishing machines, and sewing machine motors. In each case tabulated matter relating to sizes, speeds, weights, prices, code-words, &c., is very plainly set out.

MESSRS. R. H. PATTERSON & CO., LTD., Forth Street Works, Newcastle-on-Tyne.—October catalogue of new and second-hand machinery for sale or hire.

MESSRS. E. BROOK, LTD., Colne Road, Huddersfield.—November stock list of single, two and three-phase motors.

Trade Announcements.—THE BRITISH ELECTRICAL EXPORT CO., LTD., concerning which a registration notice appeared in our last issue, has been formed, with offices at 27, Martin's Lane, London, E.C., for the purpose of assisting smaller electrical manufacturers who have not branches in the foreign markets to get into touch with shipping orders at present on the market that have previously gone to German houses.

MESSRS. H. R. CLEAVE & CO., of Bristol (Messrs. Drake & Gorham's agents), are opening a branch at 15, Summer Row, Birmingham, where Mr. Ernest G. Roberts, who has been connected with Mr. G. Braulik for several years, will act as their resident manager. He will hold large stocks of Conference lamps.

No Connection.—THE ALPHA MANUFACTURING CO., of Balham, S.W., write to say that they are in no way connected with the Alpha Electrical Co., Ltd., whose registration was announced in our last issue.

Bankruptcy Proceedings.—TRUBIE MOORE, electrical engineer, Leeds.—Last day for proofs for dividend, November 16th. Trustee, H. Clifford Bowling, 24, Bond Street, Leeds.

LIGHTING and POWER NOTES.

Aberdeen.—The Electricity Committee reports that during September 957,906 units were generated, an increase of 77,978 units on the same month of last year.

Accrington.—STREET LIGHTING.—The lighting superintendent has been instructed to prepare an estimate of the cost of lighting Burnley Road by electricity on the same system as the lighting of Blackburn Road.

Aldershot.—SCHOOL LIGHTING.—The Education Committee has decided to defer fixing new incandescent gas lamps in the West End Schools, until estimates are received for installing electric light.

Ashford (Kent).—PROV. ORDER.—The East Ashford R.D.C. has decided to agree to the revocation of the Ashford E.L. order which concerned a portion of the Council's district.

Australia.—The North Illawarra Council, N.S.W., is considering the question of an electric light installation, and is in communication with the Public Works Department as to obtaining current from the power house at Port Kembla, which is to operate the new coal shipping jetty appliances.—*Australian Mining Standard.*

The Doncaster (Vic.) Shire Council proposes installing electric light throughout the municipality; current will be purchased in bulk from the Melbourne City Council. Mr. V. J. Crowley has been appointed consulting engineer to the scheme.

Barking.—The U.D.C. has decided not to give financial assistance to the Ilford U.D.C. in its action with the Ilford Gas Co., and with regard to the I.M.E.A. Private Bill, the Council requires further particulars as to the cost before coming to a decision.

Belfast.—EXTENSION SCHEME.—The Electricity Committee has adopted the report of the city electrical engineer on the proposed extension of the Corporation electricity undertaking, and the recommendation has been considered at a special meeting of the Council.

The special meeting of the Council on the 29th ult. decided that in view of the difficulty at the present time of obtaining money at a reasonable rate, the erection of the new electricity generating station should be postponed, and that in order to meet the requirements of the next three years, alterations and additions be carried out to the plant in the existing works, and that a sub-station be provided and necessary cables be obtained, &c., at a cost of £25,000.

Cardiff.—At the meeting of the Electric Lighting and Tramway Committee, it was reported that an agreement had been concluded between the Corporation and the Postmaster-General for the supply of energy to the Cardiff Post Office for a period of 10 years.

Chester.—YEAR'S WORKING.—At a recent meeting of the T.C., it was pointed out that as a result of 23 weeks' working there was a profit of £1,811 on the hydro-electric works, and on the whole of the electricity undertaking the net profit for the year had been £4,961, of which £1,094 was transferred in aid of the lamp rate, £500 to the improvement rate, and £3,339 to capital account.

Chile.—A decree approving the project of Senores Emilio Rodriguez and Eduardo Arzon for the establishment of an electric lighting system in the town of Curepto has been granted.—*Board of Trade Journal.*

Cleethorpes.—STREET LIGHTING.—The U.D.C. has decided to have the lamps in certain streets lit by electricity as an experiment, the lamps to have test meters attached, so that the result can be decided by the Lighting Committee.

Clevedon.—CONVALESCENT HOME LIGHTING.—At this Home recently the ordinary gas lighting installation, consisting of 36 vertical mantles, with a total of 900 C.P., has been superseded by a Lister-Bruston automatic electric plant, with the engine running on town gas, and supplying 60 16-C.P. metal lamps giving a total of 950 C.P. With incandescent gas burners, the March, June and September quarters of 1913 called for a gas consumption of 161,500 cb. ft. of gas, while the same quarters of 1914, using the gas-engine electric plant, only required the consumption of 89,100 cb. ft. of gas, showing a saving of 72,400 cb. ft., in addition to the advantages of electric light.

Connah's Quay.—PROV. ORDER.—The U.D.C. has decided to include in the area of supply under the prov. order its own district, and the parishes of Loughton, Northop, and Leadbrook Major and Minor, in the area of the Holywell R.D.C. The latter body has consented to the inclusion of the rural parishes, provided the Northop Parish Council approves.

Deal.—PROV. ORDER.—The T.C., on being informed that the Walmer U.D.C. had decided not to co-operate in applying for a prov. order for electric supply, resolved to take no further action in the matter.

Dover.—The Postmaster-General has agreed to accept the following terms for the supply, by the Corporation, of energy to the new post office:—Up to 8,000 units per annum (minimum), 5d. per unit; 8,000 to 12,000 units, 4½d.; beyond 12,000 units per annum, 3½d. per unit, the terms to be for one year.

Durham.—SCHOOL LIGHTING.—The County Education Committee has decided to have the electric light installed at the Industrial School premises.

Eastbourne.—The Electricity Committee has resolved to give electricity free to houses occupied by the Belgian refugees as long as the amount consumed is reasonable.

Edinburgh.—HALF-WATT LAMPS.—At a recent meeting of the T.C., it was reported that out of the 682 public electric lamps in the city over 260 had been changed to half-watt lamps, thus doing away with the carbons altogether. The lamps were being changed at the rate of 40 or 50 per week.

Greenock.—The electricity sub-station at Bay Street, for the supply of electricity to Port Glasgow, is now completed, and current was to be switched on on Monday last. Substations are now completed at the shipbuilding yards of W. Hamilton & Co., Dunlop, Bremner & Co., and Russell & Co., and cables are being laid to the Clyde shipbuilding yard.

Hendon.—The Education Committee has decided to have electric light installed at the Wessex Garden School.

London.—BETHNAL GREEN.—The Electricity Committee of the B.C. is about to carry into effect the scheme adopted by the Council for the supply and distribution of electricity within the borough. The specifications and conditions have been prepared by Mr. Conzen, the consulting engineer, and tenders will shortly be called for. The question of a site in the West Ward suitable for a sub-station is under consideration.

HAMMERSMITH.—The B.C. has decided to supply current to the London Territorial Association at the Exhibition Buildings, Wood Lane, at 1½d. per unit between sunset and midnight, and 9d. per unit between midnight and sunset.

MARYLEBONE.—The Electric Supply Committee of the B.C. reports that in the arbitration proceedings with the Electrical Power Storage Co., Ltd., in connection with the agreements with respect to the maintenance of two storage batteries at the Rathbone Place and Manchester Square sub-stations, terms favourable to the Council were secured.

We are informed by the Westminster Electric Supply Corporation that the Church Army Hut in Grosvenor Square, which is being used by the Territorials, has been equipped with electric cooking apparatus, and that the whole of the cooking for 300 men is now carried out by electricity.

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London Electricity Supply.—In a report on proposed legislation in connection with the above scheme, the Special Committee of the L.C.C. states that it has conferred with practically all the companies and authorities concerned and submits certain particulars of the scheme, for which it is suggested Parliamentary authority should be sought. It is urged that steps should now be taken so that the scheme can be launched at a favourable time without delay; this would enable action to be at once taken in directions not involving capital expenditure, but which would materially facilitate the carrying out of the scheme when necessary. The proposals follow practically without modification the report of July last (see Electrical Review, page 198), and so far as their effect on existing undertakings is concerned, it is pointed out that the only compulsory powers which it is proposed to confer upon the new authority are designed to prevent individual supply authorities from incurring capital expenditure in laying down plant or other works which, in the opinion of the B. of T., are definitely unsuitable to an ultimate scheme of uniform supply throughout the area. The importance of obtaining powers for railway supply is emphasised. It is now proposed that the proportions in which capital shall be raised by the authority and company should be a matter of agreement between them. The authority would have power to discharge its capital liabilities by the issue of stock and the company by the issue of shares.

The Finance Committee, in dealing with the scheme in its financial bearings, considers that no heavy capital expenditure would be involved till nearly 1920, if conditions were adverse—five years being allowed to bring the Act into operation. Recent loan periods have been reduced owing to probable obsolescence arising from such a scheme as is proposed; it is, therefore, considered that the periods may be longer with the new scheme, which will be free from this particular risk.

From previous experience it is assumed that the cost of an inquiry, such as this, lasting 30 days, including experts' fees, will amount to about £17,000; from the present up to second reading stage £5,000, and from that stage onwards, £12,000. In this connection the Committee suggests that depending on the likelihood of the powers being obtained, it will not be necessary to incur the full liability until after the second reading.

Maidstone.—Proposed Loan.—The T.C. has applied to the L.G.B. for a loan of £800 for extensions at the electricity works. A 150-kw. set at the works has been disposed of to the Russian Government for £700.

The Electricity Committee is considering the question of bonuses with a view to increasing the salary of the electrical engineer.

Midhurst.—E.L. Scheme.—The E.L. Committee of the R.D.C., on October 28th, presented a report as to the mains of the E.L. Co., and recommended that underground mains be insisted upon in certain portions of the parishes. The report was adopted, and it was stated that the E.L. Co. acquiesed in the decisions.

Middleton.—Upon the recommendation of the E.L. Committee, the T.C. has decided to apply for sanction to discharge the accumulated debit balance of £1,815 by six yearly instalments commencing on April 1st next.

Middlesbrough.—The Gas and Electric Lighting Committee has sanctioned an agreement with the Cleveland and Durham Electric Power Co., under which the rights of the company for the supply of electricity to North Ormesby are transferred to the Middlesbrough Corporation.

New Zealand.—The ratepayers of Pahiatua have approved the raising of a loan of £10,000 for electric light and power works in the borough.—*B. of T. Journal.*

North Bierley.—Workhouse Lighting.—The L.G.B. has sanctioned a loan of £1,260 for the purpose of lighting the Union premises with electricity.

Oldham.—Cooling Towers.—Objections having been made to the proposed erection of cooling towers at the Greenhill electricity works, the Electricity Committee has considered the question of erecting ornamental towers, but has decided that this cannot be done, as it would be very expensive; the Committee has also expressed the view that the height of the towers cannot be further reduced without the efficiency being greatly impaired.

Shipley.—Extension of E.L. Area.—The U.D.C. has decided to apply for power to supply electricity in the Baildon district.

Skipton.—Prov. Order.—The U.D.C. has decided to apply to the B. of T. for a prov. order to supply electricity in the district, and Mr. W. Emmott, of Halifax, has been appointed engineer to the scheme.

Southampton.—The Electricity Committee has under consideration the question of giving a supply of current to Melbourne Street, which will necessitate an extension of mains at a cost of about £1,300.

The surplus on the year's trading of the electricity undertaking amounted to £19,164. This is a decrease on the surplus for the year 1912-13, which was £20,286.

Southend-on-Sea.—The district auditor has disallowed the sum of £100 charged in the electric lighting accounts as expenditure incurred by the Electricity Publicity Committee in connection with the exhibit of an electric house at the Kursaal.

Torpoint.—Public Lighting Arbitration.—As a result of arbitration between the U.D.C. and the Electric Supply Co. respecting public lighting, the award has been given in favour of the Council, the company to pay £100 damages and £31 13s. costs.

U.S.A.—New York Public Lighting.—With a view to reducing the cost of public lighting, the city authorities propose replacing the street arc lamps with nitrogen filled (half-watt) tungsten lamps. About 500 such lamps of 400, 500 and 750 watts have been installed in some of the principal streets of Manhattan for comparison with the arc lamps which are in general use. The New York Edison Co. has submitted tentative prices for the 750-watt lamp, $107, as against $120 a year for flame arc lamps; 500-watt lamp, $85, against $90; 400-watt lamp, $77, to replace arc lamps at $99. These prices are based on four renewals a year, but up to the present more renewals would be wanted, and the price would need to be raised. One-year contracts are held with the electric companies, and, if the new lamps are adopted, the present arc lamps, which are modern, will have to be scrapped.—*Elec. World.*

Wolverhampton.—The Council has decided to pay £500 to the Midland Electric Corporation for the acquisition of the right of the latter to supply electrical energy in the parish of Bushbury.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The deadlock over the Corporation provisional order in its relation to the tramway profits has now been removed. It is understood the Scottish office has agreed to allow the order to proceed on the understanding that the T.C. may devote the tramway profits to the common good to the extent of £2,000.

Australia.—Representatives of the City, Borough and Shire Councils in the vicinity of Geelong (Victoria) are considering the question of buying out the Geelong electric tramways and running them as a municipal enterprise.

The Malvern Tramway Trust (Vic.) has arranged to carry out the construction of the Malvern Road tramway section, at a cost of £27,540, and various other tramway works are to be carried out.

The consulting electrical engineers to the Northern Tramway Extension League, Victoria, have submitted their report on the proposed electric tramways in Fitzroy, Northcote, and the shire of Preston. The length is 5 miles 60 chains, and the estimated cost is £95,271.

Bolton.—Tramway Reconstruction.—The work of reconstructing and doubling the track in St. Helens Road between Daubhill car shed and Four Lane Ends is to be commenced during this month.

Bury.—Proposed Tramway Extensions.—The T.C. decided on October 29th to apply to the B. of T. for powers to extend the tramways to Walmersley and along Rochdale Old Road, from the terminus at Jericho to the borough boundary.

Continental Notes.—Holland.—The Amsterdam municipal tramway receipts for August and September show a falling off of nearly 20 per cent., as compared with 1913, the figures being for 1914 643,673 guilders, and for 1913 812,753 guilders.

A concession has been granted to the Eerste Nederlandsche Electrische Trammaatschappij for the construction and working of electric tramways from Haarlem to Bloemendaal and from Haarlem to Overveen.—*Board of Trade Journal.*

Spain.—A concession has been granted to Don José F. Solorzano y Frure for the construction of an electric tramway from Ferrol to Santa Maria de Neda.—*Board of Trade Journal.*

Edinburgh.—Proposed Tramways.—The T.C. has adopted the recommendation of the Tramways Committee to include in the provisional order to be promoted in next Session powers to construct a tramway to Corstorphine, and to carry out other important extensions.

Liverpool.—The City Council has decided that the Tramways Committee shall cease all dealings with Thermit, Ltd., and the Tudor Co.

London.—The Westminster City Council, last week, refused to consent to the L.C.C.'s proposal to link up the tramways at Victoria Station and Westminster Bridge by means of a line along Victoria Street.

The London United Tramways Co. has decided to inaugurate a system of half fares for children under 12 years of age, during the hours from 8.30 a.m. to 5.30 p.m. on week days, and on Saturdays to 2 p.m.

Rotherham.—The T.C. is to seek compulsory powers for through running of tramcars between Sheffield and Rotherham, also the doubling of the tramway track in Effingham and Frederick Streets, and the extension of the present tramway in Broom and Wickersley Roads.

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Southampton.—Year's Working.—The surplus on the year's working of the tramway undertaking amounts to £24,077, showing an increase of £4,592 over the surplus for the previous 12 months.

U.S.A. Electric Vehicle Association.—The Electrical Vehicle Association of America is reported to be considering a proposal to organise a trans-Continental trip of an electric motor vehicle during the course of next summer.

TELEGRAPH and TELEPHONE NOTES.

Alien Telephone Inspector.—An Austrian, named Deigel (or F. E. Roberts), employed as a telephone inspector at Wanstead telephone exchange, was charged on October 31st with failing to register, and was sentenced to three months' imprisonment.

Alien's Wireless Installation.—On October 29th, at Woolwich, H. Focktenberger was charged with failing to register as an alien, and with having in his possession wireless telegraph apparatus. He was remanded in custody.

Marconi Shares.—On October 30th an action was brought by Mr. S. Segar in the King's Bench Division against Mr. Godfrey Isaacs, managing director of Marconi's Wireless Telegraph Co., Ltd., to recover money lost in connection with the sale of a large number of Marconi shares under an alleged verbal agreement, the existence of which was denied by the defendant. The plaintiff stated that his total losses amounted to about £32,000. He also claimed that the defendant, as director of the English Marconi Co., diverted from that company profits in which the plaintiff, as a shareholder of the company, ought to have participated. Evidence was given by Mr. Segar in support of the charge, and he was afterwards cross-examined. On Monday the hearing was resumed, and the evidence of Sir Thomas Berridge was taken. The case for the defendant was then opened, and Mr. Godfrey Isaacs was called; his cross-examination was begun, and was continued on Tuesday. The hearing was adjourned.

Rochford.—The Board of Guardians has decided that a system of intercommunication between the various buildings at the workhouse by telephone shall be installed, at a cost of £104 10*s*.

Secret Wireless Stations.—In reply to numerous applications from wireless amateurs for leave to use their installations for the detection of secret wireless stations, the Admiralty has announced that such permission cannot be given; the successful detection of illicit wireless telegraph stations depends on the careful collation of relevant observations, and it is obvious that a small and select body of observers can give much better results than a very large number who have not the necessary knowledge of the circumstances. Illicit wireless telegraph stations to be dangerous must be capable of sending a considerable distance, and although it is true that reception can be carried out to some extent without a formal and visible aerial, yet transmission to any serious extent would be impossible.

Telegrams in Code.—It is announced that code telegrams cannot be accepted for Venezuela, Curacao, Hayti and San Domingo.

War Tax on Telephone and Telegraph.—American telephone and telegraph companies will be put to considerable trouble by the "war revenue tax Bill" which the Government have found necessary because of the falling off in Customs receipts. Under this Bill these companies will be obliged to collect a tax of 1 cent on each telephone and telegraph message for which they charge the sender 15 cents or more.—*Electrical World.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—November 19th. Six or twelve months' supply of telegraph material and other supplies, for G.N. of Scotland Railway. Particulars, &c., from Stores Superintendent, 80, Guild Street.

Atherton.—November 18th. One 250-kw. single-phase transformer. Mr. C. T. Astbury, Resident Engineer. The D.C. has also decided to provide another panel for fixing to the E.H.T. board to control the spare transformers.

Australia.—Melbourne.—December 16th. Victorian Railways. Rubber-covered copper wire. Contract No. 27,705. Contractors' Room, Spencer Street.

December 16th. Victorian Railways. 100 neutral track relays for electrical circuits. Contract 27,712. Contractors' Room, Spencer Street.

December 28th. Victorian Railways. Three 50-kw. static transformers. Contract 27,727. Contractors' Room, Spencer Street.

Adelaide.—December 9th. Telephone instruments and parts, for the Postmaster-General. See "Official Notices" October 23rd.

Brisbane.—December 15th. Switchboard, common battery, automatic or semi-automatic, for the Postmaster-General. See "Official Notices" October 9th.

Sydney.—December 9th. P.M.G. Various telegraph instruments and measuring instruments.

December 21st. City Council. Motor-generators and switchgear suitable for electric vehicle battery charging. Specifications, 10*s*. 6d., from City Electrical Engineer.

Brisbane.—January 6th. P.M.G. Paper-insulated, lead-covered cable (Schedule 328). See "Official Notices" to-day.

The P.M.G. for Australia announces that it has been decided to extend the date for the receipt of tenders to Schedules 304, 310, 311 and 316 to January 13th, 1915, and to cancel the invitation for tenders to Schedule 314.

Barnet.—December 7th. Steam boilers and heating and warming plant, electrical power and lighting plant, electric lift, water-softening plant. Messrs. Williams & Cox, architects, 34, Henrietta Street, W.C.

Blackpool.—November 19th. Corporation. Water-tube boiler, mechanical stokers, economiser, steel chimney, coal-storage hopper, one 1,500-kw. turbo-alternator, surface condenser and auxiliaries. See "Official Notices" October 23rd.

Chatham.—November 11th. Corporation. Twelve months' supply of incandescent electric lamps, stores, &c., for the Corporation. Forms of tender from the Borough Surveyor's Office, Town Hall.

Croydon.—November 17th. Two electric motor pumps and connections, at South Norwood Sewage Farm. Particulars from Borough Engineer's office, Town Hall, Croydon.

Dartford.—November 18th. U.D.C. Steam exhaust and other piping, extension of H.T. cubicles, control board and cabling. See "Official Notices" to-day.

Dublin.—November 9th. Dublin United Tramways Co. Twelve months' supply of stores, including car fittings, electric supplies, &c. See "Official Notices" October 23rd.

Corporation. Electric time switches for street lamps, and radial wave reflectors. See "Official Notices" to-day.

Hawarden (Flint).—November 11th. R.D.C. Gas engines, suction gas plant and dynamos, switchboard, balancers and boosters, storage battery, underground mains. See "Official Notices" October 23rd.

Manchester.—November 17th. Pitch for paving purposes, for the Tramways Committee. Mr. J. M. McElroy, General Manager.

Port Elizabeth.—November 26th. Municipal Council. (*a*) Engine-room plant, turbo-generators, H.T. switchgear, converting plant; (*b*) boiler-house plant, boilers, coal conveyor; (*c*) E.H.T. and telephone cables. See "Official Notices" to-day.

Spain.—November 10th. The Spanish Post and Telegraph authorities, Madrid. Concession for the construction and working, during a period of 20 years, of a telephone exchange in the town of Caceres.

November 11th. Spanish Post and Telegraph authorities, Madrid. Concession for the construction and working, during a period of 20 years, of a telephone exchange in the town of Puigcerda.

Tunbridge Wells.—November 7th. Corporation. 12 months' supply of H.T. and L.T. cables. See "Official Notices" October 9th.

Wakefield.—December 4th. Yorkshire (W.R.) Electric Tramways Co., Ltd. Twelve months' supply of electric lamps, fittings, insulating materials, &c. Schedules can be obtained from the Central Offices, Belle Isle, after November 9th.

November 10th. Twelve months' supply of coal at Calder Vale electricity works. City Electrical Engineer, Old Town Hall.

Walsall.—November 17th. Corporation. Extra-high-tension cables. See "Official Notices" to-day.

Wigan.—November 11th. T.C. 40 electric torches for the police. Mr. John S. Percival, Chief Constable.

York.—November 9th. Construction of about 1½ miles of light railway, excluding overhead electrical equipment, for the T.C. Mr. F. W. Spurr, City Engineer (returnable deposit £5).

CLOSED.

Aber Bargoed.—Messrs. Johnson & Phillips, Ltd., have received an order from the Rhymney Valley and General Electric Supply Co., Ltd., for overhead and underground cables, switchgear, &c., for Aber Bargoed.

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Australia.—Albury, N.S.W.—The New South Wales Government has accepted the tender of the Brush Electrical Engineering Co. for generating plant, condensers and auxiliaries for the equipment of the Albury electricity supply station.

The following tenders have been accepted :—

Postmaster-General's Department, Sydney.—
Switchboard, Donchquin, £116 10s.; one ditto, Tamworth, £116.—Gardner, Waern & Co.

Postmaster-General's Department, Victoria.—
Switchboard cable, various, £771 10s.—British G.E. Co.
Petrol-driven desiccating plant, £169.—L.-R., G.-P. and Telegraph Works.
500 indicators, £87 10s.; 8,000 plugs, £483 6s. 8d.—J. Bartram & Son Pty.

Victoria Railway Department.—
Rolled-steel joists for electric car shed at Jolimont, £9 per ton.—Dorman, Long & Co.
Rolled-steel channels for the electrification of the suburban lines, £11 11s. 9d. per ton.—Gollin & Co. Pty.

Public Works Department, Victoria.—
£0,000 porcelain insulators, £593 15s.—Lawrence & Hanson Electrical Co., Ltd.
—*Tenders.*

Bradford.—Mr. Charles Bell has secured the contract for a full electric installation at the camp of the Miners' Battalion of the King's Own Yorkshire Light Infantry, which is being established at Otley.

Bury.—The T.C. has accepted the following tenders :—

Electrical Power Storage Co., Ltd.—Maintenance of storage battery at Rochdale Road power station.
Ferranti, Ltd.—Two 250-kw. transformers.

Dorchester.—The order for the gas engine and plant for the electricity works extensions has been placed with Messrs. E. S. Hindley & Sons. The engine will be one of their six-cylinder vertical type, 120 B.H.P., running at 500 R.P.M.

London.—The Metropolitan Asylums Board has accepted the tender of Messrs. Toy & Winslow, at £31 5s., for re-arranging the lighting in the yard at the head station.

G.P.O.—A six months' contract for the supply of Osram lamps has again been secured by the General Electric Co., Ltd.

Maidstone.—The T.C. received the following tenders for cables for extensions :—

Craig Park Electric Cable Co. .. .. (accepted)	£651
W. T. Glover & Co.	760

Manchester.—The Tramways Committee has accepted the tender of Messrs. Estler Bros. for steel storage shelving at the Hyde Road car depôt.

The Education Committee has accepted the tender of Messrs. J. Bryden & Sons, of South Kensington, for lifts for various schools.

The following tenders have been accepted by the Waterworks Committee :—

Copper conductor.—Collier Bros., Manchester.
Cable.—H. Davenport, Whitefield.

The Libraries Committee has accepted the following :—

Alterations of and additions to the electric lighting installation at Openshaw Branch Library.—E. M. Evans.
Electric lighting at the Bradford Library, and also at the Carnegie Library, Didsbury.—Maitland & Co.

Northampton.—The Borough Education Committee has accepted the tender of Messrs. J. A. Baker & Co. for wiring the Girls' Secondary School for the electric light, and supplying lamps and fittings, at £422.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association. Saturday, November 7th. At 7 p.m. At Royal Technical Institute, Peel Park. Short papers by members (for gold medal).

Institution of Mechanical Engineers (Graduates' Association).—Monday, November 9th. At 8 p.m. At Storey's Gate. Paper on "Some Notes on the Wear and Tear of Boilers," by Mr. E. B. W. Maitland.

Institution of Electrical Engineers.—Thursday, November 12th. At 8 p.m. At Victoria Embankment, W.C. Paper on "Cables," by Mr. C. J. Beaver.

(Scottish Local Section).—Tuesday, November 10th. At 207, Bath Street, Glasgow. Inaugural address by Mr. J. Lowson.

Greenock Electrical Society.—Thursday, November 12th. At 7.15 p.m. At 21, West Stewart Street. Paper on "Rotary Converters," by Mr. P. C. Kerr.

Physical Society of London.—Friday, November 13th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "A Bridge for the Measurement of Self-Induction," by Mr. D. Owen, and "On the Coefficient of Diffusion in Dilute Solutions," by Mr. B. W. Clack.

NOTES.

Alien Names.—In order to include quite correctly in the Universal Electrical Directory all those whose names were legally altered before or after October 12th, it is requested that their old and new names, clearly written, shall be sent to the Directory Department, 1, Ludgate Hill, London, E.C., as soon as possible.

Range-Finder Wanted.—The Royal Naval Division Engineer Unit, in which so many electrical engineers have enlisted, is in need of a Barr & Stroud range-finder. The cost of such an instrument is about £50. In view of the close connection between this force and the electrical industry, it seems an admirable opportunity for some engineer or firm to provide it with an indispensable item of equipment. Offers should be addressed to Major Carey, R.E., Royal Naval Division Engineer Unit, Martin Mill, Kent, mentioning this journal.

Electrical Congress Postponed.—At the meeting of the American Institute of Electrical Engineers, held in New York on October 9th, it was announced that, upon the recommendation of the Executive Committee of the International Electrical Congress Committee on Organisation, the board of directors of the A.I.E.E. had declared the Congress to be postponed until such time as it might be found practicable to hold an International Electrical Congress in the United States. All subscriptions to the Congress will be refunded in full. It is probable that a meeting of the Institute will be held in San Francisco in June or September, 1915. —*Elec. World.*

A Large "Motograph" Sign.—A recent issue of the *Electrical World* describes what is claimed to be the largest "Motograph" sign in the world, which is installed on a five-storey Chicago building. In this apparatus the words move across the screen, enabling the spectator to read any desired message up to, say, 150 words. The sign structure is 145 ft. long and 50 ft. high; the moving letters are 12 ft. high. The lamps in the motograph panel number about 4,600, and are arranged in vertical lines on about 115 socket-boards, each supporting two rows of 20 lamps. In principle each lamp socket is wired separately to the motograph instrument, but in this sign there are four lamps to a switch, and over 80,000 ft. of wire has been used. The switchboard and motograph apparatus are housed in a roof structure, and operate automatically. In all, including fixed lamps, some 10,000 lamps are used, of 10 and 5-watt sizes. The Commonwealth Edison Co. has leased the new sign for some months; the American patents for the system are controlled by the Federal Sign System (Electric)

Patents and Alien Enemies.—Before the Comptroller-General of Patents, Mr. Temple Franks, and the ex-Comptroller, Sir Cornelius Dalton, at the Patents Court in London on October 21st, Mr. W. L. Turner, of 5, Castle Street, Liverpool, and Mr. H. A. Blackwell, of The Albany, Liverpool, applied for the suspension of two patents, dated 1901 and 1902, in respect of welding metal, and for the suspension of the trade-mark "Thermit," which is the trade-mark of the Thermit Co., Ltd., of 17, Martin Lane, Cannon Street, who carry on the process. The application was opposed by the Thermit Co.

Mr. Royston, on behalf of the applicants, said that the shares of the Thermit Co. were held almost entirely by German shareholders. Three directors, who lived at Essen, were removed from office on September 8th, 1914. The invention was largely used in this country for welding the joints of tramway lines, and the Liverpool Corporation had held up some of their work until they could ascertain where they stood. Applicants wished to use the trade-mark "Thermit."

Mr. Turner, who supported the application by evidence, explained that although anybody could sell the powder under another name, they were prevented by the patents from using it for the purpose of welding.

Mr. Farmer, for the opponents, declared that if the applicants did use the powder they would not get results approaching those of the Thermit Co. The welds would not be strong and permanent. Originally the Thermit Co. sold the powder, and allowed local people to do the work. This was not successful, and Corporations, in view of their experiences, now preferred to have the loan of one of the company's own men to do the work.

Replying to the Comptroller-General, Mr. Farmer said that the company did not make the employment of their own men a condition of sale. The Corporations preferred the company's men to do it. He added that the shareholders of the company had placed it under the control of a British director. All the profits were to be kept in the country, and what happened to them became one of the conditions of peace when peace was restored.

Mr. Colefax, K.C., said that under the proclamation a company registered in Great Britain was not an alien enemy, however it might be controlled. There had been no diminution of the Thermit Co.'s work since the war. The real strength of the position was that, while one could weld perfectly well under these patents, one could not weld unless he had the company's secret. The applicants could weld tramlines without infringing the patents, but they would not do the work to the satisfaction of any Corporation authority, even if they got a licence under the patents. In this case the one director had absolute power. No resident in Germany had any power to deprive him of his power, or had any power in the company during the war.

Mr. Schultz, the director in question, gave evidence, stating that he was naturalised in 1902, while his father had been naturalised as a British Indian subject. He bore out the statements of counsel as to the position of the company.

The hearing was closed.

St. John Ambulance Department.—An appeal is being made for funds by means of a one-shilling collection. The wonderful work done by the department—which has established 150 hospitals, sent over 200 doctors and nurses to the front, provided over 5,500 orderlies, and forwarded 748 cases of medical stores and supplies, including 56,000 articles of clothing—commands our admiration and should compel our support. Donations should be sent to the Department at Marconi House, Strand, London, W.C.

Dividend Reduced.—A short time before the outbreak of the war, the A.G. Brown-Boveri & Cie., of Baden (Switzerland), declared a dividend of 9 per cent. for the year 1913-14, but, in consideration of the later events, and a probable, or, at least, possible, reduction of activity, it has now been definitely decided to reduce the dividend to 5 per cent.

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Institution and Lecture Notes.—Iron and Steel Institute.—In order to comply with the rules for dealing with purely formal business a statutory autumn meeting is to be held on Thursday, November 19th, at 11 a.m., at 28, Victoria Street, S.W. It will be remembered that the autumn meeting arranged for Paris could not be held, and the papers were taken as read.

A Research Prize of the value of £200 has been placed by Sir Robert A. Hadfield, F.R.S., Past President, at the disposal of the Council, to be awarded for original research work on the subject of the different forms or combinations of carbon in iron, steel, and alloys of iron with other elements. Intending competitors should communicate with Mr. G. C. Lloyd, secretary, 28, Victoria Street, London, S.W.

Nottingham Society of Engineers.—The first meeting of the session was held on November 4th. Mr. Wm. Yorath Lewis gave a lecture on the Niclausse Boiler. On November 18th, Mr. G. W. Worrall will give a paper on "Electrical Machinery."

North Staffs. Institute of Mining and Mechanical Engineers.—At the meeting held on October 26th at Stoke, the new president, Mr. J. Gregory, in the course of an address, stated that to-day, in spite of an enormous increase of depth and load, there were few instances where, in laying out a new colliery, a considerable advantage could not be obtained by the use of electricity. The length of time occupied in a single wind was so short that the utmost attention must be devoted to the periods of acceleration and deceleration, and it was here that the electric motor scored. A minor point, but one well worth considering, in the case of deep shafts, was the even turning moment of an electric motor, which contributed to the steady running of the winding rope.

With regard to the use of electricity for purposes other than winding, the extent to which this method of power transmission had already been applied was evident from the annual report of Mr. Johnstone, wherein it was stated that in North Staffordshire collieries alone, motors aggregating nearly 16,000 H.P. were in use at the end of the year 1913.

Mr. Hassam pointed out how very detrimental it was to that district that they had no large electric power supply to draw upon. If there were such a supply, quite a number of collieries and manufactories would electrify very much more than they did to-day. He was connected with a colliery development which would probably have been electrified throughout if there had been a large power supply to draw upon.

Institution of Electrical Engineers. — At the opening meeting of the 1914-15 session, which was held on the 29th ult., the distribution of the prizes, premiums, &c., awarded for papers read during the previous session (see Electrical Review, May 22nd, p. 862) took place.

Mr. Lewellyn Preece presented to the Institution a marble bust of Michael Faraday, on behalf of the family of the late Sir W. H. Preece. He referred to the desire expressed by his father on the last occasion on which he spoke in that hall, that the bust in question should find its way to the Institution, and mentioned their indebtedness to the sculptor, Mr. McDougal, and to Dr. S. P. Thompson, who had paid many visits of inspection to the studio, for the lifelike resemblance of the work.

Mr. W. Duddell—the retiring president—suitably acknowledged the gift on behalf of the Institution.

Subsequently, Sir John Snell—the president elect—having taken the chair, Dr. Thompson proposed a vote of thanks to Mr. Duddell for his efforts on behalf of the Institution during the two years in which he had filled the difficult office of president. He believed they had been very prosperous years, and during that time the membership had increased to over 7,000. Prof. Kapp, in seconding, pointed out that Mr. Duddell was a scientist and, at the same time, a practical man of business.

The president, Sir John Snell, then read his address, which we refer to elsewhere in our columns, and at the conclusion a reception by the president and Council was held in the common room of the Institution.

Association of Mining Electrical Engineers.—The opening meeting of the winter session of the Notts. and Derbyshire branch was held recently at Nottingham. Mr. L. G. F. Routledge was elected president, and Mr. F. Smith read a paper on "Repairs to Electrical Plant."

The subject of "Power Factor and its Improvement" was discussed by the Yorkshire Branch of the Association, at Leeds, on Saturday, being introduced in a paper by Mr. L. G. F. Routledge.

Rontgen Society.—On November 3rd Sir A. P. Gould, in the course of his Presidential address, remarked that most of the members of the Society were engaged in dealing with those wounded in the present war. When the war broke out the supply of tubes became restricted. An up-to-date equipment in radiography was necessary to every institution which dealt with the wounded. Of all the recent additions to the means of surgical diagnosis none was attended with such immediate benefit as radiography.

The Polytechnic Engineering Society.—The members of the Society paid a visit to the Ediswan Works on November 2nd, headed by their hon. secretary, Mr. R. Harben, when the various departments dealing with lamp and fitting manufacture were seen in active operation.

The Junior Institution of Engineers.—Mr. Robert Rankin, B.Sc., lectured recently on "The Working of Storage Batteries." Prevailing misunderstandings regarding the completion of the first charge were dealt with, and the necessity of continuing it until there was a complete cessation of increase in specific gravities and voltages, was emphasised. One fruitful source of trouble was excessive discharging, and Mr. Rankin described an instrument which he had invented to enable battery operators to keep within proper limits. Attention was drawn to the necessity, in the case of stationary batteries, of keeping proper log-sheets of the working, and of adhering intelligently to a proper set of working instructions, instead of religiously stopping the discharge at a definite voltage, and stopping the charge when the ampere-hours, put back after a discharge, reached a definite percentage over the latter, both voltage and ampere-hours being indicated by instruments which might be very inaccurate.

Greenock Electrical Society.—On October 29th, Mr. R. A. D. Macalister read a paper on "The Manufacture of Electric Cables."

Compensation in Russia for Damages to Trade.—The German-Russian Association is, according to a report from Berlin, co-operating with the German Foreign Office with a view to making preparations for the purpose of working out estimates of the losses that German firms and interests are likely to suffer in Russia in consequence of the war, and for which afterwards compensation will be demanded. All the firms that are interested in Russia are, therefore, recommended as soon as possible to communicate with the Association, and to give a detailed statement of their properties in Russia and their stocks of goods stored there privately at the Custom House or at the railway stores, and, further, to give a statement of their outstanding debts, and of how much they fear to lose. The Association will also assist the trade with the cashing of outstanding debts in Russia, and do all in its power with the view of securing the payment of same in the best way.

Business in Germany.—A circular, signed by a number of German electrical firms, was sent some time ago to customers, in which the latter were informed that the prices of electrical goods were to be raised in consequence of the war. The firm Dr. Paul Meyer, A.-G., of Berlin, which was one of the signatories, has now announced its withdrawal, and pointed out that it would attempt as long as possible to keep prices on the same level as they were before, and further promised to stick to the old terms for sale, and to keep the same terms of payment. It makes the reservation that its action is dependent very much on the position of the copper market and the price of copper, which, of course, may enforce a slight increase of the price for manufactures.

The War and Contracts.—The *Times* reports that the Streets Committee of the City Corporation have requested the Corporation forthwith to ask the Government to obtain power for the determination of contracts with companies for the supply of goods imported from any country with which this country is at war, or manufactured, or partly manufactured, in any such hostile country, and for the determination of contracts with companies which are, or were, on and subsequently to January 1st, 1914, under the management of, or a majority of whose directors or shareholders are or were, during that period, born subjects of any such hostile countries.

British Trade with the Straits Settlements.—Mr. A. Stuart, Registrar of Imports and Exports at Singapore, the Correspondent of the Board of Trade for the Straits Settlements, who is now on a visit to England, will attend at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C., on Tuesday, Wednesday and Thursday, November 17th, 18th and 19th, between the hours of 10 a.m. and 5 p.m., and will be pleased to see by appointment British manufacturers and traders not represented in the Straits Settlements, who may desire to consult him regarding trade conditions and openings in that Colony. Applications for appointments with Mr. Stuart should be made promptly to the Director of the Commercial Intelligence Branch, as above.

German Electrical Industry.—The *Kölnische Zeitung* of September 16th states that during August the German electrical trade was, in common with every other branch of industry, thrown into confusion by the interruption of traffic communications owing to mobilisation. On the resumption of rail traffic, the shortage of raw material continued to exert a depressing influence, and very few new orders were placed during the month of August. Subsequently some improvement was observable as far as home orders were concerned, but export trade appears to have remained entirely at a standstill. The A.E.G. has been able to keep some of its departments busy with war material, and has also undertaken work which, in normal times, would not have come within the scope of its activity.—*Board of Trade Journal.*

Inquiries.—The following are asked for:—Makers of glass wool and glass cells as applied to the small accumulator trades; makers of the "Atom" vacuum cleaner; makers of miniature hot-wire ammeters, reading to 0·5 ampere; makers of cheap paper-lined brass or zinc belt-wire tubing; makers of metal cylinders with coloured glass bull's-eyes, ⅜-in. diameter.

Appointments Vacant. — Two assistant engineers (£432), for Electrical Engineer's Office, P.M.G.'s Department, Melbourne; shift engineer (25s.), for Sevenoaks and District Electricity Co.; charge engineer (£115), for Swansea Corporation Electricity Department; junior engineers (25s.), for Cleveland and Durham Electric Power, Ltd.; junior assistant engineers for Newcastle-on-Tyne Electric Supply Co. (15s.); charge engineer (period of war), for Burton-upon-Trent Electricity Department (£2 5s.); switchboard assistant (25s.), for Stepney. Particulars are given in our advertisement pages.

Fatality.—A correspondent states that on Tuesday night George Lee, jointer, in the employ of the Eccles Corporation, was killed electrically at the Cawdor Street electricity works. He was 30 years of age.

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Late Correspondence.—

BRITISH INDUSTRY AND THE WAR.

I observe a criticism in your journal with regard to the book, "British Industry and the War," sent to you for review, which, I think, has been written under a misapprehension.

The trade journal which the Institute propose to establish is a general trade journal, and not a specialised one such as your paper is well known to be. You will readily appreciate that it will be impossible for a general trade journal to cover the ground in your section as comprehensively as yourself. My remarks, therefore, were not intended to apply to your special journal, but to general trade journals, such as the Board of Trade and Chambers of Commerce, &c.

I am sorry it has been misunderstood, and I am having the particular part modified so as to make the point quite clear.

If it is necessary to have specialised trade organisations, it is as surely essential to have specialised trade journals, and you may rest assured that, as far as the Institute is concerned, it will do everything it possibly can to advance your interests, and in doing this we will be automatically advancing in the interests of specialised trades. In the circumstances the Institute will do everything it possibly can to increase the circulation and usefulness of your journal, and our services are always at your disposal for that purpose.

J. TAYLOR PEDDIE,
Chairman, Provisional Organising Committee.

London, W.C., *November 3rd*, 1914.

[It is comforting to have Mr. Taylor Peddie's assurance that he did not mean our humble selves when he called the "usual trade journals," "deadly in character." We never thought he did, or we should have taken no notice of the matter. But it must be very disconcerting for the *Board of Trade Journal* and the *London Chamber of Commerce Journal*—useful publications, from which we ourselves frequently find it necessary to quote—to be told that that particular remark was intended for them. With all due respect to Mr. Peddie, we venture to think that in his efforts to explain himself he does not improve the situation. No worthy attempt to assist British trade and industry is going to make rapid headway or receive proper support if its originators go needlessly out of their way to reflect upon what others are doing. However, the author is going to make his meaning quite clear—presumably in later editions of the book when they are required—and we are proud to know that both he and the Institute have it in their hearts to assist the ELECTRICAL REVIEW to increase both its circulation and its usefulness.—EDS. E.R.]

Shorthand Typists from Berlin.—Mr. Geo. de Curtis, of the P.O. Engineering Department, Kingsland Green, N.E., informs us that a number of English lady typists, until lately in the employ of a leading German electrical company in Berlin, have been obliged to return home owing to the strong feeling against all English people in that city, and are now seeking situations in this country. These ladies are exceptionally skilful and well versed in languages, and should prove very useful to British electrical firms. Communications addressed to Mr. Geo. de Curtis, care of this office, will be duly forwarded.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. R. LAWTON, of the Leigh Borough Accountants' department, has been appointed clerk and meter inspector in the electricity department.

Tramway Officials.—Councillor E. Heap, chairman of the Burnley Corporation Tramways Committee, informed the Town Council on October 29th that MR. MOZLEY, the tramways manager, was a true-born Englishman, having been born near Sheffield.

General.—The *Birmingham Daily Post* states that CORPORAL WILLIAM BUTT, of the Royal Engineers Telegraph Section, a native of Dorchester, has been presented by the French Government with the military medal of the Legion of Honour for distinguished service at the front. The presentation was made by Sir John French in the presence of his staff.

MR. ARTHUR CARL SCHOLZ, electrical engineer, of 442, Slade Road, Edgbaston, Birmingham, who is a British subject, born at Aston Manor, has by deed poll assumed the name of Arthur Charles.

MR. W. SCHMAHL, managing director of the Armorduct Manufacturing Co., Ltd., announces that in the interests of his wife and children, who are English by birth, he has altered his name to W. Ratcliffe-Small. Mr. Schmahl has been in this country since he was 20 years of age, has been naturalised for a number of years, all his ties and sympathies are in this country, and he has no desire or intention to transfer them to any other.

The marriage took place at All Saints' Church, Langton, Tunbridge Wells, on October 31st, of MR. PERCY G. HOBBS, of the Electrical Installation Co., Tunbridge Wells, and Miss Winifred Ida Hoptroff, of Langton. The bridegroom, who is serving with the 30th Company, Royal Engineers at Plymouth, was granted 48 hours' leave for the happy occasion, and was attended by his best man, Trooper D. Hoptroff, of the Royal West Kent Yeomanry. The presents included a tantalus from the staff of the Electrical Installation Co.

MR. J. J. EASTON has joined the board of directors of Siemens Brothers & Co., Ltd.

Obituary.—MR. STUART RICHARDSON.—We regret to learn that Mr. Stuart Richardson, city electrical engineer, of Wellington, New Zealand, was taken ill after attending a meeting of the Tramway Board on September 10th and passed away on the following day. Mr. Richardson was born at Swansea in 1863, and as a young man spent some years in Australia. On returning to England he entered the Brush Co.'s works at Loughborough, where he was trained as an electrical engineer. Afterwards he entered the service of the Corporation of Leicester and was appointed chief electrical engineer. In 1899 he went out to New Zealand as engineer and manager to the Electrical Syndicate which then controlled the electric lighting of the City of Wellington. On the termination of his engagement with the syndicate he entered the service of the Wellington Corporation, which was then installing the electric tramway system. In 1905 he was appointed tramways and electrical engineer to the Corporation, and this position he held until his death. Mr. Richardson, who was a member of the Institution of Electrical Engineers, was held in high esteem by those connected with the electrical and tramway industries, not only in Wellington, but throughout the Dominion.

MR. C. CLARKE.—The death is reported, after a brief illness, of Mr. Claud Clarke, superintendent for the Scottish Central Power Co. at Falkirk, at the age of 24 years. Deceased was trained at the St. Helens Corporation Electricity Works under Mr. E. M. Hollingsworth, and later studied at Glasgow University, where he passed his Inter. B.Sc. examination.

MR. A. D. BROADBENT.—We regret to state that Mr. A. D. Broadbent, of Perth, W.A., who, as reported in our last issue, was shot by some person unknown, succumbed to his injuries on September 20th, after enduring great pain for nine days. He leaves a widow and two children. He had been chief assistant to his brother (Mr. Herbert Broadbent, city electrical engineer) practically from the commencement of the undertaking, and his services were highly valued by the Corporation, which recently presented him with a handsome honorarium in recognition of his efficient conduct of the works during a visit of his chief to this country; he was also exceedingly popular with the staff.

NEW COMPANIES REGISTERED.

Implitico, Ltd. (138,160).—This company was registered on October 30th, with a capital of £3,000 in £1 shares, to carry on the business of electricians, mechanical engineers, manufacturers, workers of electricity, motive power and light, &c. The subscribers (with one share each) are:—W. R. Lambert, 25, Avington Grove, Penge, S.E., electrical engineer; H. S. Lambert, 208, Waller Road, New Cross, S.E. (electrical engineer). Private company. W. R. Lambert and H. S. Lambert are permanent governing directors; special qualification, £500. Registered office, 2-6, Pocock Street, Blackfriars, S.E.

Tyne Glass Works, Ltd. (138,170).—This company was registered on October 30th, with a capital of £2,000 in £1 shares (500 "A" and 1,500 "B"), to carry on the business of glass manufacturers, workers, blowers, cutters, engravers, embossers, riveters, silverers, stainers, stoppers, grinders, polishers, drillers and perforators, &c., and to carry into effect two contracts (*a*) with T. W. Ferry and (*b*) with Pope's Electric Lamp Co., Ltd. The subscribers are:—M. W. O'Connell, 18, Nicol Road, Harlesden, N.W., electric lamp manufacturer, one "B" share; T. W. Ferry, Inglewood, Low Fell, Co. Durham, glass manufacturer, one "A" share. Private company. The number of directors is not to be less than two or more than four; the first are M. W. O'Connell and T. W. Ferry (both permanent); qualification, £250. Registered office, 68, Pipewellgate, Gateshead-on-Tyne, Durham.

Allies Electric Lamp Co., Ltd. (138,125).—This company was registered on October 28th, with a capital of £3,000 in £1 shares, to carry on the business of manufacturers, importers, exporters, repairers and fitters of, and dealers in, electric lamps, glass blowers, manufacturers of, and dealers in, glass, wire, drawn wire, metallic filaments, wolfram, platinum and other metals, electricians, electrical and mechanical engineers, suppliers of electrical energy, &c. The subscribers (with one share each) are:—J. E. Bithry, 18, Cromwell Avenue, Highgate, N., shipping agent; R. W. Latimer, 18, Caxton Road, Shepherd's Bush, W., electrician. Private Company. The number of directors is not to be less than two or more than five; the first are not named. Solicitor engaged in formation of company, L. G. Cranford, 61, Chancery Lane, W.C.

High Speed Steel Alloys, Ltd. (138,130).—This company was registered on October 28th with a capital of £50,000 in £1 shares, to carry on the business of manufacturers of and dealers in tungsten, molybdenum, vanadium, chrome and any other metals or substances used in connection with the manufacture of steel, general merchants, miners, ironmasters, smelters, engineers, manufacturers of chemicals, ironfounders, &c. The subscribers (with one share each) are:—A Balfour, Dannemora Steel Works, Sheffield, steel manufacturer; A. J. Hobson, Suffolk Works, Sheffield, steel manufacturer. Private company. The number of directors is not to be less than four or more than seven: the first are A. Balfour, A. J. Hobson, F. Best, Norfolk Works, Sheffield; H. H. Smith-Carrington, Openshaw, near Manchester; W. Clark, River Don Works, Sheffield: and C. W. Fawcett, Clyde Steel Works, Sheffield; qualification, £200; remuneration, £100 each per annum, and an additional £20 for each 1 per cent. dividend in excess of 5 per cent. Registered office, 13, East Parade, Sheffield.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

St. Helen's Cable and Rubber Co., Ltd.—Sub-mortgage, as collateral security, dated October 1st, 1914, to secure £15,584 owing to the company, and land, building, hereditaments and premises at Warrington, and machinery, &c., therein, subject to redemption under mortgage dated September 30th. Holder: Sir Joseph Beecham, Bart., St. Helens.

Reason Manufacturing Co., Ltd.—A memorandum of deposit in full, on September 28th, 1914, of debs., dated October 1st, 1906, securing £12,500, has been filed.

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Spensers, Ltd.—Issue on October 13th, 1914, of £400 debs., part of a series of which particulars have already been filed.

Cutting Brothers, Ltd.—Issue on October 10th, 1914, of £200 debs., part of a series of which particulars have already been filed.

Aberdare Electrical Co., Ltd.—Particulars of £500 debentures, created October 18th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Topsham Electricity Supply Co., Ltd.—Issue on October 15th, 1914, of £300 debentures, part of a series of which particulars have already been filed.

Chipping Norton Electric Supply Co., Ltd.—Particulars of £4,000 debs., created October 20th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Carmarthen Electric Supply Co., Ltd.—A memorandum of satisfaction in full on April 14th, 1914, of debs. (*a*) dated March 20th, 1911, securing £650, and (*b*) dated February 22nd, 1911, and March 25th, 1914, securing £2,850, has been filed.

CITY NOTES.

Vera Cruz Electric Light, Power and Traction, Ltd.

THE directors' report for the year ended December 31st, 1913, shows that the net profits in Mexico for the year 1913 amount to $378,304 (Mex.), with an increase of $66,934. Reckoning the earnings at the parity of exchange there is a balance, after meeting all expenses and debenture interest, of £23,985, but owing to the heavy loss in exchange, which amounted to £10,497, the available balance of profit is reduced to £13,488 plus £4,509 brought forward. Deducting the transfer to depreciation and general reserve account, £5,000, there is a balance of £12,997, which, owing to the disturbed state of Mexico and the uncertain state of exchange is to be carried forward. Notwithstanding the political disturbances in Mexico, the property of the company has suffered little damage. The supply of power from the Puebla Tramway, Light and Power Co. is not yet available owing to these disturbances, but it is hoped that the transmission line to Vera Cruz will be completed shortly. An extension of the tramway system is under construction and should be completed in the next few months.

The seventh annual meeting was fixed to take place on October 28th, at Salisbury House, E.C. At the time fixed for holding the meeting there were no shareholders present, and the secretary announced to the Press that no meeting would be held. In reply to a question as to whether the directors would not be present, the secretary said they formed a quorum and would hold a meeting in another room. He proceeded to collect his books and left the room, and before our reporter had written half this paragraph he returned and announced that the report had been adopted and the retiring directors and auditors re-elected.

Ferranti, Ltd.

MR. A. W. TAIT presided on October 30th at the annual meeting, held at the offices, Central House, Kingsway.

In proposing the adoption of the report (ELEC. REV., p. 568) the CHAIRMAN said that the trading profit for the year was £47,257, as compared with £59,599 for the previous year, or a decrease of £12,343. The decrease was due in a considerable measure to the discontinuance of large switch-gear work and the building up of new business in switch-gear details. It was hardly possible to expect that so large a change in one of the principal departments of the company's business could be effected without a certain amount of dislocation and falling off in one class of orders before the necessary orders in substitution could be obtained to an adequate degree. He was pleased to say, however, that considerable advance had been made during the year in completing the company's designs in certain lines of detail switch-gear, power transformers, etc., and had it not been for the unfortunate conditions created by the war it would have been reasonable to expect that the trading for the current year would have considerably benefited thereby. Another matter which contributed to the decrease was the falling off in export business due to monetary conditions in certain countries. That applied more particularly to Canada, where for some years past the company had carried on an increasingly profitable business; but, as they were aware, the monetary conditions in that country for some considerable time past had been unsatisfactory, and, owing to the restriction of credit, there had been a necessary restriction of business. They regarded that as a more or less temporary stoppage in the development of a country in which there was bound to be in the future a very large call for the articles which the company manufactured. General establishment charges showed a decrease of £2,551 as compared with the previous year. Since the close of the year certain economies had been effected, and it was reasonable to expect some further decrease in that figure during the current twelve months. Repairs and renewals amounted to £4,680, a decrease of £2,060. The net result for the year, before charging interest, was a balance of £19,776 against £28,143, or a decrease of £8,367. The interest charges amounted to £8,178, approximately the same as last year, and they had, as usual, placed £10,000 to depreciation reserve, leaving a balance of £1,598, which, together with £452, the balance at credit at 30th June, 1913, made a total of £2,050 to carry forward. Proceeding to deal with the balance sheet, the Chairman said that the item of plant, machinery, tools and fixtures at £125,966 showed an increase of £5,131 over the previous year. Expenditure on work in hand at £65,662 showed a decrease of £11,455. A certain amount of that decrease was to be accounted for by the falling off of business in certain lines, but more particularly by the supervision which had been exercised in the matter of stock of meters and stock parts. Stocks and stores on hand, £21,921, was approximately the same figure as last year. Sundry debtors, after making reserve for bad and doubtful debts, stood at £59,763, a decrease of £6,333. Goodwill and patent rights remained at the fixed figure of £69,546. On the liability side, first mortgage debenture stock at £90,000 showed a decrease of £6,000, due to the application of the sinking fund. Sundry creditors stood at £37,881, which was a substantial decrease of £13,356 as compared with the previous year. The depreciation reserve account, with the £10,000 added this year, now stood at £66,350. If they added the £22,000 in the general reserve they had a total of £88,350, which was a substantial figure as against the depreciation in leasehold land, buildings, plant and machinery, and for writing down the item of goodwill. As he stated at the last meeting, it was not intended to deal with the application of these reserves until 1917, when the whole position of the capital account would have to be revised. With regard to business generally, it would, of course, be idle for him to make any forecast as to the prospects of the business for the current year, but had it not been for the conditions created by the war he believed they could have looked forward for a substantial increase in business, with the probability of a repetition of the results for the year 1913, which were the best in the history of the company since its re-organisation. They must, however, look at the position as it existed now, with the prospect that, no matter for what length of time the present disastrous war might continue, financial and business affairs would be seriously affected for some considerable time to come. The directors, aided by the managers of the various departments, had instituted considerable economies which had not in any way affected the efficiency of the business, but which would enable it to meet the decrease of business during the period of depression. He was pleased to say, however, that the falling off in orders received was not so large as might be expected, and, in fact, over the last few weeks the prospects showed considerable improvement, and he believed that improvement would continue and increase if the parties at the head of international financial affairs could quickly bring about some re-establishment of international exchange. That had been, and was still, one of the most serious difficulties with which manufacturers had had to contend in carrying on business with the British Colonies and with other countries during the last few weeks. The company's works were now up to a high standard of efficiency as regarded plant, not only to cope with the existing volume of turnover, but also to deal with a substantial increase when the same arose, and there was every reason to hope that when conditions returned more or less to the normal, the development which had been progressive for some years past would re-assert itself. He could not conclude without referring to the very great loss which the company had suffered through the death of Mr. A. Bruce Anderson, the managing director, who was drowned in the sinking of the *Empress of Ireland* last May. Mr. Anderson had been on a visit to Canada in connection with the company's affairs there, as had been his custom for some years past, and by an unhappy fate he sailed by the *Empress of Ireland*, although it had been his previous custom always to return *via* New York. Mr. Anderson had been connected with the company for a very long time, practically being associated with it from the commencement. He had a thorough and intimate grasp of its affairs, having grown up with the business, and the satisfactory progressive results which had been shown ever since the re-organisation of the company were very largely due to the ability and knowledge which he exhibited in the conduct of its affairs as managing director. As he was cut down in the prime of life, and while in the midst of establishing his position in the commercial world, it was hardly to be expected that he had been able to make any substantial provision for his widow and children. The directors, therefore, felt that it was incumbent upon them to make some provision for his widow, and they had, therefore, granted to Mrs. Anderson a pension of £200 a year and £100 to each of his three children until they respectively reached the age of 18 years, at the end of which time the whole pension expired. He thought that was the least the company could do as some small measure of recompense for the life work of Mr. Anderson in connection with the affairs of the company. No steps had yet been taken to appoint anyone to fill the vacancy caused by Mr. Anderson's death, although the matter had had the careful attention of the directors. He was pleased to say that the managers of the various departments, together with the Secretary, Mr. Morris, had ably assisted the board in carrying on the company's affairs, and he desired to record the directors' appreciation of this assistance during a trying period.

MR. ARTHUR WHITTAKER seconded the motion, which was adopted without discussion.

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North Metropolitan Electric Power Supply Co.—The *Financial Times* states that a special general meeting of the holders of the preference stock is to be held on 11th inst. to consider a resolution authorising the company to convert the existing £300,000 of preference stock into fully-paid 6 per cent. cumulative £1 preference shares.

Reduction of Capital.—National Electric Construction Co., Ltd. (and Red.).—A petition for confirming the reduction of the capital from £250,000 to £125,000 is to be heard on November 13th.

West African Telegraph Co., Ltd.—Interim dividend at the rate of 4 per cent. per annum, free of income-tax, for the past half-year.

Brisbane Electric Tramways Investment Co., Ltd.—Interim dividend at the rate of 8 per cent. per annum, free of income-tax, on the ordinary shares for the past half-year.

United Electric Tramways Co. of Caracas, Ltd.—The directors announce that during the period of the present war they consider it desirable that profits should, so far as the other interests of the company permit, be fully divided among the shareholders. They therefore requested the local company to declare a dividend which would absorb the whole of their net profits for the past 12 months. The net revenue to June 30th shows a disposable balance £19,906. A dividend for year of 7 per cent. and a bonus of 4 per cent. (less tax) are to be paid, absorbing £18,700, leaving £1,206 to be carried forward. The profits of the local company again show a gratifying increase. The net receipts were £31,761, an increase of £5,322.

Lima Light, Power and Tramways Co.—A general meeting of holders of first mortgage debentures will be held on November 18th, for the purpose of passing an extraordinary resolution assenting to the postponement of the redemption of debentures until the expiration of one year after peace has been declared by all the powers involved in the present European war. No dividends are to be paid until after these payments shall have been renewed.—*Financial Times.*

Western Telegraph Co., Ltd.—The directors report that for the year ended June 30th, 1914, the revenue amounted to £902,837 and the working expenses to £389,943. After providing £32,747 for debenture stock interest, and £18,447 for income-tax, there remains £461,700 plus £37,008 brought forward, making a total of £498,708. Three interim dividends, amounting to £93,568 have been paid, £160,000 transferred to the general reserve fund, £30,000 to the land and buildings depreciation fund, and £130,000 to the provision on account of investment fluctuations. The directors now recommend the declaration of a final dividend of 3s. per share, making, with the interim dividends, a total dividend of 6 per cent. for the year, also the payment of a bonus of 2s. per share, both free of income-tax, which together will amount to £51,982, leaving £33,157 to be carried forward. The dividend and bonus will be payable on November 12th.

Buenos Ayres Tramways Co. (1904), Ltd.—The directors have declared a dividend of 1s. 3d. per share (5 per cent. per annum), less income-tax, for the three months ended September 30th, payable November 17th.

Metropolitan Electric Supply Co., Ltd.—The directors have declared payment of the postponed interim dividend for the half-year to June 30th last, at the rate of 4 per cent. per annum.

Craigpark Electric Cable Co., Ltd.—Interim dividend on the 6 per cent. preference shares, less tax, is payable on November 11th.

Germany.—The Elektra A.G. of Dresden.—According to the balance-sheet of this company for 1913-14, which has been published recently, the profits for the year amounted to £18,900, or practically the same amount as in 1912-13. At the general meeting was declared a dividend of 6 per cent. The capital of the company is £225,000, in addition to which it has also a loan of £112,500.

STOCKS AND SHARES.

Tuesday Evening.

The scheme formulated by the Government, whereby loans from bankers to London Stock Exchange members shall, for practical purposes, be suspended until a year after conclusion of peace, met with cordial welcome at the hands of members. Some of them went so far as to say that the Government plan would have the effect of saving at least 75 per cent. of members from failure—or liquidation, as the official word now is. The simplicity of the scheme is striking, and it must needs be followed by amplification of details, with extension of its principles, by new rules from the Stock Exchange. These may be published before this is; but, in the interval of waiting, business is tame.

One result of the Government scheme has been to revive anticipation of early re-opening of the House. Some members think that business will be started up officially on November 18th, when another settlement falls due to be arranged, but the pessimists put a later date upon the re-opening, and they are much more likely to prove right. The Treasury now controls the time when the Stock Exchange shall officially start business again, and this means, in other words, that for the time being the House becomes nationalised!

That there must be a host of new issues forthcoming, and that before long, is regarded as a certainty, unless the Government steps in and intimates plainly that other borrowers, who do not require money for war purposes, will not be considered as honoured guests in the financial fields just now. Promoters are well enough aware of this, and, besides, there is the difficulty of getting underwriters to take up lines of new stock at the present time. Were this not so, certain new issues would be forthcoming within the next few days; but borrowers are obliged to curb their desires to vanishing point.

The London County Council has this week published long reports upon its scheme, which comes before it on November 10th, for the linking-up of the electrical interests of the metropolis. Under the present proposals an issue of about five million pounds sterling would be involved, spread over a period of five years, and, as we were saying last week, this may prove to be the rock upon which the Bill will suffer possible shipwreck, because of the Government's wish to borrow as much as possible of the floating supply of capital now on hand.

We have been asked to give a table of the yields obtainable from Telegraph stocks and shares, in view of the flourishing business which the companies are doing, and the fact that the current year has witnessed heavy falls in most of the leading varieties. Figures something similar to the annexed have been published from time to time, but this table rounds off the information to date. In one or two cases it is more easy to sell than it is to buy stock:—

Stock or share.	Price.	Dividend.	Yield.
Anglo-American Preferred	101	6 %	£5 18 10
Eastern Extension	118	7 %	6 0 2
Eastern Telegraph Ordinary	125½	7 %	5 11 7
Globe Ordinary	103	6 %	5 14 3
Globe Preference	123	6 %	4 16 0
Western Telegraph	128	7 %	5 11 0
Cuba Submarine	85½	6 %	7 1 2
Direct United States	6½	4 %	6 8 0

The River Plate Electricity Supply Company should have had no difficulty in getting its new capital subscribed, because, before the lists closed on November 5th, there was already a small premium on both classes of stock. Jobbers were bidding ½ premium per cent. for each kind—Preference and Ordinary. The latter ought, of course, to stand very substantially higher, and is likely to do so as soon as the issue settles down into permanent hands.

The Lima Light, Power and Tramways Company will hold a meeting on November 18th, in order to submit a resolution to the First Mortgage Debenture holders, postponing redemption of the Debentures until the expiration of one year after peace is declared by all the Powers involved in the present European war. The immediate result would be to suspend the payment, which would be required for sinking fund purchases. The resolution further provides that no dividend shall be paid by the Company until the sinking fund payments shall have been renewed. The directors state that the necessity for doing this has been brought about entirely by the European war.

Brazil Tractions have been fluctuating between 49 and 46½, being now about 48¼. Adelaide Electric Supply Debenture stock has hardened to 102¾. Calgary Power 5 per cent. Bonds were done the other day at 85½. Winnipeg Debenture is offered at 91½, free of stamp duty. There are a few Philadelphia Company Bonds changing hands. The inquiry for Anglo-Argentine Tramways 4 per cent. Debenture is still noticeable, the price keeping very hard at 85; and the 5 per cent. Debenture stock remains in the neighbourhood of 88¼.

London Electric Supply shares are exceedingly quiet, pending the developments in connection with the L.C.C. proposals already mentioned. London Debenture stock has been wanted at 89, and several other Debenture stocks can be placed with ease. This week's order with reference to the lights of London, while insisting upon the powers of the Admiralty and Police, have been read by some people as a gentle hint that slight relaxation of the stringency may be permitted. Possibly this is to bring the official attitude into line with that adopted by certain districts round London, where shopkeepers, in particular, have treated the instructions with indulgence. London United Tramway Debenture stock is called 60-65, but it is problematical whether dealings could take place on that basis.

The Manufacturing division keeps steady. Edison & Swan partly-paid at 5s. and the fully-paid at 1⅝ are firm. Westinghouse Preference keeps at 30s. Crompton Ordinary and Preference are 5s. and 10s. respectively. Small amounts of British Electric 5 per cent. Debenture stock have been done on the basis of 87½. The rubber market is quiet and uninteresting, but there may be significance in the fact that buying orders for shares reached Stock Exchange brokers early this week from large firms in Amsterdam closely connected with the raw rubber industry. The armament group is moderately active, with prices moving on a very narrow plane.

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U.S.A. SAFETY RULES FOR THE OPERATION OF ELECTRICAL EQUIPMENT AND LINES.*

(*Concluded from page* 581.)

The general rules for the employé comprise general precautions in operation, in handling live equipment and lines, the "killing" or making dead of equipment and lines and moving parts, and making protective "grounds." The employé must be prepared at any time to show his knowledge of the rules; he is enjoined to be cautious, to keep away from danger, to warn others of danger, to treat everything as live unless positively known to be dead. Many of the requirements are very excellent, but are nothing more than such as would be naturally observed by a man who knows his job, and according to a previous rule already referred to, only competent men may be employed. Some of the requirements, however, seem to assume that the employé is either not qualified for the work or is not in that "competent mental and physical condition" previously specified. Thus "no employé shall touch two parts of different potentials at the same time" is an injunction which ought to be superfluous. If the employé is competent to know that the two parts are at different potentials, the requirement suggests a prohibition against suicide rather than a precaution against accident. Again, "accidental contacts with live parts should be carefully avoided," and "slipping or stumbling or moving backwards should be carefully avoided," beg the whole question, the actions referred to being essentially in the nature of accident.

That it should be thought necessary to include such clauses in the rules shows the weakness of attempting to ensure safety by mere personal instructions without first providing for the protection or screening of the apparatus and conductors. Thus, the rule dealing with handling of live equipment and lines at extra high potential requires that "no employé shall come or bring any conducting object within the distances named below, from any exposed ungrounded live part at or above the voltages specified:—

Voltage.	Distance (feet).
7,500	2
27,000	3
47,000	4
70,000	6

No wonder that the employé who is permitted to work within easy reach of exposed conductors at 20,000 volts is enjoined not to slip or to stumble or to make accidental contact with the conductors! Under the Factory Act Regulations in this country all conductors are required to be safe by position, *i.e.*, out of reach, or they must be protected, and even in the case of high-tension switchboards all conductors within reach must be protected.

A useful rule refers to verbal messages, and requires the receiver to repeat the message to the sender and to secure his acknowledgment. Serious accidents have occurred in this country through the misunderstanding of messages. If the message is telephonic there is no difficulty or delay in the repeating of it. If transmitted by messenger to a distance there may be much delay in the repetition and acknowledgment, the ground having to be traversed three times, but messages sent to a distance could generally be in writing.

There are numerous other general rules covering such matters as reporting clear when lines have been made dead, as to attachment and removal of "men-at-work" tags, making grounds, operating switchgear, etc. Employés are instructed not to place dependence for their safety on the insulating covering of wires, not to work from above on live parts when work can be done from below, not to operate isolating switches unless the circuit has been interrupted elsewhere, not to open secondary circuits of current transformers, etc.

The third section of the rules, comprising the special rules for employés, deals with the operation of power stations, switchboards, overhead lines, arc lamps, underground apparatus, meters, testing, signal lines and sub-ways. These rules are again numerous, and though for the most part they are quite sound, the bulk of them are of a most elementary character and suitable for the instruction of persons quite ignorant of or new to the work, and are of little general interest, as, for instance, the following from the Power Station section:—

Do not allow oil cans, tools and wiping cloths to catch in moving parts of machinery.

Do not work on or near exposed live parts unless authorised to do so.

In handling fuses or switches, use only the insulating handles or the special rods or tongs provided.

When working in an elevated position, keep tools and materials not in use in proper receptacles, and do not drop tools or materials.

Several of the requirements are repeated in the other sections.

Some of the dangers would again be more satisfactorily met by regulations for protection of the apparatus. Thus, in regard to switchboard operation, "When working near fuses and circuit-breakers, be careful to avoid injury from their operation. If the hands are exposed to flashes, wear insulating gloves." The use of gloves in ordinary operation ought to be unnecessary. It is difficult to see how care on the part of the operator can safeguard him from injury from an unprotected fuse should he happen to be close to it when it blows. A useful rule referring to the protection of other workmen is as follows: "Do not report lines or equipment dead for other men to work on until the lines or equipment have been cut out by air-break manual cut-outs, protective grounds have been applied to the parts so cut off, and 'men-at-work' tags have been attached to the cut-outs." The rules dealing with overhead lines require, amongst other things, that the worker before climbing shall see that the poles, ladders, cross-arms, etc., are strong enough to safely sustain his weight and that of the work to be done: that all lines (unless thoroughly grounded) which are being strung near power lines shall be treated as live: that when touching power lines the worker shall avoid touching guy wires, span wires, etc. Arc lamp trimmers must not handle any arc lamp until it has been disconnected from its circuit by an absolute cut-out. Dangerous conditions, such as sagging wires, broken insulators, must be reported.

In underground operation, workers before opening manholes where traffic may be obstructed must have the fire department notified! Manholes must not be entered until it is certain that they are free from dangerous gases. The openings must be surrounded by a barrier and danger signals exhibited, and a man must be stationed at the surface. Cables operating above 750 volts must not be spliced whilst live.

Meter setters must not leave joints or loose ends of wires untaped. Secondary circuits of current transformers must not be opened, but short-circuited before changing connections. Bare fingers must not be used to ascertain if the circuit is alive. Circuits must not be opened at meter connections.

In testing operations, the tester must thoroughly familiarise himself with all conditions surrounding equipment or lines to be touched, before making any change in these conditions, and must not make any change unless he fully understands the effect of the change. No persons shall work unaccompanied in testing or experimental work when the voltage exceeds 750 volts.

* U.S.A. Department of Commerce. Circular of the Bureau of Standards, No. 49.

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The rules dealing with signal wires are similar to those for other overhead lines. Signal wires "in trouble" may be in contact with power wires at some other point, and should therefore be treated as live power wires. When stringing wires or cables over or under power lines, the lines being handled shall be treated as alive.

Tunnel and subway operation is dealt with separately from "underground operation" already referred to. Before handling any electric wires or equipment the worker should make sure whether they are alive or not. It is not advisable to work on live wires or equipment when the current can be safely shut off. It is dangerous to fool with live wires. The insulation on a wire may look perfect, but cannot be relied upon to prevent shock. Trailing cables must be inspected at least once daily. In handling portable motors or lamps it must be first ascertained that the external metal parts are not alive. This last requirement is no safeguard at all. Portable motors (*e.g.*, drills) or lamps may appear to be quite sound when first switched on, but may become electrically charged whilst in use, due to vibration or movement causing the connections or coils within to make contact with the metal work. It is much safer that they should be earthed as is required by the Mines and Factory Regulations in this country.

The foregoing extracts are sufficient to show the nature of the rules proposed. As already pointed out, many of them are made in view of dangerous conditions which need not be permitted to exist, and which would not be tolerated in this country. The rules dealing with overhead lines indicate very clearly the risks to which workmen are liable to be subjected to. Thus, the stringing of wires or cables over or near live power wires must be a very hazardous operation, even if they are treated as live and as of the same potential as the power lines, as required by the rules. In this country, so far as the writer is aware, none of the power companies having overhead lines would allow such work to be carried out with the power wires live. The overhead wire problem in this country is, however, not of such magnitude as in the States, and it is possible that the precaution of making power lines dead before work is carried out in close proximity, may there present greater difficulties. In cases where two or more sets of power wires are carried on the same poles, the dangers would be increased, and the difficulties of shutting down with consequent interruption of the supply would be still greater.

It is not suggested that the rules should be adopted in precisely the same form for all undertakings; some would be inapplicable, and possibly others would be required in certain cases. Several of the larger companies have already codes of rules of their own. The uniform adoption of a standard code so far as possible by the different concerns will no doubt prove to be an advantage, particularly in the event of employés going from one undertaking to another.

In this country several of the larger undertakings have excellent codes of rules for the use of their employés. They are printed in convenient form for carrying in the pocket so as to be always available for reference. Other undertakings and private works are generally content with notices posted in certain places, *e.g.*, at switchboards or in substations, giving particular instructions in regard to the operation of certain sections of the plant. Such posted notices, even if once read by the employés concerned, are apt to be forgotten. The method of providing a printed booklet of instructions to be always carried by the employé is certainly better, as the rules are more likely to be studied and remembered. In many cases, however, few, if any, printed instructions are even posted, it being left to the employés subject to any verbal instructions they may have received, to use their own judgment in all matters of operation. It would no doubt be of great service if printed operating rules in convenient form for the pocket were more generally adopted. The advantage of having such rules standardised so far as possible is also evident. This, of course, would require co-operation amongst engineers of electric supply undertakings and others. There is no lack of good material to draw upon. Some of the booklets issued by the larger power companies contain excellent rules, and better adapted for conditions obtaining in this country than those of the Bureau of Standards, though these latter should prove of material use in the compilation of such a code.

THE PRACTICAL TRAINING OF ENGINEERS.

In our last issue we referred to the recently issued report of the Special Committee of the Institution of Civil Engineers on the inquiry which was remitted to it by the Council in 1912, touching the practical training of engineers. We touched upon the previous enquiries and conferences which have been held at the instance of the Institution, and explained that the Special Committee, whose report has just been issued, was appointed as a result of the recommendations of the conference on the Education and Training of Engineers held in June, 1911.

It is owing to the complex nature of the subject, the extensive inquiries involved in its investigation, and other circumstances, that the inquiry has extended over such a considerable period of time.

Perhaps we may repeat that the Committee was appointed to consider the possibility of defining more clearly the conditions of the practical training in the various branches of the engineering profession, required by the bye-laws; also to consider whether anything could be done to establish some co-ordination between engineering colleges and engineers and other employers, so that the practical training of well-educated students might be facilitated.

As is now generally recognised, it is no longer necessary for a skilled engineer to be a skilled mechanic or artizan; nor, indeed, if this were still an essential requirement would there be any need for him to spend five or seven years in a works in order to become proficient in the use of tools. The incipient engineer of to-day, even if he intends to devote himself solely to manufacturing, can very soon, if of average intelligence, learn all there is to be learnt about the handicraft part of the subject. The uses and advantages of machine tools and the means of securing the maximum output from them; the composition and characteristics of metals; economy in the use of materials; these and many other things appertaining to design and management must form a part of his practical training. Practical design he can learn in the drawing office, but it is essential that he have a prior knowledge of theoretical design, the strength of materials, the elements of mechanism and so on, which knowledge is best acquired either at a technical college or by following courses of correspondence tuition. During his workshop training many points will arise upon which, assuming he has had a previous technical training, he can bring his theoretical knowledge to bear; he will know the uses of various parts of machines or mechanism on which he may be working; and why they are made in a particular way. He will appreciate the importance of precision in measurement and working, and the need for care in the handling of certain materials or parts, particularly those which may subsequently be subjected to electrical pressure. In all these matters, the youth who has been scientifically trained before entering

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the works has an initial advantage over one who starts in the works without any technical or scientific training at all.

There is another side to this question, namely, that a scientifically trained youth cannot start his workshop career at so early an age as one who goes direct from school to workshop, and is therefore less inclined to start at the beginning, and may resent spending much time on the uninteresting part of the work. There is also the question as to whether or not a certain time, say twelve months, spent in the works as a preliminary to scientific training may give increased zest to study and give the practically trained student an advantage over one who is learning the technicalities of things of which he has no practical knowledge.

From these considerations there would appear to be much to be said in favour of the so-called "sandwich" system, one of the chief obstacles to which is the inconvenient arrangement of college terms. If the college session occupied the six winter months, the workshop experience could be taken during the six summer months, an arrangement which, from the point of view of the student, has many advantages. From the manufacturer's point of view this system is not so convenient or desirable, because if he has many apprentices the discontinuity of employment must cause a certain amount of disorganisation in his works; yet, as a member of the Institution of Civil Engineers, he may consider such a system a very good one for training engineering recruits.

It has also to be considered that our technical college courses do not adapt themselves very well to the sandwich system, and considerable modification would be necessary in order to permit of the fullest advantage being taken of it. It is clear, therefore, that two things are essential if the sandwich system is to become the recognised form of engineering training, viz.: (1) that employers should make some sacrifice for the benefit of the future generation of engineers and not look upon a pupil or apprentice as merely a dividend-earning unit, and (2) that the authorities of technical colleges and universities must colloborate with employers in order that the training should form an integral part of the complete engineering training.

The inquiry conducted by the Civil Engineers' Committee aimed at eliciting information on the foregoing considerations, and its first step was to approach a large number of engineers of various classes by letter, in which nine questions were propounded. As the questions are somewhat lengthy we give the essence of them as follows:—

1. Do you take into your works pupils or apprentices? Are they indentured? Do they pay a premium? What is the usual period of engagement?

2. Have the pupils or apprentices opportunities of gaining experience in various principal departments, and in the drawing office? and what period is allocated to each department?

3. Is a certificate issued stating or implying that the pupil has been afforded opportunities of acquiring suitable practical engineering knowledge?

4. Are facilities given for attending day classes in engineering subjects?

5. Are you disposed to take youths straight from school for a year's workshop training before they go into a university engineering school or become articled to an engineer?

6. Where no actual apprenticeship under indentures is served, would you give a definite undertaking that the pupil or apprentice—subject to conditions—should be afforded opportunities for acquiring the requisite knowledge to comply with the requirements for admission into the Institution?

Referring particularly to young men who have obtained a degree or diploma, exempting them from the Associate Membership examination, or are following a college course leading thereto, it was asked:—

7. If special facilities or advantages were given for practical training, considering that such pupils may be expected to make themselves useful after no great length of time.

8. If employers would make prospective arrangements with students before the completion of a college course, in order to avoid loss of time.

9. If employers would be willing to admit into their works or office for a part of each year engineering students pursuing a regular course of college study. This, of course, bears upon the sandwich system.

The replies to the foregoing questions are summarised in tabular form in the report, but the variety is such that it is difficult to generalise from them.

As regards the question of apprenticeship, 75 per cent. of the employers who replied to the questions make a practice of taking pupils or apprentices, and, of these, 75 per cent. require a premium with them. Out of the total number of pupils or apprentices accepted, about 70 per cent. are indentured, the remainder being unbound by any legal agreement. There is no uniformity in the period of practical or professional training, this ranging from two to five years, depending to some extent upon the previous technical training received. Practically all pupils and engineering apprentices are afforded opportunities of experience in the various principal departments, both as regards constructional and drawing office work. As regards drawing office experience, the time occupied varies from three months to half the total period of apprenticeship. In 86 per cent. of cases the employer gives a certificate of pupilage or apprenticeship.

As regards facilities for attending day classes, facilities are afforded in 54 per cent. of the cases to those pupils or apprentices who have not gone through a regular college course. Many employers insist on apprentices attending evening classes, and in such cases only those who have gone through a college course are accepted as pupils.

As regards the suggestion of affording a one year's preliminary workshop training prior to the college course, about 55 per cent. of the manufacturing engineers and engineers of public undertakings who have workshops are favourably disposed towards this system, but it does not appear to have been adopted in many cases, and, except as a special favour, this privilege would only be granted to those pupils who undertook to go back after the college course and complete their practical training.

In the case of unindentured pupils, about 58 per cent. are favourable to giving a statement, should it be desired by the Institution, that opportunities will be afforded of acquiring the practical knowledge required by the bye-laws, but many are disinclined to undertake any particular responsibility towards young men who enter their service without some corresponding *quid pro quo*.

As regards willingness to give special attention to young men who have completed a regular college course of study, about 46 per cent. of the correspondents expressed their willingness to do this, but a number of engineering firms are unconvinced that this preliminary training entitles the student to any particular consideration. The views held by many important manufacturing firms are to the effect that there is a scarcity of suitable students, and only a few have been found likely to be of service eventually; that the results generally have not been encouraging; that a purely scientifically educated student is absolutely of no use except on a very few jobs of design when his ability to calculate is useful; but, from the dividend-earning point of view he is practically useless. As a rule the expectations of early usefulness are rarely realised, and generally speaking youths who have obtained an engineering degree or have passed through an engineering course think too much of themselves, and

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expect to get to the top of the tree before they have reached even the first branches.

On the question of making provisional arrangements with students for affording them practical training subsequent to the completion of their college courses, about 75 per cent. of the employers expressed their willingness to consider such an arrangement, provided the undertaking was by no means binding upon them.

As regards the sandwich system, about 53 per cent. of the whole of the employers who replied are favourably disposed to the method, whilst the remainder are opposed to it, and it is a notable feature of the replies that those least favourable towards it are engineers in private practice and engineers of railway and dock undertakings, whereas the most favourable are engineers of municipal undertakings and manufacturing firms.

One of the results of the inquiry is to show that considerable uncertainty prevails as to practical training with regard to the methods which should be adopted, but there is a disposition among employers to consider any proposal which may be brought forward with a view to improving and defining more clearly the conditions which should be observed; and considerable interest is also evinced in the matter of improving the co-ordination of scientific study and practical work.

Following, and as the result of, the replies received by the Committee, certain general conclusions were arrived at, and discussions were subsequently held with representative members of the various branches of the engineering profession, one of the points for discussion being the disinclination among manufacturing engineering firms to afford special facilities to students who have gone through college courses of study. The conference was divided into sections, namely: (1) Railway, Railway Mechanical and Dock Engineers; (2) Municipal Engineers; (3) Waterworks and Gasworks Engineers; (4) Manufacturing Engineering Firms; (5) Engineers in Private Practice. There was no special section for electrical engineers, whose work now covers a very wide field, including a knowledge of railway engineering, mechanical engineering, and mining engineering, and touches more or less intimately all known branches of engineering, but from the point of view of the conference perhaps that which bears most directly upon electrical engineering training is the evidence given by manufacturing engineering firms, and engineers in private practice.

In the manufacturing section Mr. Andrew M. Alexander, speaking of his experience at the Thames Iron Works, said that he adopted a three years' system of pupilage, of which two years were spent in the works and the third in the drawing office—designing, drawing, estimating and the like. The only entrance conditions were that the pupil should have received a good general education, followed, if possible, by a technical course at a university or equivalent institution. If not already qualified for admission as a student of the Civils he had to undertake to qualify if possible during the first year. He was encouraged to continue his studies, particularly in any subject he was weak in, and in subjects bearing upon the work he was in close touch with during the day.

On the first Monday in every month the pupil had to present to Mr. Alexander a report with sketches or photographs so as to accustom himself to the method of reporting.

A small premium was paid which was returned in wages. No undertaking was given as to future employment; that rested largely with the man himself, but generally speaking a pupil was appointed as resident engineer in charge of works carried out by the company, and in this way got a start in a professional career. Mr. Alexander himself took a personal interest in all his pupils. He gave instances of several men who had passed through the Thames Iron Works and were now occupying responsible positions at home and abroad.

Mr. Alexander referred to the question of specialisation. In medicine and law, he pointed out, one becomes a general practitioner first and a specialist last, but in engineering the reverse is generally the case. On coming from his technical college a pupil is put on to the building of large dock gates, bridges and so forth, and gets his mind full of what is called structural steel work, then after his three years' pupilage he may get a berth with the public works department, and be sent to India on irrigation work and do very well at it. He thought it a remarkable thing that a man could go from special to general work, but he had come to the conclusion that it did not matter very much where a man was placed for his practical work if he had a sound education. He found also that men who had been highly educated were those who worked with the greatest zest and best will and the greatest activity, glad to have the privilege of blacking their hands. Moreover they were generally the most popular with foremen, supervisors, inspectors, and so on.

Mr. Alexander's view generally was that the best course is for a man to matriculate as early as possible, then obtain the best college course he can, say in three, or better, four years, then go to some member of the Institution who has the opportunity and will to educate him, and spend three years in a works or on a contract.

(To be concluded.)

IMPORT TRADE OF SWEDEN.

The following figures showing the imports in 1912 into Sweden of electrical and allied goods are extracted from the official trade statistics which have just been issued. The figures for 1911 have been added, and increases or decreases shown, but owing to alterations in the official classifications, it will be noted that the sub-divisions of electric wire and cable imports are not comparable in detail but only in the totals:—

	1911. Kronor.	1912. Kronor.	Inc. or Dec. Kronor.
Electric meters.—			
From Germany	692,000	808,000	+ 116,000
,, Great Britain ...	68,000	81,000	+ 13,000
,, Other countries ...	7,000	7,000	—
Total	767,000	896,000	+ 129,000
Electric incandescent lamps.—			
From Germany	929,000	1,016,000	+ 87,000
,, Austria-Hungary ...	20,000	16,000	− 4,000
,, Holland	91,000	—	− 91,000
,, Other countries ...	16,000	26,000	+ 10,000
Total	1,056,000	1,058,000	+ 2,000
Dynamos and parts thereof.—			
From Germany	162,000	200,000	+ 38,000
,, Great Britain ...	—	14,000	+ 14,000
,, Switzerland ...	23,000	—	− 23,000
,, Other countries ...	16,000	8,000	− 8,000
Total	201,000	222,000(a)	+ 21,000
(a) Over 500 kg. in weight.			
Electric motors and parts thereof.—			
From Germany	468,000	389,000	− 79,000
,, Great Britain ...	12,000	16,000	+ 4,000
,, Switzerland ...	—	13,000	+ 13,000
,, France	11,000	—	− 11,000
,, United States ...	19,000	19,000	—
,, Other countries ...	34,000	34,000	—
Total	544,000	471,000(b)	− 73,000
(b) Up to 500 kg. in weight.			
Electric cables covered with lead.—			
From Denmark	—	35,000	+ 35,000
,, Germany	5,215,000	3,976,000	− 1,239,000
,, Holland	49,000	59,000	+ 10,000
,, Great Britain ...	267,000	405,000	+ 138,000
,, Other countries ...	5,000	33,000	+ 28,000
Total	5,536,000	4,508,000	− 1,028,000

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	1911. Kronor.	1912. Kronor.	Inc. or Dec. Kronor.
Turbines.—			
From Germany	33,000	No	—
,, Great Britain ...	7,000	details.	—
Total	40,000	4,000	– 36,000
Telephone and telegraph apparatus.—			
From Germany		47,000	—
,, Great Britain ...	No	32,000	—
,, Other countries ...	details.	29,000	—
Total	18,000	108,000(c)	+ 90,000
Transformers and parts thereof.—			
From Germany	242,000	97,000	– 145,000
,, Switzerland ...	16,000	—	– 16,000
,, Other countries ...	6,000	14,000	+ 8,000
Total	264,000	111,000	– 153,000
Accumulators.—			
From Germany	796,000	999,000	+ 203,000
,, Great Britain ...	27,000	—	– 27,000
,, Other countries ...	2,000	7,000	+ 5,000
Total	825,000	1,006,000	+ 181,000
Rheostats, switches, etc.—			
From Germany	799,000	657,000	– 142,000
,, Switzerland ...	24,000	—	– 24,000
,, Denmark	40,000	—	– 40,000
,, Other countries ...	18,000	38,000	+ 20,000
Total	881,000	695,000	– 186,000
Elevators.—			
From Germany	19,000	14,000	– 5,000
,, Other countries ...	18,000	9,000	– 9,000
Total	37,000	23,000	– 14,000
Cranes.—			
From Germany	255,000	118,000	– 137,000
,, Great Britain ...	109,000	138,000	+ 29,000
,, Other countries ...	93,000	44,000	– 49,000
Total	457,000	300,000	– 157,000
Copper wire of at least 0.5 mm. diameter (new classification in 1912).—			
From Germany	No	356,000	—
,, Austria	details.	17,000	—
Total		377,000	—
Copper wire, twisted, and cable not insulated.—			
From Germany	79,000	66,000	– 13,000
,, Other countries ...	5,000	3,000	– 2,000
Total	84,000	69,000	– 15,000
Copper wire covered with textiles.—			
From Germany	11,000	No	—
,, Other countries ...	2,000	details.	—
Total	13,000		—
Copper wire covered with rubber.—			
From Germany	No	No	—
,, Other countries ...	details.	details.	—
Total	3,000		—
Copper wire otherwise insulated.—			
From Germany	320,000		—
,, Great Britain ...	21,000	No	—
,, Other countries ...	1,000	details.	—
Total	342,000		—
Other electric cable.—			
From Germany	404,000		—
,, Great Britain ...	29,000	No	—
,, Other countries ...	1,000	details.	—
Total	434,000	4,000	– 430,000
Steam boilers.—			
From Germany	68,000	319,000	+ 251,000
,, Great Britain ...	26,000	20,000	– 6,000
,, Other countries ...	16,000	47,000	+ 31,000
Total	110,000	386,000(d)	+ 276,000

(c) Includes wireless apparatus 11,000 kr.

(d) Includes feed heaters and gas generators.

Krone = 1s. 1½d.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

(*Abstract of Inaugural Address by* Sir John Snell, President I.E.E., *delivered on Oct. 29th*, 1914.)

With faith in the ultimate triumph of our cause, every corporate body like this Institution must persevere in its normal and proper duties and must perform them faithfully and diligently. Electricity enables us to command the seas, through messages and directions sent to our glorious navy, and to maintain communications with distant parts of this Empire. We thus obtain our food supply and maintain our trade, without which our whole social fabric would be paralysed. We may indeed be thankful that in this war which we did not seek, but which for our national honour and, perhaps, one may add, for our existence as a great empire, we were obliged to undertake, the discoveries and experiments of Faraday, Hertz, Preece, Lodge, and Marconi, to mention only a few of those who have assisted to develop wireless telegraphy, have enabled such dispositions to be made by those in command as, it may be hoped, will more speedily bring to an end this calamitous struggle.

Much criticism has been levelled against the Council on account of the formation of a short-lived Industrial Committee and its subsequent disbandment. It is really a very difficult matter to deal with, much more so than critics appreciate. Some of the matters referred to this committee were of a controversial nature, and to give decisions on controversial subjects affecting two sections of the industry which may happen to be opposed in their views must necessarily involve serious and sometimes insuperable difficulties.

In my opinion there must be, apart from the Institution, separate bodies who will deal with their own immediate and particular interests. The Incorporated Municipal Electrical Association, for instance, deals particularly with municipal interests, and has done and is doing splendid work. The British Electrical and Allied Manufacturers' Association deals with the commercial and industrial details of the great electrical manufacturing interests and has become a powerful organisation. The Electrical Contractors' Association, again, deals with the contracting side of electrical work, more particularly consumers' installations; the Tungsten Lamp Association with metal lamps; and the power companies have their own interests to watch, and so forth. In certain cases the interests of two of these bodies may be diametrically opposed, and yet the members of most of them are united within this institution. In view of this possible conflict of interests, it would obviously be impossible for the Institution to exercise functions such as those which the various sectional Associations so successfully carry out, each one from the point of view of the particular section of the electrical profession which it represents. On the other hand, the Institution must adopt not only a sympathetic attitude towards each and all of them, but also be ready to help them or, if asked, to arbitrate between them.

There is this essential difference between the Institution and any one of the sectional associations. The Institution has to consider electrical progress as a whole, while, on the other hand, each association has its own particular sectional interest to advance. It is in that sense that there must be sectional associations apart from the Institution, and that the Institution must maintain a broad and impartial outlook over the whole profession and electrical industry.

We ought also to be well informed on all legislative matters affecting the use of electricity, to be prepared to assist Government Departments when required, and to make representations to them when necessary in the interests of electrical development.

The Council defined their attitude towards such interests in their last annual report. I think all members, except, perhaps, a few extreme sectarians, will desire that the Council should preserve an absolute impartiality towards all sections of the profession; but that must not be interpreted as standing aloof and doing nothing to promote the interests of the profession as a whole.

I think some organisation can be created which will be constantly ready to consider any question that may arise from among the many sectional interests which the Institution incorporates. The most flexible organisation that I can suggest is the formation of a standing advisory committee, composed, say, of the president, three past presidents, and three members of council. There must be, first, some continuity of action on the part of such a committee, and that is why I suggest that some of its members should be past presidents, otherwise the committee would be continually changing its personnel. On the other hand, three members of council and the president for the time being would bring in fresh blood. This standing advisory committee might be given power to add to its number, choosing from among other members of the Institution. I do not know, of course, how this suggestion will commend itself to the Council, and it must be understood that I am only expressing my own opinion.

Suppose a Government Bill be brought in to amend the Electric Lighting Acts, I would suggest that the draft Bill

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should be referred to the Advisory Committee for report, the Committee thus acting as a Parliamentary Committee. A few outside corporate members or associates would be invited to join them *ad hoc*, and so a strong committee, including these specially co-opted members, would deal with the particular subject; and when the particular work was done the co-opted members or associates would be released from their duties, though the nucleus committee would remain.

Or again, suppose a difficulty were to arise between two sectional associations, and suppose the Council were invited to compose the difficulty. The advisory committee would again invite certain members fully experienced in the subject in dispute to join them for the time being; and thus the best thought would be brought to bear on the subject. Conferences with both parties could be held, and it may be hoped that either a fair compromise would be arranged or a direct report made to the council that some definite attitude should be adopted by them and that the Institution's influence should be directed in some specific direction.

The ultimate power to act must of course rest with the council, who clearly cannot delegate their powers and responsibilities to another body. Much time would have to be given by this committee to the interests of the Institution in order to do effective work, and the duties would certainly be heavy; but if the result is likely to be good there are many among us who would give our services freely.

The greater part of the work must necessarily fall on members residing around London, and in the advisory committee which I have outlined the nucleus would probably have to be formed from London members; but specially co-opted members could be drawn from any district.

It has been suggested that the Institution could do good work by organising lectures in various parts of the country so as to educate people in the application of electricity to various kinds of industrial power, or in the advantages of electric lighting or of electric heating and cooking. I do not for a moment say that all proper means to develop the use of electricity should not be adopted, but it would seem from my past experience that lectures and demonstrations can be best dealt with by local organisations, such as the municipal and company-owned electricity undertakings and their commercial departments. I think they are then more effective.

One good piece of work has been recently accomplished by the issue of the new "Model General Conditions for Contracts." I myself think that these conditions establish a very fair relationship between the purchaser, the contractor, and the engineer respectively; and it may be hoped that they will find general acceptance and adoption.

Remuneration of Young Engineers.

In what way can the Institution help the younger men? The Council have been asked at various times to assist in finding positions for their younger brethren and to regularise and improve the status and pay of young engineers. In a general way, and in time, the improvement in the status of associate members, due to the system of examinations and the qualifications now necessary, will have a good effect in this direction. I do not see, however, that the Institution can very well become either a trade union or even a labour bureau.

That there are serious causes for complaint from the younger electrical men I am certain. Let us look for a moment at some of the causes. One of them is supply and demand. If, for example, a vacancy for a junior occurs in a power station, the moment the post is advertised there is a crowd of applicants, with the result that the next time a similar vacancy occurs the salary offered is sometimes less than before. That, undoubtedly, is one cause of low salaries. I would ask fellow-members who are heads of departments to do this—to give so far as is reasonable and proper a preference to applicants who belong to the Institution (in a very short time this qualification should be indispensable); and in fixing salaries, do not think so much of recording a small fraction of a penny less per unit sold on the costs sheets, but remember first that we were all at one time juniors, that the price of living has gone up and is going up, and that the best can be expected from anybody only if he is adequately paid, and if reasonable opportunities for advancement are held out to him. I know it is difficult, because engineers and managers are not always able alone to deal with such matters. There are municipal committees or boards of directors who are naturally anxious to see good returns. Nevertheless, chief officers can do good service to their younger brethren if they choose.

Another cause in many cases has been the want of thorough training—sometimes too much time has been spent on theoretical training and not enough on practical work—or in other cases there has been workshop experience without proper or sufficient technical training. This want of balance is rapidly being put right, thanks to the co-ordinated efforts of our universities and technical colleges.

I hope that as the result of the various remedial forces now at work the remuneration of electrical engineers during the earlier stages of their career will soon be improved.

National Service.

patriotic and untiring service to this cause, circularised the members of the Institution at the instance of the specially appointed National Service Committee, a very large number of our members of all classes—nearly 500—offered their services. A very large majority volunteered either for service at home or abroad. Acting in company with the President and Secretary of both the Institution of Civil Engineers and the Institution of Mechanical Engineers, it was first suggested that these three institutions should form an "Engineering Institutions" Battalion for service in the field, and that we should clothe, house, feed, and train the recruits, so that when ready the battalion could be handed over to the War Office in a condition of complete readiness. The Institutions of Civil and Mechanical Engineers readily gave the weight of their influence to the movement, and in our own case we are particularly indebted to one of our members, Major-General R. M. Ruck, C.B., R.E., for his invaluable counsel and assistance and for his influence at the War Office.

There then came an unexpected proposal that the three principal engineering institutions should recruit the Engineer Units for the Royal Naval Division, just then authorised to be formed. The response from members of all classes of all three institutions was so spontaneous that the corps was formed within a few days by men not only of splendid physique but also of highly skilled intelligence, professional men trained in various branches of engineering, and forming a personnel of the highest value to the Admiralty. All three institutions owe Mr. W. Duddell, F.R.S., Mr. A. P. Trotter (who was one of the originators of the movement), Mr. Robert Hammond, Colonel D. E. Ruck, R.E., our Secretary, Mr. Rowell, and the staff of the Institution, who were all indefatigable in their labours as recruiting agents, a great and lasting debt for their untiring energy and enthusiastic assistance in this loyal movement which has met with so great a success.

It is not the first time that this Institution has been instrumental in showing its loyalty to our King and to the Imperial cause. The Electrical Engineers (Territorial) R.E. Battalion is in the King's service to-day, and the members of it are on duty under the command of my old friend Lieut.-Colonel Le Rossignol, R.E., at several of our important defence works. Many of our members are also serving in the Signalling Corps of the London Army Troops under Colonel E. H. Leaf, R.E., men able to utilise their skilled experience in telegraphic and wireless services. Many others of our members have also joined other regiments.

Legislation.

Except in the further facility needed to allow undertakers to establish show-rooms and to let fittings on hire, with due regard to the interests of electrical contractors, one does not see that much improvement can be suggested on the present laws affecting the supply of electricity.

The Electric Lighting Bill which it is the desire of the Municipal Association to have placed on the Statute Book is one of very great importance to the whole industry. The Bill, as now drafted, is receiving the support of the Manufacturers' Association, but I understand that the Contractors' Association does not approve of it. I have carefully read the Bill, and, speaking from an entirely detached and independent position, I cannot feel otherwise than that non-agreement is regrettable and contrary not only to the public interests, but to the interests of the contractors themselves. Contractors will not be competed with by the supply authority in any wiring contracts, since the proposal is that undertakers "shall not themselves execute the wiring of private property," but they will be placed in competition undoubtedly in "providing, selling, letting on hire, fixing, repairing and maintenance of fittings, apparatus and appliances for lighting, heating, and motive power," though there are proper safeguards to prevent the public authority from undercutting contractors.

Surely a reasonable compromise could be arrived at which would be mutually advantageous. Increase of business should be the first direct result of the passing of a Bill of this nature, and therefore more wiring contracts.

This is a case where, in the public interest and in the general interest of the whole electrical industry, the addition of such a measure to the existing Electric Lighting Acts would appear to be of immense value to all interests—municipal or company undertakings, manufacturers, and, in my opinion, contractors. A way should be found to pass it in a form which would bring the greatest benefits to contractors as well as to the supply authorities.

Let me now turn for a time to some of the problems which are constantly before us and with which one is often called upon to deal.

Bulk Supply.

Take first the question of bulk supply. I do not want now to enter into the matter controversially, and will deal only with what I think are facts. There is no doubt, were we beginning anew, that instead of each small local authority putting down an independent power station, considerable waste of money and fuel would be avoided by establishing one large system for several adjacent areas supplying energy to each smaller area for local distribution. Even in some cases where there are existing small power stations, some of them unfavourably situated for cheap generating costs, it would probably pay to extend one of the better placed stations only and to supply the others therefrom rather than to extend each local station from time to time.

Unfortunately there are the somewhat narrow views of some of the local engineers and local councils which prove to be serious obstacles. There is, however, another side to the question. It may be generally said that once a small station is built and the expenditure has been incurred, then and so long as the system is kept within defined limits of extension, the *extra* operating cost of an addition to the local power station is often cheaper than any commercially feasible bulk supply. I have had to enquire minutely into many such cases, and in most of them the decision has necessarily been

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to extend the local plant. No commercial alternative was possible.

A case arose a short time since where a comparatively small station—less than 2,000 kw.—required supplementing. The annual load factor, based on 30 minutes' sustained load, was 36 per cent. A neighbouring very large undertaking offered a bulk supply at very low terms—far lower than any terms yet mentioned in the various London power schemes. It was impossible to demonstrate that it would pay to purchase all the energy locally required from the bulk supplier, because of the dominating effect of the capital outlay and the standing charges on the existing local plant, which, of course, had to be paid whether the bulk supply were taken or otherwise. It was difficult to show any economy from the bulk supply when compared with the extra operating cost resulting from an extension of the local plant. Finally, the best terms were made for both parties by the local station undertaking to run its plant for one shift during only four months of the year, thus entirely taking the local load off the winter demand of the bulk station—that is to say, a co-operative system such as was proposed in the original London County Council schemes seven years ago.

I am firmly of opinion that no economy can be shown in the generality of cases where there are modern and properly managed undertakings whose capital expenditure on buildings and plant is not yet redeemed or written off, unless energy can be supplied by a bulk authority at rates not exceeding £2 10s. per kilowatt of maximum demand and 0.25d. per unit delivered for untransformed high-tension energy. In many cases the bulk figures would even have to be lower. We hear much of the benefits of bulk supply—there are benefits in certain cases, admittedly—but committees are often misled by receiving a proposal to pay £3 per kilowatt and 0.25d. per unit sold to them, which at first sight, when resolved into the particular price per unit, appears to be so much less than the local costs of generation. It is not always understood by the committees, or even by the public or non-technical Press, that many additions have to be made to the bulk figure before a proper comparison can be made with the local costs. When these other additions are made it is found that the bulk authority's figure is, of course, considerably enlarged. Yet one often finds that comparisons are wrongly made between the quoted bulk figure and the local cost. Such unskilful comparisons are injurious to the public interest, disseminate false ideas, and cause much trouble.

While this problem of assisting local stations from a bulk authority gives rise to these difficulties, it is generally true that a new local area about to install an electrical system would do well first to obtain terms from a reliable bulk-supply authority, if available, before deciding to build a local power station. Better still, in many cases, while the local authority would find the capital to build its local sub-stations and to lay its distributing network at probably cheaper rates of interest than a bulk authority can raise money, it can reduce expenses to a minimum by arranging for all the administrative work and upkeep of the local system to be undertaken, under proper supervision, by the bulk authority, the local authority only collecting the revenues.

What we all desire to see is electricity sold at the cheapest rate and at a reasonable profit to consumers, whether of the industrial or residential classes, at the same time to avoid

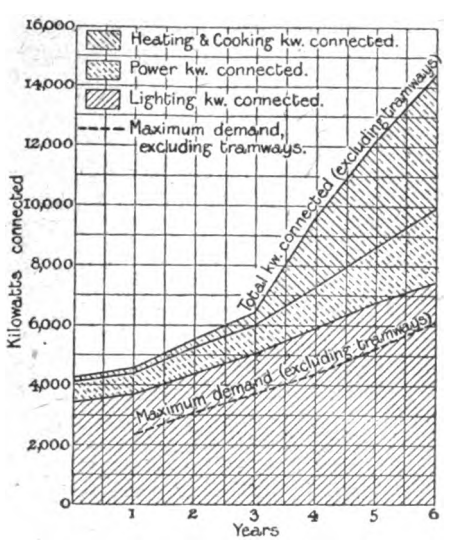

Fig. 1.

waste of capital and not to incur unnecessary working expenses. Such a policy means more consumers, greater output, more plant and apparatus, and is good for the industry and for the nation in every way.

The Local Government Board, which controls to a limited extent the expenditure by the various municipal electrical undertakings that represent the great majority in this country, could do much in this direction. I should like to see a complete survey made by the Board of the present position of all the electrical authorities, so that in those cases where amalgamation of electrical interests, or purchase of energy from some outside source for local distribution, ought rather to be adopted in lieu of a local extension of plant, the Board would decline to sanction any loans for the proposed extension of local plant.

A thorough survey of the position in this manner, and consequent action on the lines suggested, might not only save public money but would also conserve our stores of coal, and therefore be of ultimate service to the community. Moreover, it would enable the public systems thus to supply consumers on the most favourable terms. I do not at all say that this can be done universally, but I do know that there are several groups of undertakings where concentration on the lines which I have suggested would produce economies.

Domestic Supply.

Another matter of great interest to us all at the present time is the domestic supply. To my mind it is an unnecessary cost to the consumer and a brake upon progress to require two sets of wiring in any one residence. The supply for lighting on the one hand, and for heating and cooking on the other, should not be differentiated in the consumer's installation. Let us endeavour to remove all unnecessary barriers to a generally increased use of electricity. One meter and one set of apparatus generally would then suffice, with a consequent less cost per service to the supplier.

I have had during the last two years to enquire exhaustively in more than one instance into the cost of supplying electrical energy for heating and cooking. It is a fact that there is a very great diversity indeed between the lighting and cooking loads, whether in London or in the provinces. Fig. 1 reproduces an actual case. While the lighting and power connections are steadily rising, the heating and cooking connections are increasing at a greatly accelerated rate; but as will be seen, the maximum load on the power station is rising proportionately to the lighting and power only, and is practically unaffected by either the heating or cooking additions.

Several important things are shown by this, namely—

(*a*) A greatly improved annual load factor.

(*b*) The great diversity between the heating and cooking loads and all other classes of supply.

(*c*) Not only the consequent better utilisation of the generating plant, but also of the feeders and distributing mains.

Analyses of daily load curves showed that the daily load factor in the summer had increased from 26 per cent. to 37 per cent. for comparable days in three successive years, and in the winter from 38 per cent. to 42 per cent. The effect on the daily load factor of this increased domestic supply is therefore more marked in the summer than in the winter, and this result would have been expected. The whole effect in this instance is to level up the daily load factor throughout the year. Confirmatory results have also been obtained in other districts. It is safe to say that a great increase in the output for the purposes of domestic supply must be expected and must be provided for. In some cases I find that the ratio of other domestic units to the lighting units is as high as 10 to 1. An average of all the private residences in one provincial town gave a ratio of 3.5 to 1; shops, however, only gave a ratio of 1.2 to 1, while offices gave the highest ratio, viz., nearly 5 to 1. It is probable than in the near future existing consumers who now take energy only for lighting or heating to a very limited degree will be purchasing from 4 to 5 times the number of units metered at present. This will mean a very greatly increased output and improved load factors. Increased load factor and larger output will react on and reduce the costs of production. Increased output of utensils and apparatus will reduce their cost also, coupled with the constant improvement in the apparatus itself, and in its efficiency and durability. All of these factors are favourable to a greatly increased use of electricity.

I look forward to a general rate of 1d. per unit for domestic supply; but the time is not quite ripe yet. For the present, most undertakings must have recourse to a modification of the Hopkinson system, that is, either to a fixed charge per kilowatt (or fraction of a kilowatt) connected, plus a minimum charge per unit metered; or, where assessments permit, a fixed charge based on the rateable value, plus the running charge per unit metered.

Future Charges to Consumers.

What are the prevailing figures now? Energy for domestic lighting costs, say, 2½d. per unit; the cost of power varies from 1d. down to ½d. according to the load factor, size, and kind of supply (*i.e.*, whether transformed and converted, or untransformed high-tension energy). Special supplies are given under exceptional circumstances, such as restricted hour, non-peak loads, at still lower rates such as 0.15d.; these, however, may be termed by-products. The average cost to the consumer in this country is now 1.56d. per unit, and in London it is 2.15d. I do not know any other country that can show as good figures, except in one or two instances of exceedingly large supplies to railways and traction systems.

It may be worth while to consider what possibilities lie before us so far as we can now foresee. There are so many factors to be considered that without considerable sacrifice of capital and a complete change in public custom and opinion, one cannot reasonably look to the whole electrical supply in a province being given by one system. Undertakings above a certain size and output are bound to continue independently.

Let us suppose, however, an ideal case of generation on a large scale in power stations dependent on fuel, and transmission

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to various parts of an extended province, partly by overhead lines, partly by high-tension cables, the transmission pressure being, say, 30,000 volts. Suppose, further, that the output embraces a supply to transportation systems (railways and other traction systems), wide classes of industries, such as chemical works, collieries, mills, shipyards, engine works, and also that the domestic supply reaches the extended application which I have suggested. The resultant average annual load factor at the power stations might then possibly reach 50 per cent. It seems to me physically impossible to expect a higher resultant figure over the whole generating system. The undertaking equipped with large generating sets and simple inexpensive buildings, could be erected for about £8 per kilowatt installed. That must be considered to be absolutely a minimum. The average cost per unit sold, including 5 per cent. interest on capital and adequate depreciation, would be 0.54d.

This means that prices such as the following properly assessed charges would have to be made to consumers of various kinds, allowing for a reasonable diversity factor:—

Class of supply.	Consumers' annual load factor.	Average proper price to be charged.	Probable future tariffs.
	Per cent.	d.	
Lighting ...	12·5—15	1·200	1½d. { domestic
Heating and cooking	40—45	0·447	½d. { average rate, ¾d.
Power	20	0·77	¾d. to ½d.
	25	0·64	
	30	0·554	
Public lighting	35	0·493	½d.
Special power, *e.g.*, mills	40—80	0·447 to 0·286	½d. to 0·3d.
Special non-peak loads		Down to 0·15d.	

These costs for various load factors are shown graphically in fig. 2.

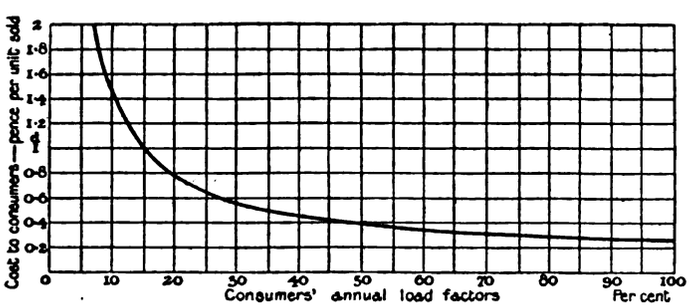

Fig. 2.

The two principal items of costs are fuel and capital charges. Now imagine some system of generation by which the cost of coal could be eliminated—such as the sale of by-products, which would balance the coal cost. The average cost of 0.54d. would only be reduced to 0.40d., and the average charges to lighting consumers would still have to be 1½d., while industrial consumers with ordinary load factors would have to pay prices ranging from 0.66d. to ½d. if the costs were properly apportioned.

Or, again, suppose the capital cost of the complete undertaking were reduced to half of that taken as a basis in the above figures, which would mean only £4 per kilowatt installed for the power house, and £12.5 per kilowatt installed for the sub-stations and mains (figures one may safely say cannot in any reasonable probability be ever reached); still the average cost of a 50 per cent. load factor would be 0.42d., and the lowest permissible charge to a lighting consumer would be 1½d., and to an ordinary industrial consumer from ¾d. to ½d. Thus we see the probable limitations of the reduction in cost of electrical energy supplied from power stations other than hydro-electric systems. In the latter the capital cost is generally the important factor, and the cost of production may be as high as that in a large steam-driven station.

It is therefore most unwise to talk about giving a general supply at ½d., or even ¼d. per unit. It is easily demonstrated that such figures are unattainable with any known methods, or from any developments which seem to be within the region of possibility.

In this country we are to a great extent dependent on coal for the maintenance of our industrial position. Coal is one of our great national assets, and it is lamentable to think how grossly it is wasted. It would pay in all but the smallest stations to have an assistant whose duties would wholly consist in noting the thermal values from the coal consumed right down to the remaining value per unit delivered to feeders, so as to improve the results and to minimise waste.

Capital Investment in Electrical Works.

As an indication of the development of electrical undertakings and companies in the British Empire, the following figures show a remarkable amount of capital invested.

	£
310 Manufacturing companies	46,703,047
178 Miscellaneous companies	8,756,417
Telegraphs and telephones	37,249,088
269 Electrical supply companies	58,364,885
262 Municipalities	49,656,951
104 Tramway undertakings	56,012,466
	£256,742,854

This huge total does not even then include Government telegraphs and telephones, power companies, or the capital invested by railway companies in electrification, which would greatly increase this total. It is nevertheless a very large amount, and is an indication of the great importance which the electrical industry has attained. When one considers that in a period of 30 years over 250 million sterling has been invested in electrical undertakings of various kinds, none can deny that electricity has become indispensable to the service of mankind.

Trend of Improvements.

We are gradually arriving at definite and accepted methods. In power-station work there can be no question that three-phase generation has such great advantages over any other system that it must be generally accepted as the system of the future. Turbo-alternators of the highest adaptable speed coupled to machines of simple design (by simple machines I mean one bar per slot) having the lowest consequential terminal pressure—stepping up through static transformers (thus giving the necessary protective reactance) to the switchboard busbar pressure—are almost certain to be generally adopted. Higher feeder pressures, now that insulated cables for very high pressures are commercially practicable, will no doubt be used, and distribution by the three-phase four-wire system will in my opinion be adopted wherever possible.

In the manufacturing section, steady progress towards standardisation is being made. If plant of whatever kind can be turned out in quantities, the articles are cheaper than when the stock order is small. Some continental competitors have realised this, and by absorbing the fixed charges at home, have delivered machines and materials here at prices which have been based on the "running costs" only. In so doing, however, they have improved their own factory load factor and increased their prosperity. Our manufacturers have an opportunity now, and if they will turn out standard plant more boldly and in numbers, economies to suppliers and purchasers alike will result, and increased output.

Steady progress is being made in our designs by the better utilisation of raw materials. There is now very little superfluous iron, steel, or copper in our generators and motors. In our distributing systems I am not so sure that we have made the same progress.

If we turn to railway electrification we seem as yet no nearer a solution of the rival claims of the overhead high-pressure system and the third rail. The tendency in this country is certainly in favour of the latter, because the great railways are confining themselves to suburban traffic, for which the third rail has decided advantages.

We have also to consider the equipment of lines in British Dominions and of British-owned foreign lines, where coal is generally so much dearer. In many of these cases, owing to the long distances to be traversed, it would seem necessary to adopt an overhead high-pressure system. There can be no doubt that the economic effect of suburban electrification in this country has been markedly successful, and has resulted in improved returns to those railways which have adopted it, and we can confidently expect that wherever commercially practicable further electrification will follow.

This is largely a commercial age, but while not neglecting the obviously necessary attention which we must give to commercial and industrial interests, let us not under-estimate the great privileges that we electrical engineers especially enjoy of understanding more clearly and of effectively using the great natural forces, in the utilisation of which electricity has been such a powerful agent; or of comprehending with clearer vision natural laws and the creative design that underlies and controls them all.

War and the Professional Classes.—Many members of the professional classes have been severely hit by the war and are already in distressed circumstances; an organisation has been formed under the title "The Professional Classes War Relief Council" to discover such cases, and to afford what aid is possible, by advice and indirect help rather than by monetary assistance. The main object is to bridge over the temporary difficulty caused by the war, and to pave the way to permanent and profitable employment. The education of children, maternity assistance, emigration, the provision of temporary employment, &c., will receive attention. For some purposes a fund will be necessary, and donations are invited, to be addressed to the Treasurer of the Council, 13 and 14, Princes Gate, S.W. The provisional Chairman is Major Leonard Darwin, who is supported by a large body of distinguished men and women. A large house has been lent for the Maternity Nursing Home, and Mrs. Hills, 32, Prince's Gardens, S.W., will be glad to receive offers of furniture of all kinds on loan or as gifts.

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HEATING AND INSULATION DETERIORATION OF CURRENT-CARRYING CONDUCTORS.

A voluminous report dealing with theoretical and experimental investigations on this subject was published some time ago by the Electrotechnical Laboratory of Tokio.* The main object of the research was to establish general formulæ for the temperature at any point in the covering of insulated conductors, and for the insulation resistance and breakdown voltage of the covering as a function of the temperature of the conductor, and thus of the current carried. The experiments were conducted with cleat-suspended wiring, such as is generally employed in Japan, but the theoretical formulæ established are applicable to any case, and include :—(1) Formulæ for temperature rise as function of current carried. (2) General and approximate formulæ for insulation resistance as function of current carried and room temperature. (3) Formulæ for breakdown voltage. The thermal and electrical constants involved by these equations being determined by experimental investigation of the thermal and electrical characteristics of various covering materials, "practical" formulæ have been derived by substitution in, and simplification of, the general theoretical formulæ.

As our readers are doubtless aware, the theoretical investigation of this subject involves cumbersome equations—particularly where multi-layer coverings are concerned. The mathematics involved is not difficult, but the cumbrous nature of the expressions derived forbids their reproduction in these columns. Even the "practical" formulæ are so formidable in appearance that their actual practical application must be limited. Fortunately, however, the author has himself applied his formulæ to the calculation of certain useful tables, which are presented in the appendices to the report, and are reproduced in abstract herewith.

Insulating Materials Investigated.—The conductors investigated were covered with :—(1) High-grade insulation (pure, separator and jacket rubber, cotton tape, and impregnated cotton braid); (2) low-grade insulation (vulcanised rubber and cotton braid; (3) Tokio-Sen (impregnated cotton). Analysis of the three classes of rubber concerned gave the following results :—

	Rubber.	*Separator.*	*Jacket.*	*Vulcanised.*
Specific gravity	...	1·695	1·693	1 679
Rubber...	... ...	38·93 %	22 90 %	16·04 %
Rubber substitutes	...	1·94 %	5·57 %	7 92 %
Sulphur—combined	...	1·16 %	6·85 %	8·12 %
,, free	...	0 72 %	0·23 %	0·40 %
Fats and resins	...	0 40 %	9·53 %	13·45 %
Bitumens ...	...	nil.	0·30 %	1·00 %
Ash ...	... ...	53·56 %	54·85 %	53 48 %
Loss at 120° C. for 1 hr.		1·19 %	2·11 %	1·16 %

Methods of Measurement.—The temperature rise of conductors was calculated from the change in ohmic resistance, and the temperature of insulating coverings was determined by aid of specially constructed iron-constantan thermo-couples. For the insulation resistance and breakdown voltage tests, gas-heated water baths were employed. Insulation resistance measurements were carried out at 5° C. intervals by the deflection method, charging being effected by the application of 100 volts, D.C. for one minute, and lead-sheathed wires being used to secure an outer electrode during "dry" tests. Dielectric strength measurements were carried out at 10° C. intervals up to 80° C., using 50-cycle alternating current.

Specific Resistance of Copper.—For the constants in the equations—

$$R_v = \rho_v (1 + a.t + b.t^2) \text{ microhms per cm. cube,}$$

and

$$R_m = \rho_m (1 + a.t + b.t^2) \text{ ohms per metre-gramme,}$$

the author finds the following values :—

Copper.	*Hard drawn.*	*Soft.*
ρ_v	1·5862	1·5640
ρ_m	0·1409	0·1394
a	$4{,}192 \times 10^{-6}$	$4{,}218 \times 10^{-6}$
b	$16{\cdot}4 \times 10^{-9}$	291×10^{-9}

Specific Conductivity and Emissivity.—Theoretical formulæ for the specific conductivity K and the radiation coefficient E (watts per sq. cm. per 1° C. temperature difference) are developed, and the following average values are given for E and K :—

	E × 10⁶	K × 10⁶
Rubber—pure	—	140
,, separator	647	318
,, jacket	561	387
,, vulcanised	565	484
Cotton tape	552	434
Impreg. cotton braid—high-grade ...	514	288
,, ,, low-grade ...	520	323
High-grade insln. (as specified above) ...	552	224
Tokio-Sen	510-530	400-300
Lead	346	74,800

Insulation Resistance.—Formulæ expressing insulation resistance as an exponential function of temperature are inconvenient. A quadratic equation of the form—

$$k = k_0 (1 - a.t + b.t^2)$$

is sufficiently accurate for practical purposes, and is actually more accurate the smaller the temperature difference concerned. Average values of k_0, a and b, for temperature ranges from 15° to 35° C., and from 35° C. to 55° C. (normal and summer conditions), are given in the following table. The right-hand column in the latter shows the percentage recovery of insulation at 20° C. (during 12 hours' gradual cooling). The values for k_0 are in 10^{12} ohms per cm. cube.

Applicable between	15° and 35° C.			35° and 55° C.			Recovery of k at 20° C.
	k_0	$a \times 10^6$	$b \times 10^8$	k_0	$a \times 10^6$	$b \times 10^8$	
Rubber—pure—dry ..	19,475	33,060	386	11,652	90,649	249	51·3 %
—separator—wet ..	1,562	50,056	672	627	88,978	296	12
—dry ..	1,585	46,582	596	746	89,228	271	59
—jacket —wet ..	7,802	52,704	782	2,599	35,263	318	36·6
—dry ..	9,738	52,704	782	3,242	35,263	318	43·8
Common grade insln.—wet	2,967	47,898	609	1,246	88,655	292	55
—dry ..	3 121	49,294	651	1,386	33,690	116	57
Tokio-Sen	5,030	44 886	549	2,759	31,468	260	100

Dielectric Strength.—A small irregularity in the nature or thickness of the insulating covering affects very greatly the breakdown voltage of the latter, and, at temperatures up to 40° C., considerable discrepancy was observed between the dielectric strengths of pieces from the same sample of wire. At higher temperatures, however, the deteriorating effect of heating predominated, and samples of the same grade of wire broke down at practically the same pressure. Low-grade insulation does not fail by rupture, but is ultimately burnt by the leakage current. Whereas low-tension wires require a covering of high insulation resistance, high-tension insulation is graded for high dielectric strength. The author finds that the breakdown voltage for pure and separator rubber, in a certain case, = 170,000 (1 − 0·008 t) volts per cm., and, for jacket rubber, is 208,360 (1 − 0·008 t) volts per cm.

Specific Inductive Capacity.—The following average values are stated :—

Rubber—pure ...	1·908	Tape	... ...	1·049
separator	3·722	Braid	... ...	1·309
jacket ...	2·758			

Practical Formulæ.—By substituting average values for electrical and thermal constants in the general theoretical formulæ, approximate practical formulæ are evolved for :—Temperature rise at any point in the covering of the conductor; insulation resistance; and breakdown voltage. These formulæ are derived for various covering materials and for wires carrying and not carrying current. Very fair agreement is shown between data calculated from these formulæ and data determined by experiment, and from the new formulæ it follows that a No. 20 S.W.G. wire will carry 10 or 11 amperes; a No. 8 S.W.G. wire about 75 amperes; and a No. 0 S.W.G. wire 195-200 amperes, if insulated with Tokio-Sen or the high or low grade insulations mentioned above. These ratings assume 20° C. temperature rise (15° to 35° C.), and at the higher temperature the insulation resistance is in each case approximately one-third or one-fourth as great as at the lower temperature. The author suggests that the current-carrying capacity of insulated conductors be determined by the deterioration in their insulation due to heating, and in this connection his formulæ are readily applicable to determination of the current corresponding to any specified decrement in insulation resistance. Actually, however, there would be excessive pressure drop in conductors rated simply by the 20° C. heating limitation. Only short circuits could be thus operated, and in few cases would mechanical considerations and the actual current to be transmitted enable full advantage to be taken of the thermal rating suggested.

* T. Hirobe. Report No. 12 of third Section.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

War and Science.

I do not know whether you are indeed desirous of arriving at the truth of the matter treated in your leader "War, and the Neutrality of Science" to such an extent as to give me, an American citizen of Austrian birth, an opportunity to reply thereto.

I do not think you will find a single German scientist of any importance who will not agree with you on the international nature of science.

As for the utterance ascribed to Dr. Lenard, if, indeed, it is a matter of positive utterance, it seems to me that your leader does not consider it quite fairly. On page 453, your correspondent, Mr. A. A. Campbell Swinton, includes the following passage in the alleged statement of Dr. Lenard :—

"The spirit of these great men has long ago passed into the souls of the living—and more so in those countries which England is trying to put down than in England itself."

The honest assumption of this being the case—which matter only history will be able to decide—justifies the hard judgment, the harshness of which is, of course, psychologically explained by the present conditions. These explain also the fervent patriotism which unites Germany and Austria to-day.

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Science, as you will grant, has made such tremendous strides in Germany during the last hundred years, that to accuse the leading intellects of this nation of a sudden loss of their reasoning powers would be equal to more than rashness. . . . May I remind you also that German scientists have again and again stood unwaveringly for universal and humane rights, have battled for political freedom as well as freedom of thought. Cool deliberation—perhaps it is unfair to demand it of anybody to-day—must convince anyone that men like Haeckel and Hauptmann (to name leaders in two intellectual directions), cannot possibly be scared so as to fall in line with autocratic dicta after having opposed such bravely all their lives. To such men cool deliberation must concede—if *vox populi* does not prove anything, in your opinion—as much courage and brain power as any men in similar lines on the side of England and the Allies.

Permit me a few more words. You seem to consider the writings of Treitschke, Nietzsche and Bernhardi as responsible for the thought of Germany of to-day. This is rather like blaming the rainbow for the rain. These three writers are all esteemed by only a very, very small part of the German people and even intelligence. Nietzsche is a past issue, Treitschke and Bernhardi are largely the exponents of class interests foreign to those of Germany's and Austria's peoples. Prussian militarism has never had the sympathy of the majority in either of the two empires, but because its interests to-day are entirely in parallel with those of the great working class in both countries, it has the undivided support of these people. Even a year ago, the military budget in Germany was passed only with the greatest difficulty, and in Austria the Reichsrath was dissolved because of anticipation of such difficulties. But, as I said, the monarchy in Germany has assisted for the past 30 years in rendering the position of the worker better and more secure, and supporting his rights against the encroachments of his bosses; and the German people know just what good and what bad there is for him in this militarism, peaceful as the nation is. If English intentions were so friendly to the German people as is generally professed, Russian armaments would not have been furthered as they were, from Paris and London, for the preparation of a war which must necessarily decimate the German nation, no matter what the outcome of the present struggle might be. Trust the Germans to rid themselves of any overlords they don't want and have no use for, monarchy or "Grosskapitalismus," just as they managed to free themselves, and, moreover, Europe from the formerly indefatigable yoke of Rome.

As I read this over, I grow more and more convinced that it would be to expect not only fairness—an unfair expectation in itself at such a time as the present—but also bravery, should I hope for these lines to be published. But even if this cannot be done, I shall send this letter, knowing as I do by experience the fairness of the individual Englishman in his innermost reasoning and judgment, even when his thoughts are not given public expression for some reason or other.

Hans W. Weysz.

New York, *October 19th*, 1914.

Cable Censorship.

We regret to observe an editorial in your issue of October 16th containing a severe criticism of this company on account of an alleged protest by the Commercial Cable Co. against British censorship. This editorial is apparently based on a misunderstanding by you of our letter of August 20th, also printed in your edition of October 16th, on page 529. If you will refer to this letter you will observe that our protest was against the proposed censorship by the United States Government of trans-Atlantic messages, and had no reference whatever to the censorship of the British Government. As there was no ground whatever for your criticism, we trust you will at least give as much attention to correcting the mistake.

Fredk. Ward,
Manager in England, Commercial Cable Co.

London, E.C., *October 29th*, 1914.

[We fully understood that the censorship in question was that imposed by the United States Government, and we pointed out that, as a company registered in the United Kingdom, the company had incurred obligations to this country which could not be ignored. That the United States Government, in instituting the censorship, was acting in accordance with the wishes of the British Government cannot be doubted, and in opposing it the company was acting in opposition to British interests.—Eds. Elec. Rev.]

Who Can Help?

Please accept my best thanks for having given publicity to the matter of the young Belgian refugee. I am glad to say that I received two very generous offers of help, and that the refugee leaves here to-morrow to take up his new work feeling very grateful for the assistance given him. The local Belgian relief fund has been drawn on for his expenses.

Again thanking you for the part you have taken in bringing about such a satisfactory result.

L. W. Woodman,
Borough Electrical Engineer.

Dover, *October 29th*, 1914.

[We are glad to know that the refugee has been satisfactorily provided with employment. We also have a similar case on hand, and shall be glad to hear of any opening for a graduate of Brussels University, who has had considerable commercial experience.—Eds. Elec. Rev.]

Capturing German Trade.

Mr. E. J. Fox's letter in your October 2nd issue on the above subject voices the views of this writer and a good many others, no doubt, with respect to the necessity of something more permanent than war sentiment to aid domestic manufacturers to hold business against German competition after the war is over.

Only recently engineers connected with Corporations round London have frankly admitted to the writer that they would be buying German electrical goods as soon as the war was over, pointing out that the Corporation regulations, requiring them to purchase from the lowest bidder, compelled them to buy German goods in numerous cases. It would seem, as Mr. Fox states, that the country needs to adopt some commercial policy to offer protection to domestic manufacturers as a means of inducing capital to flow freely into line for the development of new enterprises and the extension of present industries.

Atlantic.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

21,157. "Points, switches, and the like of tracks for electrically-driven vehicles." R. Cumming. October 19th

21,175. "Electric switches." J. H. Tucker & J. A. Crabtree. October 19th.

21,184. "Electrical pressing-irons." A. E. Reimers & F. F. Kiefer. October 19th. (Complete.)

21,185. "Telegramophone microphone." V. B. Krigh & A. Meyer. October 19th. (Convention date, October 16th, 1913, Denmark.) (Complete.)

21,189. "Method of influencing the electrical charge of a diaphragm." Ges. fur Elektro-Osmose m.b.H. October 19th. (Convention date, November 6th, 1913, Germany.) (Complete.)

21,190. "Treatment of materials for impregnating them electro-osmotically." Ges. fur Elektro-Osmose m.b.H. October 19th. (Addition to 19,849/14. Convention date, January 7th, 1914, Germany.) (Complete.)

21,206. "Process for the manufacture of metallic powders." S. O. Cowper-Coles. October 19th.

21,264. "Cold moulding or phenolic condensation products." E. Hemming & Hemming Manufacturing Co. October 20th. (Complete.)

21,266. "Telephone systems." E. G. Godfree. October 20th.

21,302. "Dynamos." H. Leitner. October 21st.

21,338. "Telephone systems." A. B. Smith. October 21st. (Convention date, October 22nd, 1913, United States) (Complete.)

21,354. "Magnetic clutches." M. Walker. October 22nd.

21,368. "Contact breakers or interrupters." G. F. Cook. October 22nd.

21,375. "Electrical inspection lamps and other kinds of lamps." W. E. Halladay. October 22nd.

21,388. "Wireless signalling systems." British Thomson-Houston Co., Ltd. October 22nd. (General Electric Co., United States.)

21,389. "X-ray devices." British Thomson-Houston Co., Ltd. October 22nd. (General Electric Co., United States.)

21,397. "Electricity meters." F. Garcia & F. de Diego (trading as Soc. Colectiva F. de Diego y Garcia). October 22nd. (Complete.)

21,411. "Magnetic compasses." G. A. Grove. October 23rd.

21,435. "Electric Incandescent lamps." British Thomson-Houston Co., Ltd. October 23rd. (General Electric Co., United States.)

21,448. "Process for purifying and separating the constituents of glue, gelatine, or bodies like glue, or containing glue, with the aid of electric current." Ges. fur Elektro-Osmose m.b.H. October 23rd. (Convention date, March 2nd, 1914, Germany.) (Complete.)

21,449. "Semi-automatic telephone systems." Betulander Automatic Telephone Co., Ltd., W. Aitken & D. C. Crowe. October 23rd.

21,450. "Semi-automatic telephone systems." Betulander Automatic Telephone Co., Ltd., W. Aitken & D. C. Crowe. October 23rd.

21,474. "Receiving arrangements for wireless telegraphy." T. W. Stratford-Andrews & A. Orling. October 24th.

21,482. "Electrical insulation of track rails." C. P. Sandberg. October 24th.

21,483. "Process for purifying bodies which yield glue or gelatine." Ges. fur Elektro-Osmose m.b.H. October 24th. (Addition to 21,448/14. Convention date, March 2nd, 1914, Germany.) (Complete.)

21,484. "Process for the manufacture of gelatine suitable for photographic emulsions." Ges. fur Elektro-Osmose m.b.H. October 24th. (Addition to 21,448/14. Convention date, March 2nd, 1914, Germany.)

21,488. "Automatic cut-outs for electrical installations." A. H. Midgley & C. A. Vandervell. October 24th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

19,109. Plates for Electrical or Secondary Batteries or Accumulators. E. Hancock & D. David. August 22nd.

19,919. Electrical Transformers. F. Coates, J. Mirrey & A. Reyrolle & Co. September 3rd.

21,672. Connections of Electrical Condensers. Marconi's Wireless Telegraph Co. & R. N. Vyvyan. September 25th.

22,406. Telephone Hand Sets. Western Electric Co., G. H. Nash & B. B. Grace. October 4th.

22,416. Electric Water Heating and Supply Apparatus. A. F. Berry. October 4th.

22,544. Manufacture of Resinous Condensation Products. British Thomson-Houston Co. (General Electric Co.). October 6th.

23,030. Apparatus for Displaying Announcements, Advertisements, and the like. A. B. D. Lang & J. A. Powell. October 13th. (Cognate application, 28,040/13.)

23,117. Means for Measuring, Indicating, or Recording Force at a Distance. H. S. Hele-Shaw. October 13th.

24,688. Demagnetizing Switches for use in Magnetic Chucks and the like. T. L. Jones. October 30th.

25,607. Plates or Electrodes for Secondary Batteries. E. H. Naylor. November 8th.

27,582. Electric Arc Lamps. A. H. Railing & A. E. Angold. December 1st.

29,581. Electric Bells. W. J. Blenheim. December 23rd. (Cognate application 6982/14.)

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THE

ELECTRICAL REVIEW.

VOL. LXXV. NOVEMBER 13, 1914. No. 1,929.

ELECTRICAL REVIEW.

Vol. LXXV.] CONTENTS: November 13, 1914. [No. 1,929.

	Page
Electricity Supply ...	645
Copper	646
The Special Constable	646
The Vamma Water-Power Plant in Norway (*illus.*)	647
Correspondence—	
Constructive British Business	648
British Manufacturers and their Sales Methods	649
About Electric Radiators	650
Assisting the Enemy	650
New Electrical Devices, Fittings and Plant (*illus.*)	650
Legal	651
War Items	652
Business Notes	654
The Government Electric Power Station of Bangkok, by F. B. Shaw (*illus.*) (*continued*)	659
Notes	664
City Notes	669
Stocks and Shares	669
Electric Tramway and Railway Traffic Returns	670
Market Quotations	670
The Practical Training of Engineers (*concluded*)	671
Institution of Electrical Engineers	672
Electric Cooking	673
The Electrical Industry in Austria-Hungary	675
New Patents Applied For, 1914	676
Abstracts of Published Specifications	676
Contractors' Column	Advertisement page xx

THE ELECTRICAL REVIEW.

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ELECTRICITY SUPPLY.

RETURNING to the inaugural address of Sir John Snell, of which we reviewed a portion in our last issue, we note that the President, while admitting that the existing "system" of supply from small independent generating stations which has obtained so wide a vogue in this country has resulted in considerable waste of money and fuel, regards the matter as being almost beyond remedy, and argues that the *extra* operating cost of an addition to a local power station is often cheaper than a bulk supply from a much larger station. We do not propose to set up a direct negative to the views of the President, whose exceptional experience in connection with this class of investigation commands respect; but we should be glad to know whether, in arriving at this conclusion, he has confined his attention to the immediate future, or whether he has given due weight to the requirements of ten years ahead. On his own showing, the demand for electricity for cooking and heating is growing at a rate far in excess of that for lighting and power; on the other hand, the diversity factor obtained is so great that the maximum demand on the works is approximately proportional to the lighting load connected, and appears to be unaffected by power, heating and cooking.

In three years, in the case which he cites, these three components of the load increased from less than one-quarter of the total load to nearly half, and if we may assume that the proportion will hold good for ten years to come, they will far outstrip the lighting load. The load factor also is greatly improved. Even on a moderate estimate, Sir John anticipates that the present consumers in the near future will take four to five times the number of units metered at present, and as the maximum demand will not be correspondingly increased, the obvious deduction is that the capital charges per unit in the case of such consumers will be reduced to a very moderate figure. Now, it is on the continuance of these capital charges on the existing plant that he bases his statement that an economy could not be shown by purchasing the whole of the energy in bulk, and if the said capital charges were spread over an output four or five times as large, this difficulty would be greatly diminished. Moreover, the capital charges on the power station and the existing network would disappear on the expiry of the loan periods, and the charges on sub-stations and new mains, as indicated above, would be spread over a very much larger output. It would appear, therefore, that the conclusion depends upon two main factors: the period taken into consideration, and the prospect of obtaining the greatly increased output to which Sir John looks forward with such confidence. No doubt the question is encumbered by the necessity, in municipal undertakings, of showing a balance of profit not only five or ten years ahead, but in the immediate future; but this is an extraneous and fortuitous circumstance which ought not to be allowed to influence the abstract question under discussion, namely, whether it pays better to extend a small station than to take bulk supply from a large one. The fact that sound engineering and finance often have to be subordinated to considerations arising out of wholly irrelevant circumstances is one of the unfortunate results of the craze for municipal ownership with which

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this country was afflicted in the early days of the electrical industry. If a company happened to own a small station, and a large one in the vicinity, can it be doubted that it would scrap the little one, write off the capital cost, and quickly demonstrate a marked saving as the result? We cordially welcome the President's suggestion that the detrimental effects of the former policy should be minimised by pressure applied by the Local Government Board, as well as his conclusion "that there are several groups of undertakings where concentration on the lines which I have suggested would produce economies."

Sir John's vigorous protest against the unnecessary restrictions at present often imposed upon the wider adoption of electricity for domestic purposes cannot be too strongly endorsed. When we compare the niggling methods of some electrical undertakings with the broad-minded and obliging policy of the large gas companies—and of some municipal gas suppliers—we cannot but deplore the attitude adopted by the former. "Why should a consumer have to pay for two separate and complete wiring systems in his house?" Various tariff systems are available which approximately solve the difficulty, and any small disadvantages that they entail are far outweighed by the resulting simplicity of the consumer's installation, and, still more, his freedom from exasperating restrictions and regulations.

In dealing with the probable future cost of electricity in this country, Sir John departs from his generally optimistic attitude and severely reproves unduly sanguine estimates of what the future will bring forth. His arguments are certainly weighty—in the light of present knowledge; but here again, has he looked far enough ahead? We well remember when Col. Crompton drew up a set of costs, embodying the "ideal" at which station engineers might aim; but within a very few years those costs had been improved upon in actual practice, and we hope the same fate will overtake the figures now put forward by the President.

We agree that the lower the costs become, the more difficult it is to lower them further; but one fact stands out prominently in the history of the industry—that the word "impossible" does not apply to electrical engineering. So many surprises have been sprung upon the world by its votaries, that we have ample grounds for looking forward to the attainment of results at present clearly beyond our means. We may yet see the successful gas turbine, or, better still, the direct production of electricity from coal without the intervention of rotating machinery. Again, the invention of a better means of storage than the secondary cell, which cannot be declared impossible, would go far to lower both fixed and running costs. Even using the methods and plant at present in vogue, Sir John shows an improvement during the past 10 years of 36 per cent. on his own figures, and progress has by no means come to a standstill. Moreover, each step in advance towards reducing costs leads to a wider range of consumption, which increases the output, further lowering the cost of production, and again extending the demand—a cumulative process, asymptotic it may be, but *ipso facto* continuously approaching the base line.

In his section on the trend of improvements, Sir John again suggests an approach to finality to which we demur; nevertheless, he points out various directions in which economies can be, and are being, effected. And in his brief comments on the electrification of railways he does not mention the enormous influence that this factor, as yet hardly felt, will eventually exert upon the cheapening of electricity supply and its extension to vast areas of demand at present untouched.

There are immense potentialities still unrealised, and others possibly unthought of, before the industry of electrical engineering, and we look forward to developments in the future far beyond our present field of vision.

Copper.

There has been no feature of special interest in the copper market other than the resumption on a limited scale of business on the Metal Exchange. No "ring" dealings are permitted so far, but the exchange is open for an hour daily, and official prices are made and duly posted. This is a step in the right direction, for since the war the issuing of prices of "standard" copper has until now been forbidden, and everything has been done to leave things alone so that the position could get clearer by degrees and without any drastic interference gradually right itself. Whether the course adopted was the wisest that could be devised is a profitless question to attempt to answer, but things are now shaping towards a resumption of business, though probably on narrow lines.

The statistics issued for the month of October were not brilliant, but then they hardly represent the real position. The German stocks, for instance, are taken at the same level as at the outbreak of war, and, indeed, there is nothing else to do but to treat them as being unaltered, whereas it is certain that they have practically disappeared. It is known positively that in Germany the price of electrolytic copper is about £100 a ton, and it may be taken for granted that people do not hold copper in warehouse when they can realise anything approaching such a price as this for it. The efforts of Germany, too, to buy copper from abroad are as persistent as ever, the intermediary of neutral countries being enlisted, but most of the channels are closed, and those still open are being gradually blocked, until at last it is believed it will be impossible for her to procure supplies from outside her own borders.

There is not much copper produced in Germany, the leading mines, the Mansfield, not being of much importance, but no doubt every effort will be made to utilise the native deposits to the utmost. It is interesting to record that Germany paid 20 cents a lb. or about £92 a ton at normal exchange, to America soon after the war, for several hundred tons of copper, and the metal was duly shipped in three vessels, but only one of them succeeded in eluding the vigilance of the British fleet. At this rate we seem to have been a bit more successful in holding the seas for copper than for other metals—in the matter of tin for instance. It has lately been a most risky operation to ship tin from Singapore, and valuable consignments were sunk by the *Emden*, while equal and successful activity is shown by German cruisers in the South Atlantic and South Pacific where they have scored heavily off our ships.

The demand for copper is quiet still, but a fair quantity is going into consumption especially when the war is considered. Prices are much about as they were, but in one or two directions a slightly better feeling is apparent, and there is no doubt that costs of production are at a level which leaves no profit at current selling prices except to a handful of mines. The market should, therefore, be near bottom, and any cheerful news or any little development of buying, might affect prices very sharply.

The Special Constable.

London has had this week its first opportunity for seeing, drawn up on active duty, its civilian husbands, uncles and other relations who are enrolled as metropolitan special constables. Some twenty thousand of them had the honour of acting as a guard to the King and Queen, by lining the streets on Wednesday, as their Majesties drove to the opening of Parliament, and home again afterwards. When their attendance was mooted at first, there was a slight hesitation on the part of men in some divisions of the Special Constabulary: it was as though they were wanted to take part in some popular show. Then, as the larger part of the duty became more clearly seen, a rush of volunteers occurred: every man was eager to play even the humblest part in the protection of the King and Queen, and, in the event, many had to turn away very disappointedly, because the ranks were so full, and no more places were available.

"The King," wrote Lord Stamfordham a month or so ago, "gratefully recognises the patriotic spirit evinced in the performance of their duties, which are not unattended by personal risk and sacrifice." This was His Majesty's generous appreciation of the manner in which upwards of 30,000 inhabitants of the metropolis had

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responded to the call for special constables. And yet there is plenty of room, in certain districts, for more men. The special constable, pursuing his lonely beat round a huge reservoir, knowing that besides himself there is, perhaps, but one other on the next equally capacious sheet of water, may well wonder why the hundreds of male occupants of the houses so near at hand, allow a mere couple of men to patrol for a week on end, between the hours of midnight and 4 a.m., or the equally depressing period that yawns between 2 o'clock and 6 in the dark hours of November mornings. There is no one to stir up an enlistment boom for their sakes. The papers are engaged, as they certainly should be, in recruiting the laggards who, being eligible, have not yet joined Kitchener's Army. A few keen and zealous sub-inspectors, to whom all honour, put forth persistent and earnest efforts to gain new special constables; their rewards come slowly, and one new man per week is regarded as good.

As usual, it is often to be found that the men who have the least qualification of leisure time are those who take the hardest hours, and stick to them with the more determined regularity.

The picture palace manager, whose working hours are from 10 in the morning till 12 at night, will do alternate mornings of duty from 2 a.m. to 6. With him will be found another man, who puts in a fairly long day at an electric power station, and then comes on from 10 p.m. to 2 a.m. for six consecutive nights and two off. The Feather-Bed Brigade, whose stalwarts toil on their beats from 6 p.m. to 10 p.m., are horrified at being asked to put in a night or two a week upon the other duties. They threaten to resign, to fling away their truncheons, armlets, whistles, note-books and warrant-cards. "Resign?" snorted an exasperated sub-inspector; "I won't *let* 'em resign; I'll chuck 'em out, but Resign be damned!"

There is no doubt that the apparent futility of the duty does much to damp the readiness of volunteers, as well as the enthusiasm of the men already enrolled. It is so difficult to persuade one's self that, after all, most kinds of police work must be of the preventive variety, and that the simple fact of knowing that they run the risk of disturbance will deter the evilly-disposed. The new truncheons, too, are short, heavy, and extremely hard. Some men carry what they call pop-guns; unauthorised at best, and, at worst, about as dangerous to friend as to foe, unless the nerves of the wearer are of tougher texture than are those of most men unaccustomed to the "scattiness" of night and early morning. But the dreary melancholy of the same uneventful duty is wearing to resolution, and the dank misery of a foggy four-hours' patrol eats into the soul of the chilled patriot. So he growls to others, as well as to himself, "What's the good?" and, of very charity, is reluctant to urge his friends to do their share, even though by so doing they would afford him relief from some of his duty in those "wee sma hoors beyant the twal." Patriotism itself pales into a poor and pitiful possibility of pneumonia. And then, on a sudden, some heaven-sent thought of those chaps of ours across the water, lying in muddy trenches for many hours at a stretch, whips across the puling purpose, makes taut once more the failing nerve, and braces like a wholesome tonic the enervated powers of body and mind alike. Maybe it was the knowledge of this cumulative force of futility that prompted the mysterious headquarters to introduce a weekly drill in some of the divisions.

Meat for much reflection can be found in the sight of a well-appointed motor driving up to a parade-ground—its owner jumps out and takes his place in a squad, shoulder to shoulder with a butcher's assistant on one side, a stockbroker on the other, and, in front, a drill sergeant whose alphabet may not include an aspirate, but whose vigorous vocabulary is at the service of any blank recruit in his ranks.

And a still more personal note may be pardoned by those many special constable readers of this Review who know that if they sit up writing till 11 p.m., they are likely to share the experience of the special who slept blissfully while his alarm clock rattled itself out at 1 o'clock, and awoke at six. With as fervent a prayer of gratitude as he has ever breathed in his life, he rolled over and went to sleep again.

THE VAMMA WATER-POWER PLANT IN NORWAY.

[BY OUR OWN CORRESPONDENT.]

The Vamma-fos is the collective name of a series of waterfalls, which are formed by the largest river in Norway, the Glommen, and are situated at a distance of about 6½ km. below the large Kykkelsrud-fos, from which energy is transmitted to Christiania, and about 32 km. above the Sarpsfos, which is near the mouth of the river. There are in all eight falls and rapids, which are to be regulated, and which together, after regulation, will represent a head of 27 metres, with a regular flow of 220 cb. metres per second. None of these falls has previously been made use of for industrial purposes, except the Vamma-fos itself, on the western bank of which there has been a small flour mill. For the harnessing of the Vamma, a few years ago a company was formed, in which a controlling interest was acquired in 1912 by the large electrical power company, the A/S Hofslund. The Vamma falls are now being harnessed, and the following are some details of the works, which are approaching completion.

At the upper part of the Vamma-fos itself a reservoir has been built by the construction of a concrete wall across the river, which is 280 metres wide at this place. In the middle of this dam are arranged the intakes for 15 turbine pipes. At the western bank there is an arrangement serving as an outlet for the water in case of necessity, which is connected with a concrete catch-basin, by the aid of which it becomes possible to drain the reservoir altogether, for repairing purposes for instance. Below the reservoir and parallel with the dam is the power station, as shown on the plan, p. 648, and at right angles with this on the northern side of the river is the transformer station. On the southern side is the spillway, which has been blasted through solid rock. The width of the spillway is 100 metres, and the water is regulated by means of two cylindrical drums, respectively 20 and 28 metres long. The total quantity of water that can pass this spillway is 4,000 cb. metres per second.

The dam lies at an altitude of 56·79 m. above sea level, and at the highest point it is 38 metres high, while the greatest width at the bottom is 27 metres. The width of the summit of the various profiles varies between 4·40 and 7·60 metres. The foundation is blasted in the solid rock everywhere, and the walls are made of concrete. On the water side the walls are rendered with cement, which has been painted twice with Inertol. The intakes to the turbine pipes are provided with valves, which measure 5·4 metres in diameter. In front of the intakes are placed grids in order to prevent wood or other materials from entering the pipes, and these can be electrically heated so as to prevent the formation of ice during the cold season.

The openings for the draining of the reservoir are situated at a height of 25·79 m., and consist of two large passages, which are 7 m. wide and 8 m. high. They can be closed by means of two sets of doors, which are operated by the aid of a winch placed on a bridge on the top of the wall.

The power station now under construction is designed for six generators, with a capacity of 12,000 H.P. each, and two exciters. By means of a further regulation of the water it will be possible to obtain sufficient power for 15 sets in all, and the station has been designed with this extension in view. The turbines will be of the double Francis type with horizontal shafts, and will drive the generators at 214 R.P.M.

As the water level is subject to great variations, viz., from 23 to 31 metres in time of flood, the generator pit, the bottom of which is at a height of 26·39 metres, will, consequently, at times be considerably below the level of the tail water. In order to prevent flooding, special precautions have been taken, and, if any water should enter the pits, it will immediately be carried off by a series of drain-pipes, which lead to sumps connected with a powerful pumping plant.

For the cables from the generators to the tranformers a special cable canal is provided, which runs between the

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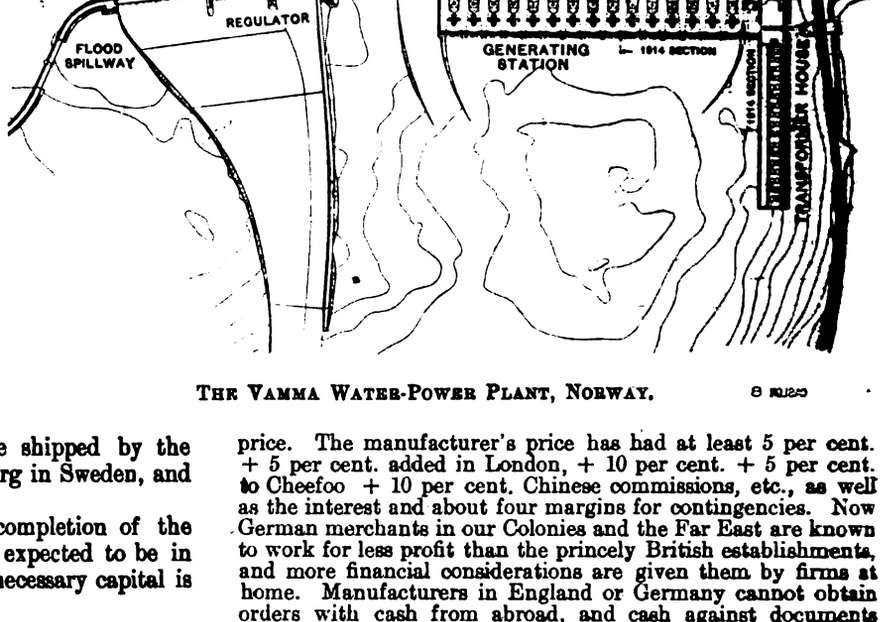
power station and the reservoir, and alongside the front of the transformer station. At the corner of the two buildings are built a mechanical workshop and stores, from which there is a railway running to a loading platform, where goods from the railway line are unloaded by means of a crane.

The works were commenced during the winter 1911-1912 and are to be completed in the course of this year, if no delay takes place.

When the war broke out the work on the Vamma power plant was threatened with total stoppage, because it was impossible to obtain possession of the large generators, which were ordered in Germany, and completed but not delivered.

The managing director of the company, however, has been to Germany, and recently succeeded in obtaining the necessary permit from the military authorities to have the machines forwarded. This was apparently not an easy matter, as rolling stock had to be used, which was specially constructed for the transport of such huge machines, and which is now used for the transport of heavy guns. The machines were shipped by the ferry-boat between Sassnitz and Trelleborg in Sweden, and have now safely arrived in Norway.

There will thus be no delay in the completion of the power station, and the whole project is expected to be in order within the appointed period. The necessary capital is also fully secured.



The Vamma Water-Power Plant, Norway.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Constructive British Business.

Recent correspondence regarding the constitution of "British firms" has been interesting as revealing the passion and the "static charges" of individuals, but it tends too much to set up "eddy currents."

Let us be done with bitterness and consider how we can best put our own houses in order whilst the opportunities avail, securing work for all British workers, irrespective of masters, leaving the Government to deal with the matter of dividends going abroad. Naturally there are those who think differently, and their opinion will no doubt make itself severely felt by the respective firms. We ought to remember that there is a duty to humanity as well as nationality.

Price and Quality.—In most countries the first consideration in purchasing is given to price, irrespective of quality. In time men become educated up to quality, and then the two become co-related, but we must remember that a very great deal of our business is still carried on with nations whose people have not reached the second consideration. It is here where the average British firm fails to rise to the occasion. It is our pride and our boast that British goods have the finish and stability. Purchasers like it up to a certain point, but turn away when the bigger margin is available. It is commendable that we should aim at quality, but not always the wisest course when pursued alone. I have tried, by sending home foreign samples, to secure cheaper British-made goods, but as a rule have had to approach a London broker, who sells me what I want at the right price without mention of origin. The war will not last long, and again there will be the inducive cheaper German article in every British Colony and foreign market; then why should not our makers pocket their pride and make a cheap line as a leader to their better quality goods?

Middlemen.—The English have been called "A Nation of Shopkeepers." There are the legitimate business mediums and the parasites, but the fact remains that the middlemen's business is overdone. The man who is fortunate enough to live at the pit-mouth gets his coal cheap, and the rest get it at a price which depends upon the number of times the coal is handled. So it is with machinery and accessories. From the manufacturer to the foreign consumer is too long a process nowadays, and demands the very special consideration of our producers. In the past he has been content to make agency arrangements with wholesale firms abroad, and has not considered the number of concerns engaged in the process of marketing his goods and their necessary profits. Take a typical instance. A manufacturer has a London office or agent who deals with the London office of a British firm abroad. The firm's head office is, say, in Shanghai, and correspondence goes there. Prices are again made up and sent to the branch office at, say, Cheefoo, where their is a representative of the firm, and a Chinese Compradore who finally gives the purchaser his price. The manufacturer's price has had at least 5 per cent. + 5 per cent. added in London, + 10 per cent. + 5 per cent. to Cheefoo + 10 per cent. Chinese commissions, etc., as well as the interest and about four margins for contingencies. Now German merchants in our Colonies and the Far East are known to work for less profit than the princely British establishments, and more financial considerations are given them by firms at home. Manufacturers in England or Germany cannot obtain orders with cash from abroad, and cash against documents from a native is practically impossible for a variety of reasons.

Consider, too, the larger British Colonies. It has often been my experience when writing to manufacturers of repute in England, asking for a quotation, that they will tell you that they are restricted from your market, or else refer you to an agency at the other end of your country. Instead of carefully nursing your business they may send your enquiry on to the agency in a general way without data to meet it. So, often the agents are not direct representatives, and the principals do not know the basis of their agent's quotations, thus making direct quotation impossible, and delay and consequent dissatisfaction results.

The question is, how can this be remedied when we consider the impossible expenses of keeping up separate branches abroad? There is but one answer—Co-operation at lower cost. Merchants need only stop a moment to see that they are now co-operating through their agents abroad and have practically no hold on them.

It is here where the I.E.E., combined with our technical journals, could do such a wonderful work. It is such a pity that our Institution should have thrown overboard their Commercial Committee, for it is often through such means that co-operative organisation can be effected. Why should not combinations of twenty or more different manufacturers get together and organise their foreign trade, and eliminate a large number of middlemen? Suppose we connect up directly from the factory office, or from a joint London salaried office if necessary, with the office of the co-operative scheme in Cairo, Calcutta, Bombay, Singapore, Hongkong, Shanghai, Yokohama, Vancouver, Winnipeg, Toronto, etc., where the salaries of the officials are paid by the joint concern, and nothing but the recognised percentage of expenses, exchange, interest and handling expenses added—the profit having already been allowed for by the manufacturer's quoted price. Then, and then only, shall we be able to get our products to the consumer at a reasonable and tempting price. I cannot but feel that, were I possessed of sufficient means to be able to give time to promote such co-operation, I should be doing a patriotic duty to the British nation at this time, although the army of business middlemen would not favour the scheme. There are, of course, economic considerations involved in each colonial or foreign city concerned through the loss to them of profits now made and retained locally. With this the manufacturer need not bother. Then, too, careful selection of men with foreign selling experience must be considered if it is to be made a success.

Consul Reports.—The U.S.A. Consuls in foreign countries are usually more concerned with trade than with diplomacy, whereas our average Consul considers himself above ordinary commercial interests. This is a fact much commented on abroad and keenly felt by the Britisher, who, however, tries to soothe himself with the belief that this attitude of his Consul adds to British prestige, etc. If only our Vice-Consuls were allowed more opportunity to promote business the average Britisher would excuse the Consul on diplomatic grounds, but as a rule the Service consider it beneath their dignity. Why should not the Government be forced to publish, more fully than they now attempt, commercial reports? Failing

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these, the group system outlined above could work up and produce a well-edited private report that would be full of interest and value to all concerned.

Advertising.—Here, again, is where British custom, that bugbear of the forward policy, is so restrictive. If we take up any English technical journal, or any published in our older colonies, we find the same old staid advertising. There is nothing "live" about it; there is no "art" in our advertising—or should I call it science? Some years ago it was realised by retailers of certain commodities much used by the public, that they must "catch the eye"—or any other sense—of the people in order to sell their goods. A poor article but a "live selling department" were both successful on the Canadian market not long ago, and if you pick up the U.S. edition of *Power* you find the essence of engineering advertising, perhaps overdone at times, but nevertheless it tends to convince where the small square of dense black type in your pages are not looked at. Of course, there are exceptions, but we must remember that it is said on this continent that a man can get as much education from advertising columns of his technical papers as from the articles. The ethics of advertising are too deep to discuss fully here, but as a Britisher, with reasonable patriotism and a long experience of technical literature, I must confess that I am often drawn to believe in U.S. goods against my desire. Let us, then, add to our name as a "Nation of Shopkeepers" that of "A Nation of Wholesalers."

Instructions and Details.—So often our suppliers or manufacturers forget the inexperience of the average purchaser at the other end, and do not realise how fatal a small mistake in shipment can be. Again and again this has been mentioned in your columns, and a recent article by the Engineering Professor of the Hongkong University showed how careless our manufacturers can be over shipping lists and detailed drawings. There are very few British engineers abroad who have not had the same experience. There are, again, the brilliant examples, and if all manufacturers followed out the methods employed by Messrs. B. & W. with their boilers, there would be far less complaint. Young engineers of from 23 to 30 are often sent abroad, and it cannot be expected that they have had all the experience beforehand, or that they have even made up a mixture of concrete, or set an engine. A regular set of instructions, complete in every detail, are easy to draw up, and they often keep a man attached to the firm which thus helps him along. This question of the young engineer abroad is also another important one for the manufacturer to consider. It is seldom that one receives a catalogue abroad unless you make an effort to get on a mailing list or write specially, but co-operative effort could register every engineer and keep him well supplied. I will not say that other countries do very much more than the British in this way, except it be the special efforts from time to time of the U.S. manufacturer, but it is well worth attention. An agent never has more than one catalogue, and that is usually lent somewhere when you want it; moreover, there seems to be some kind of fear in the heart of the British manufacturer that his catalogues and prices will be misused, and it is only after being pressed that he will give you a price and some data. Purchasers, I know, will hawk a price around, but whenever it is given it will get out, and reticence causes more trouble than it secures business.

In conclusion, let me plead again for co-operation with experienced men at the helm. There is more to fear from the irresponsible agent abroad who is in the business for what he can make, and not in the interest of the principals, who can be as underhanded or upright as it suits him, and must add sufficient to satisfy the heads of the firm and maintain the heavy proportion of expenses of his department. Manufacturers would get more business, better prices, more satisfaction and more direct representation by a twentieth share in a forty city co-operative agency than they do with the same expenditure now, and British trade would increase enormously.

Sidney F. Ricketts.

Moose Jaw, Saskatchewan,
October 10th, 1914.

P.S.—Your article on "Co-operation in Trade Expansion" (Sept. 25th) just seen after above written. I think the above is in much the same strain.—S.F.R.

British Manufacturers and Their Sales Methods.

Now is an opportune time to consider this important subject. Many of our manufacturers still continue in the old-fashioned style of waiting until someone brings them something to manufacture, and even then, if anything new, the difficulty of getting this accomplished has been almost beyond belief. We must have a complete change in these methods; new articles made to customers' requirements at competitive prices must be manufactured suitable for the new markets now available.

Many seem to imagine that sales organisation only consists in appointing a large number of agents as canvassers and travellers on commission, without providing them with any funds or giving them power to do anything if they could; in many cases this is done simply with a view of trying to get sales conducted at other people's expense; these agents accept these positions from want of something better, and are helpless, and so it continues, neither party doing anything in a permanent direction. The term "agent" would be better abolished as now applied in the engineering trade unless it is to be recognised in future as representing a person of position and capability. All employees, from the managing director downwards, are in reality agents of any company, but buyers are tired of interviewing what are now known as agents, and they require to see the equivalent of a principal

We have, therefore, on the one hand, in many cases, manufacturers employing on starvation terms and on temporary arrangements agents, canvassers, and travellers, and immediately thereafter proceeding to stultify their position and efforts by corresponding directly behind their backs with the customers and in other ways lowering what prestige they possess, thereby destroying their connection and chance of success, possibly, in some cases, to prevent their getting too strong a hold on the business, but in others, we fear, with a view of preventing them earning too much money, and this system is carried out in many ways right down to the man at the works that offers better terms if the sales can be completed without the knowledge of their own representative. Such methods must be exterminated.

On the other hand, we have the customers, the architects, and the consulting engineers trying to exterminate these agents, canvassers and travellers, by shutting their doors against them and communicating direct with the works; this arises in some cases through the utter incompetence of the men employed and their failure to satisfy the customers' requirements, but in many cases owing to the behaviour of the works correspondents.

The natural result must be to throw thousands of these men out of their present employment; but, being a gradual process, they will, when unable to take the place of the expert salesman, no doubt be provided for in offices and works where they would be better employed; when this is accomplished think of the relief to the buyers and the relief to many of these weary individuals themselves, to say nothing of the enormous saving to everybody when they are found definite employment with a visible earning capacity benefiting to themselves and the country in general.

Out of this medley, if we are to improve, must arise the expert salesman and the enlightened works correspondent both engaged on terms of possible permanency with the firm, the one realising that he must satisfy his customers' requirements in every way, and the other admitting the salesman's position and giving him the utmost support. Such salesmen would be welcomed with appointments by the customer again and again if only they were available, and the persecution of buyers by incompetence were discontinued. The salesmen of the future should be fewer in number and much better paid, and of permanent and superior position with the manufacturers; they must be men who, having passed through every shop, are selected and finally trained for this position in the estimating and designing departments, and with at least ten years' experience. Such salesmen will be expected to answer any questions and give any advice, and be in a position to take particulars, making hand sketches of suggestions, and, if required, preparing and pricing estimates, and in cases of necessity concluding contracts on the spot.

What a rarity such men are to-day! Equally so the manufacturers who have sufficient confidence in the outside agents and travellers they now employ.

The works correspondent is in reality the manufacturer, as, after all, this correspondent is the person who controls the situation, making or marring any concern; anyone nowadays, from the junior partner to almost the office boy, is permitted to deal with correspondence, the result in many cases being as might be expected.

The works correspondents should have been salesmen for five years at least, having had what workshop experience salesmen should possess before they occupied that position; we should then have correspondents knowing all the difficulties and trained in both the positions necessary for success. They must realise that the entire system of customers, salesmen and works staff are in a sense under their control, and that they can by carelessness or want of forethought destroy the best laid plans, and until such men are appointed by merit only we shall continue as we are.

The subject of advertisement in the technical press is another opportunity that is sadly neglected, many of our manufacturers never appearing. This should form the first subject of discussion between our salesmen and the works correspondents, as without this how are purchasers ever to know, more especially abroad, of a manufacturer's existence? Many manufacturers seems to imagine nowadays that if they employ large numbers of commission agents advertisement is unnecessary—the greatest fallacy of all.

If only we can persuade our manufacturers to devote a reasonable sum to their selling organisations, instead of spending their all on the works, and to select their salesmen and works correspondents by merit, encouraging them with permanent appointments, and, having done this, persuade the British workmen to do as much work as they can if they like, then there will be little trouble in holding our own and securing our full share of trade at every opportunity. Surely there has never been a better time for a change.

Victor H. Coates, M.I.Mech.E.

London, S.W., *November 4th*, 1914.

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About Electric Radiators.

We flatter ourselves that the beginning, at least, of Messrs. Belling's advertisement in your last issue is aimed at us. We do not know why they should be nervous about our radiator, in view of their very definite opinion that "It is wrong even in the most rudimentary principles" and that their own fire is "Right in theory and practice." If these two statements are correct, engineers will have the necessary intelligence and training to see it for themselves. Of course, one may feel some doubt of Messrs. Belling's ability to speak from the theoretical side if they really mean to imply, as it seems from their wording, that radiant heat dries up the moisture in the air and causes irritation of the nose and throat. Surely they have heard of, or seen, the sun? And they might have known that a coal fire, which is admittedly satisfactory on these two points, does its work by radiant heat. Perhaps the idea is that there are certain proportions of radiant and convective heat which are the only right ones and that only the advertisers know what these are?

We don't know at whom the paragraph about profits going to Germany is aimed, and we shudder to add one more to the many claims of being wholly British, but we really are—every shareholder and every employé.

There is one other thing that perhaps we shall have an explanation of later on, and that is the statement that "Radiant heat thrown in every direction makes excellent toast." One would have thought it better to throw the radiant heat in the direction of the toast!

Finally, cannot we carry on this business without accusing each other's apparatus of being bad for the public? Let us be agreed that *all* electric heating is good, but that each manufacturer knows better than the other fellow how to make radiators. That will still leave us lots to say in our advertisements.

The Jackson Electric Stove Co., Ltd.
E. E. Sharp, *Director.*

London, W., *Nov. 9th*, 1914.

Assisting the Enemy.

Some four or five English firms—by no means obscure in the industry—are actively taking orders from well-known German concerns through the latter's English branches. These orders are for making goods which those branches have always obtained in peace times from Germany.

Possibly the Royal Proclamation of September 9th does not actually prohibit this, but the legal position created by this Proclamation has yet to be defined, and at the moment is engaging attention in the Courts. Apart from this, however, I venture to think that all right-thinking men in our industry, or out of it, will regard such trading as not only unpatriotic, but indirectly assisting the enemy.

Surely English purchasers of such goods also deserve a tablet to themselves for the future guidance of that vast majority which intends to serve its Country first, and its selfish interests secondly.

X.

November 10th, 1914.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The Thomson Police Lamp.

About six years ago, Messrs. L. E. Wilson & Co., of 10, Corporation Street, Manchester, introduced an electric lamp specially designed for police use, which was considered to be an improvement on the oil lamps then in use. This lamp was received with general favour, and many police forces in the country—including the Metropolitan and City Police, and those of Liverpool, Glasgow, Edinburgh, and the Royal Irish Constabulary—have adopted it in place of the oil lamp.

The lamp has been improved from time to time, and some of its advantages, according to Major Fergusson, H.M. Inspector of Constabulary for Scotland, are as follows: (1) A better light is obtained; (2) clothes are not spoiled by the oil; (3) fumes no longer rise to the men's faces; (4) Chills hitherto produced by heating the body when carrying the oil lamp under the cape in wet weather, are avoided; (5) the light is maintained in any position; (6) the weight is very little more than the oil lamp, with the advantage that the bulk of the weight is nearer the body; (7) no naked lights are necessary; (8) the recharging operation is simple in character; (9) a saving is effected.

The success of the Thomson police lamp is in a great measure due to the co-operation and interest of the electrical engineers in the various cities in arranging suitable charging facilities, after which very little supervision is necessary. Moreover, the annual maintenance costs are below those of the oil lamp; each lamp will give 15 hours' light from one charge, and at least 50 can be recharged at one time at a cost of 4½ l. with current at 3d. per unit.

It has been found from experience that the light required for inspecting property per night is generally equivalent to four hours' continuous burning, and one charge therefore lasts three nights besides leaving sufficient reserve for contingencies. The switch is conveniently placed at the top of the lamp and enables the light to be used permanently or intermittently as desired.

Particular attention is drawn to the high quality and strong construction of these lamps, which enable them to withstand the rough usage incidental to police use. In addition to the folding handles, a clip is provided to enable the lamp to be slipped on to the belt when necessary, thus leaving both hands free.

An innovation in connection with the Thomson electric pocket-lamp—the junior edition of the police lamp, which has been

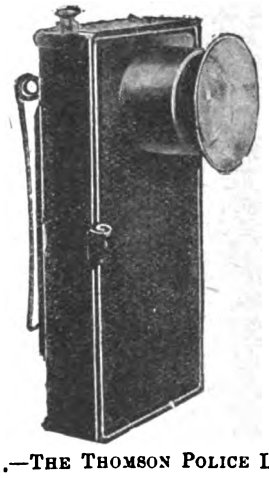

Fig. 1.—The Thomson Police Lamp.

largely adopted for inspection purposes by railway, gas, water, and electricity companies—is the supply of a dry battery with it instead of the usual re-chargeable accumulator, the price, of course, being considerably reduced in the first instance.

Full particulars in regard to these lamps and accessories are contained in the recent list issued by Messrs. Wilson.

Eclipse Cooking Apparatus.

The Eclipse electric cooker of the restaurant type is extra wide, double cased, and is provided with two doors. The equipment of a complete cooker consists of the oven with two grid shelves, a sheet iron shelf, drip tin and meat hook. The top is fitted with four 7¼-in. and two 5-in. diameter hot plates, and a combined double grill and hot plate, 14⅜ in. × 10⅝ in., the grill being provided with a drip tin and toast grid. There is also a white enamelled crown plate. The heating elements, mounted on a light framing, are assembled on each side of the oven, and are securely held in

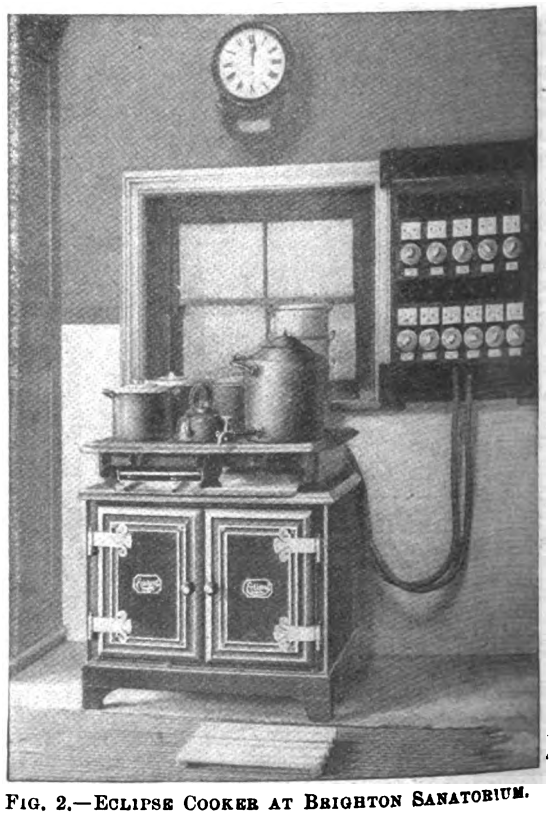

Fig. 2.—Eclipse Cooker at Brighton Sanatorium.

position by means of substantial screw fixings; they can be easily replaced without loss of time if desired. The heating elements are protected by perforated cast-iron gates.

We illustrate in figs. 2 and 3 Eclipse electric cookers of the type described, manufactured by the Electric and Ordnance Accessories Co., Ltd., of Aston, and installed in the kitchen of the Brighton Sanatorium, and at the Central Hotel, Old Steine,

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Brighton. Both of these equipments are on the 460-230-volt three-wire network, and the circuits are wired up as equally as possible to balance each other on full load. The switchboards, which were supplied by the Brighton Corporation, are fitted with "Diamond H" switches on each circuit, with high, medium, and low control. A pilot lamp and a double-pole "Zed" fuse are provided on each circuit. The sanatorium equipment is chiefly used for baking and roasting meats, &c., and also for simmering soups, for which latter operation it is well adapted. There is a

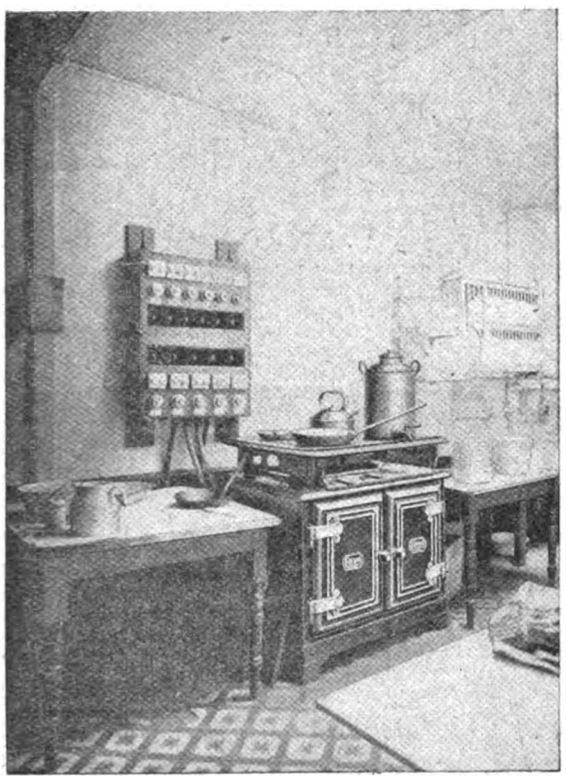

Fig. 3.—Eclipse Cooker at a Brighton Hotel.

large coal fired kitchen range available, but very often the work of the institution can be done on the "Eclipse" cooker alone. The hotel cooker is used practically for the whole of the roasting and baking operations carried out at the hotel, and the results obtained are considered very satisfactory. The overall dimensions of cookers are 40 in. high × 39 in. wide × 30½ in. deep, and the current consumption is for the oven 4,800 watts, grill 2,000 watts, each of the four large size hotplates 950 watts, and each of the two small size hot plates 400 watts.

New "Half-Watt" Lamps.

The British Thomson-Houston Co., Ltd., of Mazda House, Upper Thames Street, E.C., has introduced a range of Mazda "half-watt" lamps of 6, 8 and 12 volts, for use on motor-cars. These are described in list No. 10,136, and we illustrate one of 50 c.p., for 12 volts, taking 2 amperes, herewith.

Fig. 4.—Mazda "Half-Watt" Automobile Lamp, Full Size.

The close coiling of the filament enables the best results to be obtained with parabolic reflectors, and the small consumption renders it a most efficient device for use on a car. The candle-powers range from 20 to 100 c.p.

Fig. 5.—Wotan "Half-Watt" Automobile Lamp.

Messrs. Siemens Brothers Dynamo Works, Ltd., of Dalston, have also brought out a series of "Wotan" lamps possessing the same characteristics, and very similar in appearance to the foregoing.

LEGAL.

North British Wireless Schools, Ltd., *v.* Mayne.

Decision has been pronounced by Sheriff Laing in an action at the instance of the plaintiffs, of Edinburgh and Glasgow, against Edward Alfred Mayne, wireless telegraph expert, formerly of Aberdeen. The pursuers sought to interdict defender from carrying on, or from being interested in, the business of wireless telegraphic instruction in Aberdeen, and alleged that, in breach of an agreement between the parties, the defender had commenced and carried on business at Aberdeen by opening a school for instruction in wireless telegraphy. The defender pleaded that the Court at Aberdeen had no jurisdiction in respect that he was not carrying on business in Aberdeen at the date of the raising of the action, and that service had not been made upon him personally within the sheriffdom. The defender further counterclaimed for a sum of £200, being an alleged balance due to him by the pursuers. The Sheriff holds that jurisdiction has been constituted in the action by reconvention, and continues the case for further procedure.

Trading with the Enemy.

The Lord Justice Clerk, in the High Court of Justiciary, Edinburgh, dealt with a charge of attempting to trade with the enemy, which was preferred against William Drummond Dick.

The accused addressed a letter to Herr Herbert Glassell, Gothenburg, Sweden, in which he stated he was negotiating with a Berlin company for the sale of a cargo of coal, and requested Glassell to post on a letter, which he had enclosed, addressed to the German-Cuban Electricity Co., Ltd., Berlin, and in which he stated that the esteemed inquiry of the company regarding a cargo of about 1,350 tons of coal was having his greatest attention; that he would forward to them as soon as possible a tempting offer for that and also for other qualities of coal, and that he would do his utmost to hasten the negotiations, and in this way attempted to trade with the enemy. The case had been remitted from the Sheriff Court, where accused had pleaded guilty.

Counsel, who appeared for the accused, pointed out that the coal was intended for electric lighting purposes. The only offence of the accused was that he communicated with Berlin. Had he communicated directly with Cuba it would have been a perfectly legal transaction. Accused was of British birth.

Describing the case as "a particularly mean crime," the Lord Advocate for the Crown explained that prior to the outbreak of hostilities accused was in treaty with the firm mentioned in connection with the shipment of a cargo of coal, and when war broke out he still endeavoured to dispose of that shipment. From several firms of high standing in this country to whom he had applied, he had received warning letters which must have put him upon his guard that he was endeavouring to do a dangerous thing.

Passing sentence of five years' penal servitude, the Lord Justice Clerk said that sending coal to sea at this time was a thing which certainly ought to be prevented with the utmost rigour of the law.

Armorduct Manufacturing Co., Ltd., *v.* Defries & Co.

In the King's Bench Division on Monday, according to the *Financial Times*, before Mr. Justice Horridge and Mr. Justice Rowlatt, sitting as a Divisional Court, Mr. Hinde applied that the hearing of this case should be expedited.

The circumstances were reported in the Electrical Review for October 23rd, p. 554. Counsel for the plaintiffs said that there was no dispute as to the amount being due, but Judge Atherley Jones took the point that plaintiff company was an English company in which the bulk of the shares were held by Germans

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resident abroad, and held that in the public interest he could not enter judgment for the plaintiff company.

Mr. H. L. Tebbs, for the defendants, said the case was an unfortunate one for his clients. He had advised them to ask the Court to allow the appeal.

Mr. Justice Horridge: That can only be done by consent. Probably Mr. Hinde desires to have the decision of the Court on the point raised.

Mr. Hinde: Yes.

The Court fixed the hearing of the appeal for yesterday.

WAR ITEMS.

Australian Manufacturers and the Trade Position.—An Australian newspaper, dated September 25th and just received, states that the views of the manufacturers of Victoria and New South Wales regarding the industrial position of the Commonwealth as a result of the war have been submitted to the Federal Royal Commission on Food Supplies and Trade and Industry through the Executive Council of the Chambers of Manufacturers. "Although German industry in many channels of trade," says the executive, "has been brought to a high state of perfection by the application of science and technical training to the various commodities exported from that country to Australia, generally speaking there is very little of the multitudinous commodities 'made in Germany' that cannot even now be obtained either from the United Kingdom or America. German trade has largely been fostered on the basis of low prices, and although an increasing business has been done by Australia of late years with Germany, only temporary inconvenience will be felt at a stoppage of these supplies, as most of the trade done by the various members of our chambers in raw materials can be almost immediately diverted to other sources of supply, provided increased prices are paid. On general principles, seeing that German imports into Australia have been fostered largely on the basis of low prices and special freights, the obvious thing to do in order to divert this trade into other channels by the development of new Australian industries, the enlargement of present ones, or help the trade of the mother country. France or Belgium is to place a Customs surcharge for some years upon goods made in and coming from Germany and Austria-Hungary. Further suggestions that would generally tend to divert trade from the enemy are as follow:—

"(*a*) Giving substantial preference in any readjustment of the tariff to goods made within the Empire.

"(*b*) The initiation and completion of reciprocal trade relations with our white kinsmen in the sister Dominions of the King across the seas.

"(*c*) The procedure concerning German patents and trade marks followed in the Mother Country can be adopted here, as already suggested by your Commission.

"(*d*) Immediate assistance can be given by the Federal Government in the direction of an effective tariff, substantial bonuses, and by assistance in capital expenditure, in order to further develop by private enterprise the consumption of wool in our own factories, and the establishment of smelting works for the treatment of our own mineral ores.

"(*e*) An education in national sentiment and patriotism that would make it difficult to sell any goods 'Made in Germany,' if any reasonable alternative sources of supply exist.

"(*f*) It should be borne in mind that the establishment of any new industry in the Commonwealth, the products of which would displace trade now done with the enemy, would probably necessitate the importation of highly-trained technical Continental workers.

"(*g*) German shipping to be treated by the Commonwealth in connection with passenger and freight traffic on the lines existing with regard to foreign commerce in the United States, Japan and other countries.

"If these general principles were adopted by the Commonwealth Government, we believe that it would not be long before private enterprise throughout the Empire could effectively deal with German trade. It is probable that, unless some immediate steps are taken by the Commonwealth Parliament in the direction of preference in trade with the Empire and to our Allies, a considerable portion of the trade Germany is sure to lose will be filched by the United States of America."

The *Sydney Morning Herald* for September 28th quotes a Melbourne telegram stating that a circular letter had been addressed by Mr. Deakin, the chairman of the Foodstuffs Commission, to the Chambers of Commerce, Agriculture, and Mines, to the Institutes of Engineers, and other bodies, as well as to the Public Works Departments of the Commonwealth and the States, asking, in view of the serious interference with trade and manufactures threatened by the war, and the reduction of employment it might entail, unless energetic steps were taken to meet the situation:—

1. What are the things of major importance to our production, manufactures, or trade, that will be wholly or partly unobtainable from the usual sources of supply?

2. To what extent, and by what means can they be produced in Australia, during, at least, the stoppage or reduction of supplies from abroad?

3. Failing Australasia, which of such things are likely to be obtainable from the United Kingdom by either the enlargement of a production already existing there, or by special efforts being put forth for establishing industries previously confined to the countries of the enemy?

4. Failing the foregoing, the possibility of supply from: (*a*) Other British Dominions; (*b*) our allies; and (*c*) neutral countries.

5. Can substitutes obtainable outside the closed sources of supply be temporarily used with success in processes of manufacture, or as ingredients?

6. What things from markets now closed, such as food and clothing usually regarded as necessities, may be replaced by articles not generally so favoured, but equally effective in use, which could be obtainable in Australasia or elsewhere?

7. Would the cancellation of patent rights held by subjects of the enemy in Australasia assist to any large degree the production and supply by Australasia?

Anchor Cable Staff.—The employés and staff of the Anchor Cable Co. agreed, a few weeks ago, that whilst the factory is working full time, they would contribute a certain sum each week based on the amount of their earnings towards the local branches of the Prince of Wales's National Relief Fund and the Belgian Relief Fund. The result has been that a weekly sum has been handed to the Mayor of Leigh for one or other of these funds. The employés and staff have now decided that instead of contributing the fortnightly sum to the Belgian Relief Fund, to make themselves responsible for the maintenance of one family of Belgian Refugees, as long as it is necessary. The tenancy of one of the new cottages being erected for the Leigh Corporation has been allotted to them, and arrangements are now being made to furnish this cottage throughout and to maintain a home for some of the refugees at a cost not exceeding 35s. per week. The directors and management of the company are contributing towards the cost of furnishing, and immediately the cottage is ready it will be offered for the purpose for which it is intended. This scheme does not in any way affect the fortnightly contributions to the National Relief Fund. The company are having an illuminated "Roll of Honour" prepared, to contain the names of all employés who have responded to the nation's call to arms, and this will be placed permanently in a conspicuous place in the factory. They propose to send a photograph of this "Roll of Honour" to each of the men who are serving and to give one to the dependents of each man. The firm have, from the first, made themselves responsible for seeing that the dependents of the men are properly provided for.

Trading with the Enemy.—A correspondent has sent us a copy of a letter which has been circulated by a London firm of contractors, in which they are inviting other firms to contribute toward the expense of defending an action in the Divisional Court, in which the question to be considered is the payment of debts to firms in this country in which the capital is largely German. Our correspondent says:—

"I have recently received a circular from some electrical contractors, and from the contents note that they want others to help them to fight their creditors. My personal view in this matter is there are too many firms who are only too anxious to seize such an opportunity. Personally, as much as I am against all German houses, and have never been anxious to support them, I still believe that they should have some sort of security against the above tactics.

"I feel if it were suggested that all money owing to such firms should be paid into Court until the crisis was over, many firms would be found who had no means at all, so therefore I reckon that they would in such case be taking advantage under false pretences. Whilst I do not agree that money should be sent to Germany, I do say that when a firm is established here, and pays rates, rent and taxes, and employs British labour, it would receive money for the goods supplied by it in the past. I may add that I can state a case where our Government had placed an order with a German house who were trading under an assumed name, which was not discovered until the work was completed. In spite of this, the Government paid for the work. Surely, one cannot act fairer than that, and should take as an example the honourable dealings of our Government, that is to say, pay for what you have. I should like to hear what your opinion and that of other people is in this matter."

Stepney Men with the Forces.—The following is a list of the staff and employés of the Stepney Borough Council Electricity Department who are now serving with His Majesty's Forces. Those marked * are privates; † sergeant; ‡ riflemen; § sappers ‖ captain; ¶ driver:—

*Abrams, G., 6th Royal Fusiliers.
†Andrews, W. F., London Electrical Engineers.
*Aspinall, A. B., 7th (City of London) Battalion.
*Barber, F., 6th Royal Fusiliers.
‡Bayne, L., 5th Rifle Brigade.
*Bodkin, V., 6th Royal Fusiliers.
§Brown, W. H., London Electrical Engineers.
*Bruce, A., 7th (City of London) Battalion.
*Crook, W. H., 6th Royal Fusiliers.
‡Dubbin, J., Herts Yeomanry.
‡Ewer, G. G., 7th Essex.
*Gibson, R., 6th Royal Fusiliers.
§Graves, F., London Electrical Engineers.
*Green, G., 6th Royal Fusiliers.
*Green, U. F., 7th (City of London) Battalion.
*Hendry, H. C., 7th (City of London) Battalion.
*Hewett, W., 6th Royal Fusiliers.
*James, H., 6th Royal Fusiliers.
*Keller, F., 22nd (County of London) Battalion, (The Queen's.)
*Knight, W., 6th Royal Fusiliers.
*Legg, W., 6th Royal Fusiliers.
§Linsdell, H. J., London Electrical Engineers.
*Mabbett, W. G., 6th Royal Fusiliers.
*Mellish, W., 7th (City of London) Battalion.
*Nash, J., 6th Royal Fusiliers.
‡Penfold, W., 17th (County of London) Battalion (Poplar and Stepney Rifles).
*Pert, E., Royal Army Medical Corps.
*Scrivener, R., 15th Royal Fusiliers.
¶Trattle, W., Army Service Corps.
*Webber, C., 6th Royal Fusiliers.

For German Prisoners.—Men belonging to the Royal Engineers paid a visit to Leigh last Saturday and erected electrically charged wire entanglements, and fitted up heating apparatus in the large shed which has just been erected by the Lilford Manufacturing Co. in Etherstone Street. About 1,000 German prisoners are to be interned here.

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West Ham and Allowances to Electrical Employees.—At a recent meeting of the West Ham Town Council, the electrical engineer reported that there had been no difficulties with regard to mobilisation pay, but the case of men taken on since the commencement of the war was worthy of consideration. In the case of temporary men taken on to replace those who had joined the forces, he had made it clear that they were not entitled to mobilisation pay if they in their turn should leave for the same purpose. There was, however, another class of case, namely, where men of any grade were taken on, not to replace war vacancies, but to occupy new positions if such arose, or to serve as additional men due to work increasing. In these cases he took it that the spirit of the Council's resolution was that mobilisation pay should not be given in the event of such men joining the forces, seeing that they had become employés of the Corporation since the commencement of the war. The Committee recommended the Council to accept the engineer's suggestions, but when the matter was under discussion in the Council meeting objection was taken. Councillor Jones said that the country might even want more men in the future than it did now, and if any Council employé were seized with enthusiasm and wanted to enlist there should be no embargo placed upon his doing so. He moved that the clause be referred back for reconsideration. This was agreed to after Councillor Littler had remarked that the Committee felt that it was not desirable that men should get into the employ of the Council, remain a few days or weeks, join the Army, and then be put on the same conditions as the others.

Motor Ambulances for the Front.—Messrs. Babcock & Wilcox, Ltd., have presented two standard motor-ambulances to the British Red Cross Society for service at the front. One of these ambulances has been given by the company, and the other has been paid for by subscription from the directors and staff. The response from the staff has been so satisfactory that there will be a surplus of between £40 and £50 beyond the £400 required for the ambulance, and it is proposed that this should be handed to the Red Cross Society to go to the cost of another ambulance. The British Red Cross Society have allotted to Messrs. Babcock & Wilcox two 35-H.P. Lancias, each ambulance being capable of accommodating four wounded men, and being fitted with stretchers and all necessary appliances. Both these ambulances have already left for the front. Each has a plate attached stating by whom the ambulance was presented.

Christmas Gifts for Sailors and Soldiers.—We desire to draw our readers' attention to the coupon which appears in our advertisement pages to-day for the convenience of those of our readers who are prepared to send contributions to Princess Mary's Sailors' and Soldiers' Christmas Fund for sending gifts consisting of a embossed tobacco box, tinder lighter, pipe, tobacco and cigarettes to be received by our men at the front on Christmas day.

Appeals.—We have been asked to publish several further appeals for assistance for various funds that are being raised in connection with efforts to help those affected by the war. One of these is intended particularly to appeal to our lady readers, of whom we believe there are not a few, and to the wives and daughters of electrical men. The movement has for its object the formation of an Association known as "The Friends of our Forces," as a bond of cohesion between women who, while unable to undertake hospital work, wish to offer occasional help as needed in providing entertainment of different kinds in recruiting camps and among the convalescent wounded. Particulars can be obtained on application to the secretary, Miss Tudor, 47, Beauchamp Place, London, S.W. A second appeal received is that of the Royal Society for the Prevention of Cruelty to Animals (105, Jermyn Street, W.) for funds to assist in its efforts to co-operate with the Army Veterinary Corps in its care for the sick and wounded horses of the British forces at the front. Already some 23,000 horses have been drafted into the hospitals of the Corps, and large numbers have been enabled to return fit to service again.

The Trade War and Science.—The enlistment on the part of the Entente Trade League of leading scientific advisers, for the benefit of firms anxious to avail themselves of the openings for the capture of German manufactures, is making rapid progress. The Master of Christ's College, Cambridge, assisted by the secretary of the Appointments Board of Cambridge, has furnished the Executive Council of the League with the names of members of the staff of the University willing to advise British makers of the following goods, amongst others:—Glass and porcelain for scientific purposes, chemicals, chemical and other scientific instruments, optical glass and instruments, electrical goods, mathematical instruments, photographic materials and coloured diagrams. Similar information and assistance will be furnished through the Entente Trade League by prominent experts on the professorial staffs of other prominent seats of learning in the United Kingdom, and this knowledge and advice will be at the disposal of firms who become affiliated to the Sectional Committees of the League representative of the principal British industries.—*Financier.*

Concessions in Turkey.—A Press report from Amsterdam quotes the *Cologne Gazette*, as giving information received from Vienna, to the effect that in financial circles it is said Turkey will cancel all banking, railway, mineral and electricity concessions granted to British, French, Russian and Belgian concerns.

The *Financial Times*, of Tuesday last, throws doubt upon the accuracy of the information for a variety of reasons. Direct communication with Turkey is, of course, cut off, but the Ottoman Railway London office received information since the outbreak of hostilities to the effect that the railway was working normally, and that the staff was safe and well. "It is also understood that the operations of the Constantinople Telephone Co. are being continued and that the staff is remaining. It is reported on good authority that the Turkish Government is not interfering with the staffs composed of British and other enemy subjects, the authorities desiring that they shall continue at work."

Australian Mining Offices Raided.—Reuter's Melbourne correspondent reports that on Sunday last the military authorities raided the offices of the Broken Hill Proprietary, Mount Lyell, Mount Morgan, North Brokenhill, and South Brokenhill Mining Companies, and also the offices of the Australian Metal Co. Books and other documents were seized. It is understood that the authorities were desirous of obtaining information concerning the disposal of metals, and also information regarding contracts entered into since the outbreak of war. Mr. Hughes, the Attorney-General, stated subsequently that the raids had been conducted by his authority under the Trading with the Enemy Act, and that circumstances required this unusual action.

Oldham E.C. and German Contracts.—At the last meeting of the E.C. it was reported that the town clerk had communicated with the Board of Trade, with reference to the advisability of continuing to trade with the Tudor Accumulator Co., Ltd., whose tender for the supply of a battery of accumulators was recently accepted. The E.C. decided that the Tudor Co. be requested to proceed with the work in accordance with the terms of their contract, upon their undertaking that no part of the moneys payable for the work should be remitted to Germany during the continuance of the war.

Traders and Government Orders.—The President of the Associated Chambers of Commerce has addressed a letter to the Presidents of Chambers throughout the kingdom urging them to do everything they can to induce traders to recognise the importance of giving precedence to Government orders. The President points out that the Government are calling for a prompter delivery of contracts than they are receiving at present. He suggests that if any contractors have any suggestions to make for expediting delivery, or have any difficulties that might be removed which would secure earlier delivery, they should write at once personally to Mr. Wintour, Director of Army Contracts, or ask for an appointment.—*Times.*

Exporters and their Debts Abroad.—It is officially announced that the Committee appointed by the Treasury (and mentioned here last week) to deal with the authorisation of advances in approved cases to British traders carrying on an export business in respect of debts outstanding in foreign countries and Colonies (including unpaid foreign and Colonial acceptances) which cannot be collected for the time being is composed as follows:—Sir Henry Babington Smith, chairman; Sir Algernon Firth, Sir William Plender, Mr. Donald Maclean, M.P., Mr. Brien Cokayne and Mr. G. A. Pownall.

The City Corporation and German Companies.—The *Times* states that the City Corporation last week passed a resolution calling on the Government to introduce legislation for dealing with German companies and companies managed by, or whose shareholders are preponderantly, subjects of hostile countries. The desire is to enable contracts to be determined.

Bradford Contributions to the Relief Fund.—The list of employés' contributions to the Bradford Lord Mayor's War Relief Fund includes:—Bradford Corporation Electricity Department workmen, £92; tramways workmen, £384; Chr. Pratt & Sons Ltd., electrical contractors, workmen, £7 19s.

Manchester I.E.E.—It is stated that at least 25 members, including four of the Committee, of the Manchester Students' Section of the Institution of Electrical Engineers, are serving with the Colours.

Board of Trade Reports.—No. 91 of the special series of campaign pamphlets gives particulars of German and Austrian exports of milling machinery.

Stalybridge Tramway Board Employés.—Of the employés of the Stalybridge, Hyde, Mossley and Dukinfield Joint Tramways Board, 48 are now serving with the Colours.

Personal.—Mr. Ernest G. Baker, chief assistant electrical engineer, Morecambe Corporation, is serving as colour-sergeant with the 5th Res. Batt. "King's Own," G Company, R. Lanc. Regt. He is at the Centenary Schools, Lancaster.

Mr. M. D. Boddy, who is on active service in France as an electrician to the Army Service Corps, writes wishing to be remembered to his many friends in the electrical trade. His address is No. 1,439 M.T., A.S.C., 66th Coy., 7th Division, Expeditionary Force.

Corpl. Wm. Parker, who was up to recently employed at the Tudor Accumulator Works, Dukinfield, has been complimented by his commanding officer for smart work whilst serving with the 2nd Lancs. Fusiliers.

Messrs. Frank Hirst and Bernard Willis, employés in the Blackpool Corporation electricity department, left the town on Monday to join the field telephone department at the front.

Private Chorlton, formerly a Blackpool Corporation tramcar driver, is reported to be lying wounded in a German military hospital.

Major Bates, one of the officials of the Prescot Wire Works, Lancashire, has been promoted to the rank of Lieut.-Colonel, and will take command of the reserve battalion of the 5th South Lancashire Regiment.

Roll of Honour.—Private J. Hasdell (1st Northamptons), an employé at the Peterborough electricity works, died of wounds at the front, and was buried at Trayles Churchyard on September 22nd.

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BUSINESS NOTES.

Consular Notes. — CHOSEN (KOREA). — *Hydro-electric Development.*—The Japanese authorities at Seoul have lately been making an investigation of the prospects of developing power in Chosen by means of hydro-electric installations, and the American Consul says that the view held locally is that a growth in electrical enterprises may be looked for in the near future. An electrical company in New Wiju on the northern border has commenced operations, while Okura & Co. have applied for permission to extend the service of their plant at Shinanju. This plant is now used to supply power to the gold mines of the Oriental Consolidated Mining Co. (an American Corporation) at Unsan; and the application has been made in the hope of supplying power also to the districts around Shinanju and Pukchin.

Tungsten.—Last year operations were commenced in the tungsten mines discovered in the eastern part of Chosen. An average of 5 tons per month, reports the American Consul, was shipped to Yokohama, the estimated value being £80 per ton. Numerous applications are being received for permission to work similar mines in the same section of the country. The authorities are not, however, granting permits at present for such mines, owing to the general scarcity of tungsten and to the probable need of such supplies as exist, for the development of the iron industry in Chosen.

MEXICO.—*A Time for Action.*—A German report which has reached us shows that before their activities became devoted solely to fighting the Germans were alive to the fact that the damage done in Mexico to electrical plant and material during internal strife would sooner or later have to be repaired. Finance will be the governing factor in the distribution of orders, but that is no reason why manufacturers should not cultivate the field in readiness. Mexican industry is largely dependent on the development of its water power by means of hydro-electric installations, as coal is lacking and the transport of other fuel costly. Quite a number of large power stations were partially destroyed during the war. There are only about 100 town-owned power stations in Mexico, as, except for Mexico city and the ports, there are no large towns in the country. There are, however, numerous well-equipped plants in textile mills, whilst the mining industry—to which the country practically owes its existence—is entirely dependent on electric power. Pumping installations for irrigation purposes are being more widely planned.

An optimistic view is taken by the United States Consul at Monterey concerning the resumption of trade in Mexico. He reports in September a marked increase of exports from his district, as well as of imports of American goods to replenish the long-depleted stocks of Monterey dealers, all of which he looks upon as evidence of peace and good order and the return of commercial prosperity. A six weeks' "trade-winning trip" to Mexico has been organised by the Business Men's League of St. Louis. Electrical supplies and machinery are to be amongst the lines of goods represented.

MANCHURIA.—*Prospective Electrical Work.*—The Town Council of Harbin is awaiting a favourable opportunity for making financial arrangements for carrying out a number of public works, including electric tramways and lighting for the municipality and the construction of a telephone line. The loan it proposes to raise is £550,000, and, according to the American Consul, £135,000 of this will be spent on the tramway and lighting systems, and £15,000 on the telephones. A large proportion of the remainder will be spent on various municipal enterprises involving buildings, and the undertakings and buildings will be offered as security for the loan. Meantime an offer to furnish £304,000 has been made by a banking house.

PORTUGUESE WEST AFRICA.—*Electrical Progress.*—The American Consular representative in the Belgian Congo has recently made a tour of Portuguese West Africa and drawn up a report on the industrial and agricultural pursuits of that colony generally, and also on opportunities of increasing the sale of manufactured goods. Amongst the limited number of manufacturing enterprises the electric light and power plant at Catumbella is of interest as being the first electrical plant on the whole west central coast of Africa. It is a British enterprise, holding a concession from the municipalities of Lobito, Benguella, and Catumbella for the supply of light and power for 99 years. The growing importance of Lobito on account of the Benguella railway, of which it is the terminus, makes the concession a valuable one. The street lighting of the three towns has been successfully inaugurated, and negotiations have been started with the Benguella railway for supplying light and power on the company's wharves, stations, workshops, &c. A good return is also looked for in supplying current for electric fans and electric pumps for irrigation and house water supply. The company supplies incandescent lamps at about 4s. each. The duty on lamps is 25 per cent. *ad valorem*, and there is a 30 to 40 per cent. breakage. Portugal supplies about 60 per cent. of Angola's imports, though in reality a considerable part of the amount credited to the mother country is of foreign origin. Th[illegible] goods f[illegible] sought [illegible] Lisbon [illegible] Portuguese manufactures. The United Kingdom has always held second place as a supplier of Angola's wants, but other countries are actively cultivating the market. In Loanda four or five German firms have complete exhibits of every sort of goods suitable for the Angola trade, every article being labelled with the price, freight, duty, &c., in Portuguese currency. By these thorough methods German trade has been rapidly increased, in some cases to the detriment of British firms, who are more conservative, but nevertheless, says the Consul, far more active than American competitors. The Germans have been operating not only in Loanda, but, as a rule, in all the larger towns along the West Coast, and some of them even on the East Coast. Catalogues and correspondence should be in the Portuguese language, or at least Spanish. The prices and terms of sale should be stated fully, together with approximate freight rates. The precautions usual in packing goods for tropical countries should be exercised. Iron manufactures should be well greased, and leather goods wrapped in oiled cloth. Outside cases should be strongly constructed of thick boards, and care should be taken to secure them with a sufficient number of iron bands and straps, so that they will resist the rough handling of various transhipments.

GUATEMALA. — *Openings for Electrical Materials.* — The American Consul-General in Guatemala City considers it probable that as a result of the war in Europe there will be an increased demand for certain electrical supplies in his Consular district, chiefly in the line of incandescent bulbs, wire, fuses and fittings, as these supplies have been imported almost wholly from Germany. Bulbs in use are 5, 16, 25 and 32 C.P., ordinary screw socket, and the current is 120 volts, alternating. No electric fans are used, with the possible exception of a few at San Jose. Cooking and heating utensils are forbidden by the electric companies under severe penalties. It is estimated that nearly 100,000 incandescent bulbs are imported each year. There seems to be a prejudice on the part of some people in Guatemala against electrical appliances, which are regarded as some kind of infernal machines. Instances have been known of such goods being held up at the Custom house for months, notably in the case of an X-ray machine for a hospital in Quiragua. There is not much chance of any important quantities of the larger electrical machinery, such as dynamos, generators, switchboards, &c., being imported for some time, as Guatemala seems to be entering one of the lean periods just at present. With over one-half of the ordinary exports looking for new markets, and a possibility of much of the coffee crop being lost through inability to finance the harvest, to say nothing of the practical impossibility of obtaining foreign exchange, the Consul believes that 1914 and 1915 will be the worst years in the history of the Republic.

It is impossible to give any detailed figures as to the importations of electrical goods, as they do not appear in the Customs reports, while importers are largely German, and do not wish to give the desired information.

A dispatch received at the Board of Trade from H.M. Minister at Guatemala warns traders that if the country is unable to dispose of the bulk of its coffee crop—which usually goes to Hamburg—it will naturally be unable to import any goods in exchange, and for this reason it is considered that the present moment is not a favourable one for attempting to extend trade there.

Condensing Plant Contracts.—The Mirrlees Watson Co., Ltd., Glasgow, have recently received orders for condensing plant, for the following:—Gravesend, Devonport, Manchester and Leeds Corporations; Dartford U.D.C.; Hampstead Borough Council; numerous colliery companies and iron works; the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., and the China Light and Power Co.

Bankruptcy Proceedings.—W. R. Wedge, electrical engineer, The Arcade, Northampton.—The adjourned public examination of the above debtor was fixed to be held on Tuesday last week, at Northampton, but the debtor again failed to put in an appearance. The Official Receiver (Mr. A. Ewen) stated that debtor had written to say that he was suffering from influenza and bronchitis. On being requested to forward a doctor's certificate, debtor had complied, and had expressed the hope that the case would not be adjourned *sine die*. The Official Receiver said he had no objection. The Registrar said that the case had been adjourned several times, and even now they did not know whether debtor could appear in one month or two months. It might be difficult for a man with bronchitis to travel in December. The Official Receiver said that of course the case might be adjourned for six months. The estate had been wound up. The Registrar ordered an adjournment, and expressed the hope that it would not be necessary to ask for a further adjournment.

William Walker (D. Smith & Co.), dealer in electric lamps, late of 2 and 3, Red Lion Court, Fleet Street, E.C.—The application for debtor's discharge will be heard at Carey Street, on December 1st.

Liquidations. — The Roundhay and District Electric Lighting Co., Ltd.—This company is winding up voluntarily, with Mr. W. Smith, of 34, Albion Street, Leeds, as liquidator. A meeting of creditors is called for November 20th.

Salsbury Lamps, Ltd.—A meeting of creditors is called for November 19th, at 11, Long Acre, W.C., by the liquidator, Mr. A. Riding.

Trade Announcements.—The Compagnie des Cables Sud-Americains (South American Cable Co.) has changed its address from Cannon Street to 22, Royal Exchange, E.C.

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Electrical Exports from Sweden.—Returns just to hand show that the exports of electrical machinery from Sweden during the eight months ending with August last attained a value of only £120,641, as compared with £158,280 in the corresponding eight months of 1913. On the other hand, the exports of telephone material advanced from £203,710 to £234,470.

Book Notices.—*Kelly's Monthly Trade Review* is a new shilling publication which is launched by the well-known Directory publishers of the same name. It contains a great deal of matter relating to commercial and industrial affairs, which is put forward with the object of enabling British firms to capture German-Austrian trade at home and abroad.

"Shop Lighting" is the title of an excellently got-up booklet of 40 pages issued by the British Thomson-Houston Co., Ltd., of 77, Upper Thames Street, E.C. It may be thought that the times are unpropitious for showing the advantages of brilliant illumination of shop exteriors, but it is to be hoped that the regulations that are found so irksome to the shopkeeper who has learned the advertising value of good illumination, will not have to be imposed for long, and that Zeppelin fears will soon be a thing of the past. As a matter of fact, most of the pictures in the book show interiors where we can be as lavish as we please with our light. Department stores, millinery showrooms, furniture showrooms, shop interiors, restaurants and motor showrooms, are among the finely illuminated premises included in the booklet, and these the regulations do not touch if the blinds are drawn or lights are adequately shaded. Appropriate notes are given beneath each of the pictures, and at the end of the pamphlet are particulars of Mazda lamps, Eye-Rest fittings, X-ray and other reflectors and glassware, all of which combine to produce the good results shown in the photographs.

"Boilers, Economisers and Superheaters." By R. H. Smith. London: Crosby Lockwood & Son. Price 7s. 6d. net.

"Science Abstracts." Sections A and B, Vol. XVII, Part 10. October 28th. London: E. & F. Spon, Ltd. Price 1s. 6d. net each.

"Lektrik Lighting Connections," the little book issued by Messrs. A. P. Lundberg & Sons (price 6d. net) has just been reissued, revised and enlarged. We had thought that nothing further was left to be said on this subject, but there are now 60 more pages and 77 additional illustrations, and the fact that 25,000 copies have been printed to date suggests that the book has successfully filled a vacant niche in the literature of the industry. In the new edition additional notes on lighting and switches are given, with diagrams, switches and controls are classified, and a wire and lamp table is added. A list of holders of advanced grade certificates is appended.

Catalogues and Lists.—British Prometheus Co., Ltd., Salop Street Works, Birmingham.—Illustrated leaflet No. 157, showing a variety of types of water heaters, jugs, polished and antique, shaving pots, water cans, &c. Prices are tabulated.

Messrs. Magneta Time Co, Ltd, 14, Soho Square, London, W.C.—Thirty-six-page catalogue, describing and illustrating the "Magneta" electric time system and the interior mechanism of the clocks. Illustrations appear of a number of designs of master and secondary clocks used in different classes of buildings. A lengthy list appears of post and telegraph offices and other public buildings and business houses which are equipped on this system, and some of the premises are photographically shown. The Magneta apparatus is of British manufacture, being made at the works at Watford.

Messrs. Campbell & Isherwood, Ltd., Raleigh Street Works, Bootle, Liverpool.—Sixteen-page illustrated booklet containing descriptive matter relating to their recently-patented "C and I" electrical hoist for marine and general purposes. Two of these hoists have recently been supplied for hoisting ammunition on board one of H.M. ships. Other orders are on hand for these machines for ash and baggage hoisting aboard ships.

Messrs. Rawlings Bros., Ltd., 82, Gloucester Road, South Kensington, London, S.W.—We have received a neat photographic reproduction in postcard form of a timely poster, designed by Mr. Kelly, a member of the firm's staff. It shows Tommy Atkins seated in camp "in a warm corner" beside a luminous electric radiator. The humorous information is imparted that "the current in this case is obtained from the field battery."

Messrs Musgrave & Co., Ltd., St. Ann's Ironworks, Belfast.—Folding card giving specification and tabulated sizes, steam pressures, shipping and other particulars, of their enclosed double-acting engines.

Messrs. Cryselco, Ltd., Bedford.—Wall show-sheet in patriotic design and colouring emphasising the fact that the Cryselco lamp is All-British.

Edison & Swan United Electric Light Co., Ltd., Ponder's End.—Leaflet No. E 3,038, of 14 pages, gives illustrations, tabulated particulars and prices of various types of storage batteries, which they can supply in capacities ranging from 8 to 2,340 ampere-hours or larger. They include laboratory and telegraph cells, lighting, central station, motor-car and launch, ignition and motor-car lighting types. Leaflet No. L 3,071 (six pages) details the Ediswan "Tubolite" system, and gives prices.

Messrs. Petters, Ltd., Yeovil.—Illustrated pamphlets dealing with small Safety oil engines, motor-boat engines, horizontal magneto-type oil engines, and the Petter Junior electric lighting set for country house and such like lighting.

Messrs. Millard Bros, Ltd., 123, Houndsditch. London, E.C. —"War edition" catalogue illustrating and giving prices of a variety of pocket and other electric lamps, lamp cases, and standard batteries, the bulk of which are stated to be made in London, though a supplementary supply has to be obtained from a neutral country "made in Holland." Many electrical novelties for the Christmas season are also listed.

The Brimsdown Lamp Works, Ltd., of Kingsway House, W.C., have prepared a very attractive coloured poster, which is designed to impress all and sundry with the fact that the Brimsdown lamp is British made, and, like the lady who obscures the filament, "will always please." Reductions of the poster in postcard and poster stamp sizes have also been issued. Contractors should apply for specimens.

For Sale.—Bolton electricity department has for disposal a number of single-phase, 83-cycle, 2,000-100 or 200-volt transformers. Keighley Corporation has for disposal one 125-kw. Allen high-speed vertical reciprocating engine. Particulars are given in our advertisement pages.

Fire.—A serious fire occurred on the 3rd inst., at Newcastle-on-Tyne, when Messrs. Siemens's electrical supply stores were completely gutted.

LIGHTING and POWER NOTES.

Kintore. — E.L. Scheme Inaugurated. — A new system of electric lighting was inaugurated in the burgh of Kintore last week. The power is obtained from the Shirraburn, the flow from which is stored in a dam near the town. On the outskirts of the burgh there has been erected a power station, containing two 29-H.P. water turbines and dynamos. Messrs. T. C. Smith & Co., of Aberdeen, were the contractors for the scheme, under the supervision of Mr. M. K. Cooper. Mr. James Duncan, of Tillycorthie, by whose enterprise the T.C. has been enabled to inaugurate the new system, was presented with the freedom of the burgh.

Abingdon.—E.L. Charges.—The T.C. has empowered a Sub-Committee to arrange with Mr. Edwards, of Bristol, representing the Electric Supply Co., for a supplementary agreement governing the charges for electricity, which are stated to be higher than had been expected.

Altrincham.—Street Lighting.—The application of the U.D.C. for sanction to borrow money for lighting certain streets by electricity is to form the subject of an inquiry by the L.G.B.

Australia.—Victorian Electric Supply Undertakings.—The official returns of electricity undertakings in Victoria, for the year ended December 31st, 1913, show 54 undertakings in operation, and a further list gives 93 Orders in Council granted for electric lighting.

Of the undertakings in operation, the Melbourne Electric Supply Co. (9,100 kw. generating plant capacity), Melbourne City Council (7,750 kw.), Ballarat and Bendigo (each 1,800 kw.), Geelong (1,000 kw.), and Essendon (750 kw.) are the largest. Only the Melbourne undertakings employ steam turbine plant, and both of them give bulk supplies to certain other towns. A feature of the returns is the number of gas-engine installations working with producer gas, these being installed in 37 cases, with units varying in size from 175 h.p. to 25 h.p.; the bulk of such plants consist of 60-80 h.p. units. One small water plant for street lighting and one oil engine plant are included in the list.

In 42 cases public electric lighting is in use, Melbourne contributing the greatest number of lamps, while Essendon, Bendigo, Footscray, and Geelong also employ many such lamps. In Melbourne the prices charged are low judged by English standards, particularly under the City Council, but in the smaller country undertakings 7d. to 8d. per unit for lighting, and 4d. per unit for power are the usual prices.

Bacup.—The T.C. has approved a scheme for lighting the market buildings by electricity.

The questions of installing electric lighting at the chief constable's residence and at the police buildings, and also the provision of an electric fire alarm, are being considered.

Negotiations are also in progress for the lighting of Olive Mill by electricity.

A scheme has been submitted to the Electricity sub-Committee for the conversion of street lamps from gas to electrical lighting.

Batley.—Proposed Loan.—The T.C. is to apply to the L.G.B. for power to borrow £6,500 for extensions of electric lighting cable to Healey, Staincliffe, Carlinghow and Brownhill.

Belfast.—The Harbour Commissioners have granted a site for the new sub-station, to be erected by the Corporation and equipped in order to meet the demands on the electrical undertaking for the present.

Bradford.—Reduced Lighting.—The orders for restriction of lights at night now include the entertainment houses, the tramcars and the street lamps, the railway stations and trains and all shops. The order affects the latter as from 8 o'clock in the evening, after which time all outside lights, whether shaded or not, have to be extinguished.

Bristol.—Bulk Supply.—The Electricity Committee recommends the confirmation of the provisional agreement with the Clevedon, Portishead and District Electric Supply Co., Ltd., for giving a bulk supply of electricity, and that it be authorised to apply to the B. of T. for an order under the Act permitting such supply.

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Canada.—The Laurentide Co. has under construction at Grand Mere, on the St. Maurice River, a hydro-electric plant to comprise nine 20,000-H.P. units; only 120,000 H.P. is at first being developed, of which half is being completed now. The company will require some 25,000 H.P. for its own use and, it is said, will save the cost of over 65,000 tons of coal, at $4 a ton, per year. The cost of the hydro-electric development is over 4 million dollars. The construction motors, &c., are being supplied from the Shawinigan Falls plant four miles further down the St. Maurice.

Dawson City (Yukon territory) is considering a scheme to establish a municipal electric lighting and telephone plant, at a cost of $165,000.—*Canadian Engineering.*

China.—Fall of Tsingtao.—According to the *Daily Telegraph's* special correspondent, the Japanese officials attribute the sudden fall of this German stronghold primarily to the destruction of the power house by shells, as this destroyed the value of the electrical mines on which the trench defence had been largely based.

Clayton.—Prov. Order.—The U.D.C. has decided to support the Yorkshire Electric Power Co.'s application for a prov. order to supply electricity to the district.

Continental Notes.—Spain.—A concession has recently been granted for the establishment of a plant to utilise the water power of the river Bornoba, near Villares de Jadraqua (Province of Guadalajara), in the generation of electrical energy for power purposes.

Sweden.—The new power station at Porjus, which is to supply electrical energy for the railway from Kiruna to the Norwegian frontier, is rapidly approaching completion, the first turbine and generator having just been started.

Dartford.—The U.D.C. has decided not to contribute towards the cost of the appeal against the Ilford and Long Eaton cases, nor towards the cost of the I.M.E.A. Bill authorising local authorities to provide fittings, &c.

Dover.—The T.C. has decided to contribute towards the cost of the promotion of the Bill of the I.M.E.A. to give municipal authorities similar powers to gas companies to supply fittings, &c.

East Preston.—The R.D.C. has decided to raise no objection to overhead wires being used in connection with the E.L. scheme at Durrington. The Council had previously required underground mains.

Farnworth.—The Bolton Textile Mill Co.'s application to the Electricity Committee for a supply of current for power purposes at their Moses Gate Mill, has been referred to the Lancashire Electric Power Co.

Greenock.—Port Glasgow Supply.—This supply was inaugurated on Wednesday last week. Three-phase energy at 3,500 volts from the Greenock power station is stepped up to 10,000 volts for transmission to four rotary converter sub-stations having a total capacity of 4,000 KW., and there converted to direct current at 250 volts. Some 6½ miles of H.T. feeder and 2½ miles of L.T. distributing mains have been laid. The Greenock station contains 11,300 KW. of plant, and had an output of 11½ million units last year.

Ilkley.—E.L. Charges.—In connection with the electricity scheme, it has been decided that the charge shall be 5d. per unit for lighting purposes, and 2d. per unit for power purposes.

Keighley.—Prov. Order.—The T.C. on Monday decided to apply for a prov. order for E.L. in the Worth Valley district. Sanction has been received to a loan of £17,700 for electricity purposes.

Knaresborough.—Prov. Order.—The U.D.C. has confirmed its previous decision to apply for a prov. order for E.L. It is understood that the Harrogate T.C. intends to apply for a similar order for the district.

Leeds.—Domestic Tariff.—The Corporation has just sanctioned the introduction of an optional tariff to private householders, consisting of a fixed quarterly charge at the rate of 10 per cent. per annum upon the net rateable value of the premises plus ½d. per unit for all energy consumed for any purpose. There are in Leeds between 800 and 900 users of electricity for cooking, heating, ironing, &c., on the present rate of 1d. per unit with 3½d. per unit for lighting. The new scale is believed to be as low as any so far introduced.

London.—Marylebone.—With reference to our Note of last week regarding the arbitration proceedings between the Electricity Supply Committee and the Electrical Power Storage Co., Ltd., the following is a summary of the terms of settlement arrived at:—(1) Claim and counterclaim to be withdrawn; (2) each party to pay their own costs, and half the fees and expenses of the arbitrator; (3) both batteries to be put right by the company by December 31st, 1914; (4) to determine whether the batteries have been put right—*i.e.*, whether they possess the capacity on discharge specified by the contract—the test conditions shall be determined by the general manager of the Council and the chief engineer of the company, or, failing their agreement, by the present arbitrator, Mr. Swinburne; (5) if the batteries cannot be put right without replacing the negative plates, the date (December 31st) may be extended by the arbitrator for a reasonable time, having regard to all the circumstances; (6) Manchester Square battery to be put right free of cost to the Council; (7) on Rathbone Place battery being put right, the Council to pay £1,500 in respect thereof, and the old lead to belong to the company; (8) no maintenance money to be paid by the Council with regard to Rathbone Place battery in respect of the two quarters ending March 25th and June 24th, 1914; the maintenance payable as from June 24th, 1914, shall be paid on both batteries being put right, but not before, and no interest shall be payable; (9) as from December 31st, in case the batteries are not put right, the maintenance payments shall be reduced in proportion to the capacity obtainable from the respective batteries until the batteries be put right; no maintenance shall be payable in respect of Rathbone Place battery whilst its capacity is below 80 per cent. of the capacity specified in the contract, and no maintenance shall be payable in respect of Manchester Square battery whilst its capacity is below 70 per cent. of the specified capacity; (10) the maintenance agreements to be renewed for another 10 years; (11) the company in future to provide two battery attendants to keep the cells in order, and the Council to contribute 40s. a week towards their wages; (12) the Council to provide a milking booster at Manchester Square capable of giving 500 amperes on a fully-charged cell. The Committee recommends the sealing of an agreement with the company embodying these terms.

Stepney.—Proposed Loan.—The B.C. is recommended to apply for sanction to borrow £15,000 for mains extensions, and £5,000 for house services. The Council has been recommended to promote a Bill for the statutisation of the Limehouse generating station.

Southwark.—There was a net loss of £1,600 on the Council's electricity undertaking for the past year. The loss is attributed to increased cost of coal, removal of ashes and increase in the sinking fund, also the inefficient working of the station during the installation of the new plant.

Poplar.—Loan Sanction.—The L.C.C. has sanctioned a loan of £10,504 in respect of the electricity undertaking, for the purchase of the freehold site of the telpher railway and wharf, £1,000; mains extensions, £6,803; extension of generating station, £2,701.

Greater London Electric Supply.—The Local Government, Records and Museums Committee of the L.C.C., in a report on this scheme, points out that its administration involves another area not coterminous with any of the others, and that it is essential that the representation of London on the authority should be commensurate with its concern in the subject dealt with. Should the authority not be able to make satisfactory arrangements for the working of the new undertaking by a company, it would be necessary for these powers to revert to the local authority as the main object in setting up the authority would disappear. It is understood that this point will be met in the Bill. The Committee considers that the whole assessable value, as suggested in the scheme, will form a better basis for apportionment of any deficiency than rateable value, and that the whole assessable value according to the county rate basis will form an equitable basis for this purpose. In the case of the Water Board, the basis includes only properties supplied with water, although the rate levied locally to meet the precepts is charged on all rateable hereditaments.

The L.C.C. decided at its meeting on Tuesday to apply to Parliament for authority to carry out the electricity scheme. Sir John Benn moved an amendment, the effect of which was to prescribe that the undertaking should be a municipal undertaking, and this was seconded by Mr. P. A. Harris. Mr. Cyril Jackson said the Municipal Reform members did not pledge themselves to push this scheme in the face of the Borough Councils or companies, but they felt it should go to second reading, when, if necessary, it could be carried over to the next session. The scheme was claimed as a basis on which a sound measure could be established. The amendment was defeated by 63 votes 44, as was also a further one by Mr. Gordon, to allow a metropolitan borough which is an authorised distributor to stand outside the scheme.

Lowestoft.—The T.C. has been recommended to contribute up to £10 towards the cost of the action brought against the Ilford U.D.C., provided electric lighting authorities generally join in contributing.

Mansfield.—Workhouse Lighting.—The Committee appointed by the B. of G. to report on the comparative cost of gas and electricity, states that the electricity installation had now been running one year, and although it was difficult to estimate the cost, there was no doubt the electric light was less costly than gas, it was also cleaner, and considerable saving would be effected in cleaning and decoration.

Newcastle-under-Lyne.—Power Supply.—Messrs. J. Hammond & Co., of Enderley Mills, clothing contractors, have come to terms with the Corporation for the supply of power for the next two years, instead of using their own plant (gas), which has been giving considerable trouble for some time past. The normal demand will probably be about 100,000 units per annum, but at the present time they are working day and night, so that for the next 12 months the demand will probably reach 150,000 units. Messrs. Hammond are the only large employers of labour in the town, and it is, therefore, a great matter for the electricity department that they have succeeded in securing this load.

New Zealand.—The Miramar B.C. had its electrical energy supplied from the Wellington City Council until recently, but in view of the growth of the borough it decided to put down its own plant. Mr. Black, consulting engineer, in con-

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junction with Mr. Mestayn, drew up the plans, and the contract was put in the hands of Messrs. J. J. Niven & Co., Wellington. The plant consists of two three-cylinder Willans-Diesel engines coupled to 100-KW. Bruce Peebles dynamos; also a 40-KW. lighting motor-generator and a three-wire balancer. The circulating water from the cylinders is passed through a "Little" water cooler. The station supplies both lighting and traction.

Oldham.—The Electricity Committee has decided to take no action in regard to a complaint by the Chamber of Trade that an assurance, which had been given to the electrical section of the Chamber, to the effect that the Corporation would not supply motors to customers, was not being carried out. At a meeting of the Electricity Committee last week, it was stated that resolutions, which were in the minute books, gave no evidence that such an assurance as that suggested had been given. The practice of the department was to call the attention of prospective customers to a list of tradesmen they had, and to inform the customer that they would be pleased if he would call on any one of those named. There was no attempt on the part of the department to compete with local contractors.

Sheffield.—Sale of Electric Fittings, &c.—Mains are to be extended in various parts of the city, at an estimated cost of £12,981; £11,670 of this amount is the cost of installing a new feeder main from Neepsend to Tinsley. A Special Committee of the City Council has had under consideration the question as to what course the Corporation should adopt in the matter of the sale of electric light fittings. Having discussed the matter thoroughly with the representatives of electrical contractors in the city, and with the object of arriving at an agreement, certain suggestions were placed before the representatives of the contractors as a final proposal for their consideration. To these suggestions the secretary of the Sheffield Electrical Contractors' Association wrote that the proposals were in direct opposition to the settlement agreed at the House of Lords, and that they could not be accepted. The Committee states that it considered the terms suggested provided an equitable scheme for the working of the Corporation Act, but having failed to arrive at an agreement with the contractors, it devolved upon it (the Committee) to make a recommendation to the Council as to the future working of the motor and installation department of the undertaking in the following terms:—(1) That the powers of the Corporation as contained in the Sheffield Corporation Acts, 1903 and 1912, be exercised. (2) That a showroom or rooms be maintained for the exhibition of electrical fittings, including such electric light fittings as the Corporation can only sell through a contractor carrying on his business independently of the Corporation. (3) That the following be the method of selling electric light fittings through contractors carrying on their business independently of the Corporation:—(*a*) A list of such electrical contractors as are willing to co-operate with the Corporation in the sale of electric light fittings be prepared and maintained; (*b*) that the Corporation's canvassers and showroom attendants be supplied with this list and authorised to inform customers that the Corporation will sell to them through any of such contractors such electric light fittings as they may require; (*c*) a purchaser having selected fittings, he shall declare the name of the contractor upon the Corporation's list through whom he wishes the fittings to be sold to him, and thereupon the Corporation shall sell the fittings to the purchaser through such contractor; (*d*) the Corporation shall notify the contractor selected by the purchaser that the purchaser wishes to purchase through him the fittings specified, and request him to undertake the transaction, and on his doing so the sale shall be carried out through such contractor who shall become liable to the Corporation for the price of the fittings and shall receive payment for the same from the purchaser; (*e*) the Corporation shall receive as payment for the services rendered on the sale of such fittings a sum equal to 20 per cent. of the amount charged by the contractors to customers in the case of customers introduced by the Corporation, and a sum equal to 10 per cent. of the amount charged in the case of customers not so introduced, or such other sum or sums as may from time to time be mutually agreed upon; (*f*) the fittings shall be delivered to the purchaser by the Corporation or the contractor through whom they have been sold, as may be mutually arranged. (4) That an invitation be given to all electrical contractors in the city to place their names upon the list of contractors. The Committee further recommends (*a*) that the showroom be open to contractors and their customers, and full information and assistance as to electric light fittings be given by the Corporation and their officials to the contractors and their customers free of charge, and without being requested or expected to purchase such fittings from the Corporation; and (*b*) that a bonus be paid to the contractors on the official list of 3d. per lighting, heating or power point installed in any residence, office or saleshop, and connected to the supply within six months of the receipt of an application form signed by the prospective customer.

Shanklin.—Reduced Lighting.—The U.D.C. has been informed by the Electric Lighting Co. that in consideration of the enforced reduction of lighting it would make a reduction of £50 in the contract, but if an increase of light was authorised before the end of the half-year an adjustment would be made.

South Africa.—Amongst municipal contracts about to be carried out at Cape Town are extensions to the electricity undertaking, to cost £100,000. Sanction has been given to the electric lighting scheme for Ladybrand, O.F.S.—*British and South Africa Export Gazette.*

St. Helens.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £3,500 for underground, and £800 for overhead cables, £600 for services, and £400 for poles for overhead cables.

Stoke-on-Trent.—Proposed Loan.—The T.C. has applied to the L.G.B. for a loan of £30,000 for electricity purposes. The Council has also decided to extend the mains so as to supply current to the Goldendale Iron Co. and the Clarmac Roads, Ltd., and to apply for a loan of £2,500 to carry out the work. The companies guarantee a payment of £600 in three years for electricity.

Stretford.—Year's Working.—The accounts of the electricity department for the past year showed a net surplus of £774, after meeting all charges. On the tramway revenue account the year's surplus was £280.

The consulting engineer of the electricity undertaking recommends the Council to dispose of the four 100-KW. sets at the works, to make room for further extensions. In his report on the work of the undertaking for the year, the engineer states that the increased number of consumers represented an equivalent of 11,702 8-C P. lamps, and the number of units sold during the period amounted to 2,385,848, an increase of 194,297 as compared with the previous 12 months. The Committee is prepared to supply electricity to the White City during the use of the premises for military purposes at an average cost of 1½d. per unit. The Council has also undertaken the temporary electric lighting of the playgrounds at certain local schools during their use for drilling purposes by the local Volunteer Defence Corps.

Torquay.—The T.C. has been recommended to give financial assistance in the case of the Ilford Gas Co. *v.* Ilford U.D.C., for the alleged granting of undue preference to certain consumers and to support a Joint Private Bill for electric lighting purposes.

Truro.—Board of Trade Inquiry.—Mr. A. P. Trotter on November 2nd held an inquiry as to objections to the site of the proposed E.L. generating station, the objections being to the vicinity of the site to houses. The inspector observed that he had known stations where the engine was running and people outside did not know it.

Walsall.—The Electricity Committee has decided to accept no more applications for 105-volt supply, but, where necessary, to extend the 210-volt mains. The electrical engineer has been instructed to enter into a contract with Callender's Cable Co., Ltd., for supplying and laying the cables required during the next two years. The B. of T. has approved of the Council's system for the supply of energy from the new generating station.

Watford.—The District Council has resolved to make an additional charge for electricity in Bushey, and it has been decided, for the time being, to make the Norwich system charge 15 per cent. of the rateable value plus 1d. per unit for all energy consumed. The engineer points out that while the above additional charges are only fair and just, they are likely to lessen the spread of appliances for using current in houses under the Norwich system.

West Hartlepool.—The T.C. has decided to give financial support to the Ilford Council in its action with the Ilford Gas Co.

TRAMWAY and RAILWAY NOTES.

Bury (Lancs.).—Prov. Order.—The T.C. has applied to the B. of T. for a prov. order to authorise the construction of additional electric tramways in the borough.

Eccles.—Negotiations are in progress with the Salford Corporation in regard to the arrangements for repair and maintenance of the tramway overhead equipment, and the borough electrical engineer and the Salford tramways department are to submit estimates for the maintenance, painting work, &c., for the overhead work, tramway standards, &c.

The Eccles Corporation is prepared to bear the costs of the Salford Council superseding the existing bracket arm attachments by clip attachments.

Glasgow.—As regards the extensions of routes granted by the House of Lords Committee, a start is to be made shortly in order to provide work for men thrown out of employment by the war.

Halifax.—The R.D.C. has decided, at the request of the Corporation, to enter into an agreement similar to that of December, 1913, with regard to the tramways. The Corporation contemplates promoting a Bill in connection with this matter.

Lowestoft.—Year's Working.—The deficiency on the year's working of the tramways was £897, notwithstanding the fact that the gross profit amounted to £460 more than in the previous 12 months.

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London.—L.C.C. Tramway Proposals.—It was proposed to seek Parliamentary sanction in the forthcoming session to new tramway schemes involving a total capital expenditure of £881,885, of which £787,035 represented tramway construction and the remainder street widenings.

The following were the proposed new routes :—

1. Victoria to Westminster Bridge.
2. Shepherd's Bush to the Broadway, Hammersmith.
3. Harrow Road to King's Cross.
4. Seven Sisters Road to near Crouch Hill Station.
5. Charles Street to Charterhouse Street.
6. Gray's Inn Road to Blackfriars Bridge.
7. Seven Sisters Road to Stamford Hill.
8. Mare Street to Terrace Road and Church Crescent.
9. High Street, Shoreditch, to Cambridge Road.
10. Aldgate Terminus to Aldgate Station.
11. Aldgate to near Mark Lane Station.
12. Waterloo Road to Blackfriars Road.

In addition, it was proposed to electrify and reconstruct tramways in Southwark Park Road.

The Committee anticipated that great financial benefit would accrue to the tramways from the construction of the East and West link (Harrow Road to King's Cross), and North and South link (Gray's Inn Road to Blackfriars Bridge).

In view of the special conditions which have arisen, the Bill will specify seven years as the period for completion of the schemes.

The L.C.C., at its Tuesday meeting, agreed to an amendment that only such tramway proposals as were agreed to by the road authorities should be proceeded with in Parliament. These embrace the lines from Seven Sisters Road to Crouch Hill Station, Charles Street to Charterhouse Street, Mare Street to Church Crescent, High Street, Shoreditch, to Cambridge Road, and Aldgate to near Mark Lane Station.

Sheffield.—The Tramways Committee has decided to proceed with the work of constructing the Bow Street tramway track, at an estimated cost of £1,300.

South Shields.—Proposed Tramway Extensions.—The T.C. has decided to promote a Bill in Parliament for power to extend the tramways within the borough, and to run omnibuses to Boldon colliery, and to sell electrical fittings.

Stoke-on-Trent.—Tramways Agreement.—By the Act of Parliament federating the six towns of the Staffordshire Potteries, the County Borough of Stoke-on-Trent had power to take over the undertaking of the Potteries Electric Traction Co. in 1914. An understanding is, however, being arrived at by which the company may continue to run for some years. By the draft agreement between the Corporation and the company, it is proposed that the Corporation's rights of purchase shall all be postponed to December 31st, 1940, subject to certain conditions. These include the payment by the company to the Corporation yearly in advance of the sum of £2,000 until 1927, and then of £3,000 a year until 1940, or a total of £65,000. In addition, the company must undertake to double certain lines and improve the rolling stock and the system generally at an estimated cost of £35,000 altogether, keeping the rolling stock up to date, and providing not fewer than eight new cars every year. A fleet of motor-omnibuses must also be run by the company, on routes to be agreed upon. As clauses were still under consideration, the agreement was not discussed at the last meeting of the Council, but will be brought forward at the next meeting.

U.S.A.—According to the *Canadian Engineer*, in connection with the Chicago, Milwaukee and St. Paul Railway electrification across Montana, the electric power is to be supplied by the Montana Power Co., which has under construction a 100,000-volt transmission line which is being carried out with wooden poles. These poles are to be of Western red cedar, 45 and 50 ft. long and 8 in. at the top. A telephone line will parallel the power line on 25-ft. poles, and all the poles are being treated with avenarius carbolineum by the open tank process.

The electrification is to be completed early in 1918.

TELEGRAPH and TELEPHONE NOTES.

Alien's Wireless Installation. — Harold Fochtenberger, the German wireless engineer who was charged with failing to register and with being in possession of electrical apparatus connected with wireless telegraphy, was handed over to the military authorities by the Woolwich magistrate on Thursday last week.

Marconi Shares.—During the week the action brought against Mr. Godfrey Isaacs has been continued. The defence having alleged that the charge was of a blackmailing nature, an adjournment was granted until next Thursday to enable additional evidence to be called.

Canada.—A powerful wireless station is just being completed at Newcastle, N.B. The main tower is 500 ft in height and is surrounded by six 300-ft. auxiliaries. The antenna forming the network around these towers comprises 120,000 ft. of silicon bronze wire, while over 140,000 ft. of wire have been laid in trenches around the station to secure proper ground connections. The power house is equipped with two 225-H.P. motors direct connected to two 1,000-volt D.C. generators. The total cost of the station is about $175,000. The sending and receiving instruments are of the Poulsen type. The distance across the Atlantic to the corresponding station at Ballybunion, Ireland, is about 2,700 miles. —*Canadian Engineer.*

Pacific Cable Repaired. — In the *Telegraph and Telephone Age* for November 1st a full and interesting account is given of the destruction of the British cable station on Fanning Island on September 7th by the German cruiser *Nurnberg*, as told by Captain E. L. Tindall, of the steamer *Kestrel*, which was commissioned to visit the station by the Pacific Cable Board. The ship arrived at the island on September 25th, and received a hearty welcome from the cable staff. The latter stated that the German cruiser and an attendant collier were flying the French flag, and a boat started from the shore to welcome them, but two boat-loads of German soldiers put off from the *Nurnberg*, called upon the residents to surrender, and trained a machine gun on the cable headquarters. They then held up the cable operators, who were hard at work, and proceeded to smash the instruments with axes. Failing to locate the shore end of the cable, they placed heavy charges of dynamite and blew it up ; they also grappled for the cable further out to sea. The engine and boiler rooms were blown up, and a number of valuable papers were seized, from which the enemy ascertained that valuable instruments and arms and ammunition were buried ; these were discovered and seized, and the office safe, which contained $3,000, was rifled. "Through all of this devastation the courtesy extended by these German officers was most marked. They expressed themselves as being greatly surprised that no armed resistance was offered, as they had every reason to believe that Great Britain had taken the precaution to defend this important outpost." The Germans completed their work in about 12 hours.

When the *Kestrel* left the island on September 27th the cable connecting Suva with Fanning had been repaired, and it was expected that the section connecting with British Columbia would be repaired in a few weeks. The damage done was expected to cost over £30,000.

It was reported from Vancouver on November 6th that the cable had been repaired and communication restored.

Pacific Cable Returns.—The accounts of the Pacific Cable Board for the year ended March 31st, 1914, were issued this week. They show that the receipts were £197,848, and the expenditure (including £30,000 to renewal account) £131,197, leaving a surplus of £66,651 ; to this was added £19,951 by the Imperial and Dominion Parliaments, making a total of £86,602 to cover interest and sinking fund on capital expenditure. The balance was £21,376 greater than in the previous year, and the deficit to be made up was £12,319 less ; the net traffic receipts exceeded those of 1912-13 by £30,028, and exceeded the original estimate of the Board by £11,055. A rapid increase took place in the deferred and week-end traffic, but the full-rate traffic, whilst greater than in 1912-13, was less than in 1911-12. An increase of £8,571 took place in the expenditure.

No interruptions occurred on the cable system during the year, but minor interruptions took place on the landline between Montreal and Bamfield, due to the operations of railway construction gangs. The portion of the line which traverses Vancouver Island is less reliable, and a fault occurred on the light cable from Bamfield to Alberni ; a new cable was laid by a different route, from Bamfield to Victoria, in August, 1914.

The international traffic in 1913-14 amounted to 1,329,067 (1,288,949 in 1912-13) words at ordinary rates, 560,011 (415,616) deferred ordinary, 214,971 (193,688) Government, 161,478 (212,500) Press, 525,392 (505,442) deferred Press, and 326,920 week-end cable letters—total 3,117,839 words, in addition to a very considerable inter-Colonial traffic.

Telegrams in Code.—Much dissatisfaction still prevails amongst business firms with regard to the question of cable telegrams in code. It is alleged that the four codes authorised are by no means adequate to meet commercial requirements, as many industries use codes specially devised to suit their own needs. Firms which cannot use the codes permitted are worse off than before the codes were sanctioned, as the ten-letter counting was then abolished.

Wireless in War-time.—The wireless station on the island of Lissa, reinstated by the Austrians, has again been destroyed by the Anglo-French fleet. British destroyers have bombarded the telegraph stations at Sarmussak and Ayasmat, in Asia Minor. It is persistently rumoured that Germans are working secret wireless stations in the United States for military purposes, the installations being situated in remote and unpopulated districts, and the messages being couched in apparently harmless commercial phrases. A previously unknown wireless station at Ensenada, Lower California, has been closed by the Mexican authorities. The British representatives in Washington held that Germans had been receiving information as to the movements of British ships by way of this station.

A powerful French wireless station was opened on Monday at Podgoritza

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THE GOVERNMENT ELECTRIC POWER STATION OF BANGKOK.

By FRANCIS B. SHAW, A.M.Inst.C.E., A.M.I.E.E., Electrical Engineer to the Government of Siam.

(*Continued from page* 614.)

Boiler House.—The boiler house is equipped with eight boilers in four batteries, each capable of easily steaming a 1,000-KW. turbine set on full load.

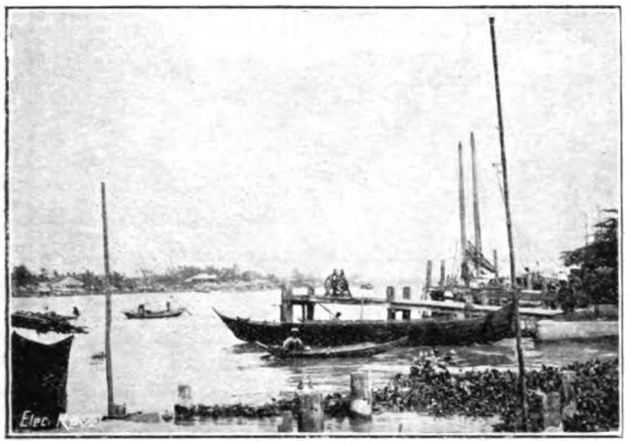

Fig. 4.—View of River and Site.

The boilers are of the Babcock & Wilcox land type, for 205 lb. working pressure and 300° F. superheat. Three out of the four batteries are arranged so that their furnaces may be used to burn alternatively rice husk or oil without any alteration, while the fourth battery is designed for burning coal or oil fuel.

The husk furnaces are in most respects similar to those in use in most of the rice mills (fig. 7). The fire bars of cast-iron

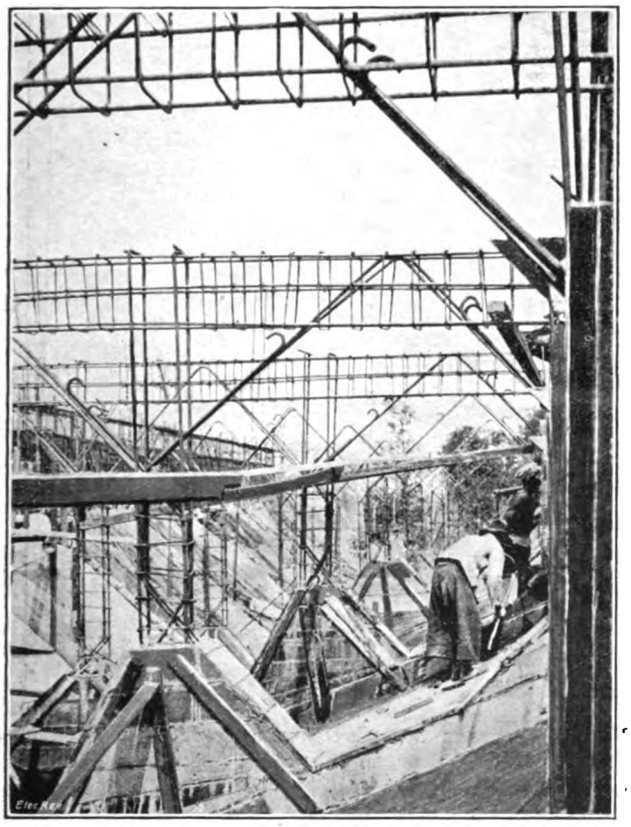

Fig. 5.—Fuel Hoppers under Construction.

are provided with holes of ¼ in. diameter, spaced as closely as possible between the stiffening ribs; these bars are carried on bearers at an angle of 42° with the horizontal.

The husk is allowed to fall on the top of this grid, and to slide slowly in a continuous stream to the bottom. It takes fire within the first few inches of its progress, but this is somewhat dependent on the load at which the boiler is being worked.

The burnt husk collects at the bottom of the grid as a red-hot mass, and is raked into the circulating water drain, which is arranged to conduct the water from the condensers back by way of the boiler house to the river. The large volume of water carries away the burnt husk without any

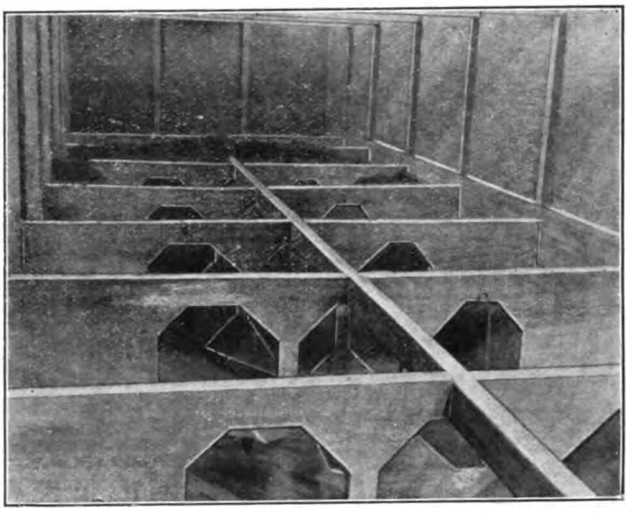

Fig. 6.—Husk Store of Ferro Concrete (see p. 614).

trouble. The drain is divided immediately outside the station into two branches, one on the down-stream side of the culvert, and the other on the up-stream side, as shown in fig. 1, p. 612. During two or three months in the year when the river is low the tides make themselves felt sufficiently to cause a current up-stream, and thus if we always discharged down-stream we should at times get this burnt husk back into our condensers.

About a foot from the base of the fire bars is the flame

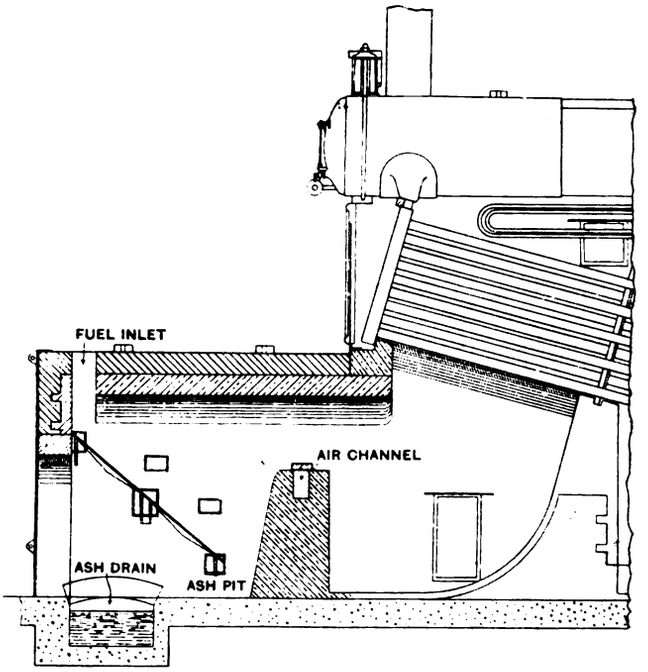

Fig. 7.—Section of Furnace for Rice Husk.

arch, and by modifying this a 30 per cent. saving in fuel has been effected. This arch in the first battery constructed was made solid, but in subsequent batteries a tunnel has been left in the top of the arch for introducing air at this point. Since two furnaces go to make up a battery, there is a wall

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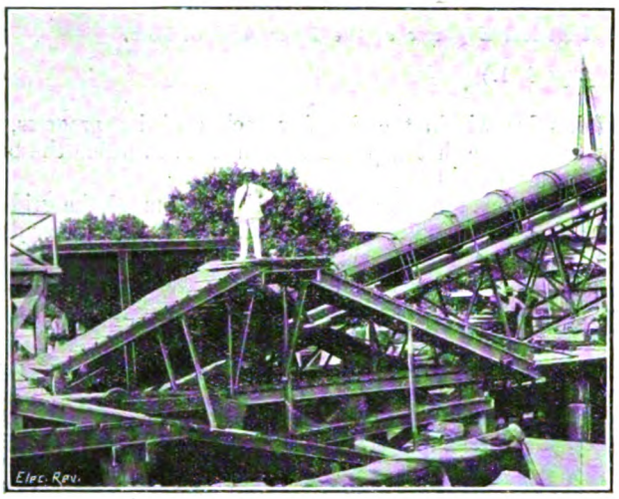
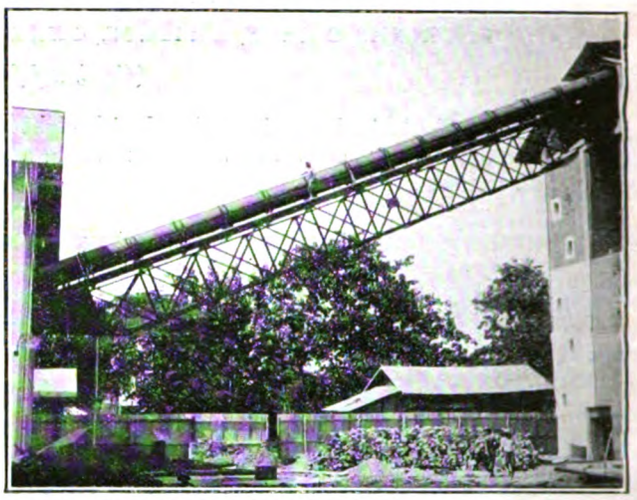
common to both furnaces. In order to allow of sufficient air being drawn into the tunnel it is open at both ends, fire brick without any fire-clay filling. The air from the tunnel is thus drawn up through the fine spaces between the bricks.





FIGS. 8 AND 9.—NOS. 1 AND 3 CONVEYORS (see p. 613).

and a vertical shaft with regulating dampers is constructed in this common wall.

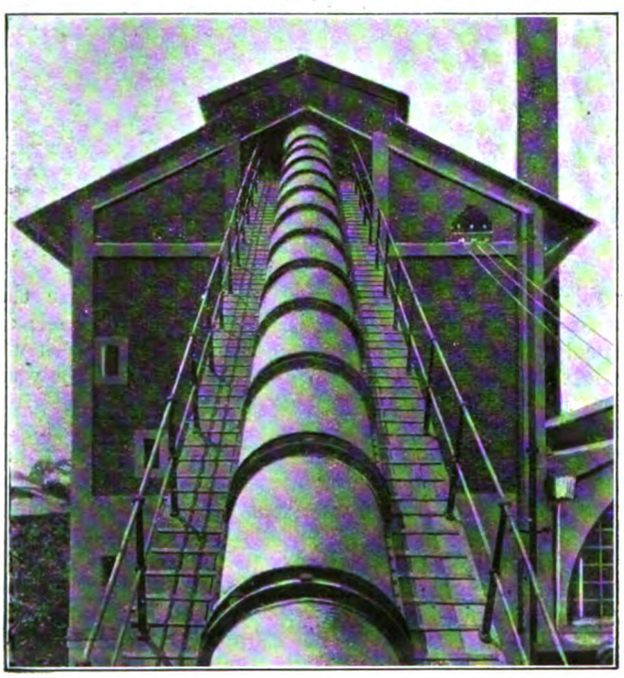


FIG. 10.—NO. 3 CONVEYOR.

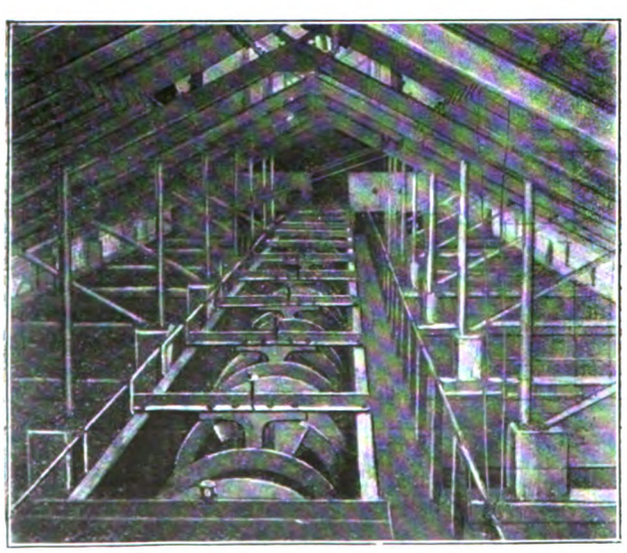


FIG. 11.—NO. 4 CONVEYOR, OVER BOILERS.

As shown in fig. 7, which gives a sectional elevation of the furnace, the top of the tunnel is covered by a single layer of

It was found in practice that the highest efficiency was obtained with the regulating shutters fully opened; it is, therefore, intended to introduce still more air at the foot of the grate.

Originally openings were left in the side walls, but it was found that when these were opened the rush of air set up a whirling action and carried the unburnt husk in such large quantities over the flame arch that the spaces beyond soon became choked, and the boiler had to be shut down.

It is most important that mechanical feeding of the husk into the furnace be employed, and that this can be easily

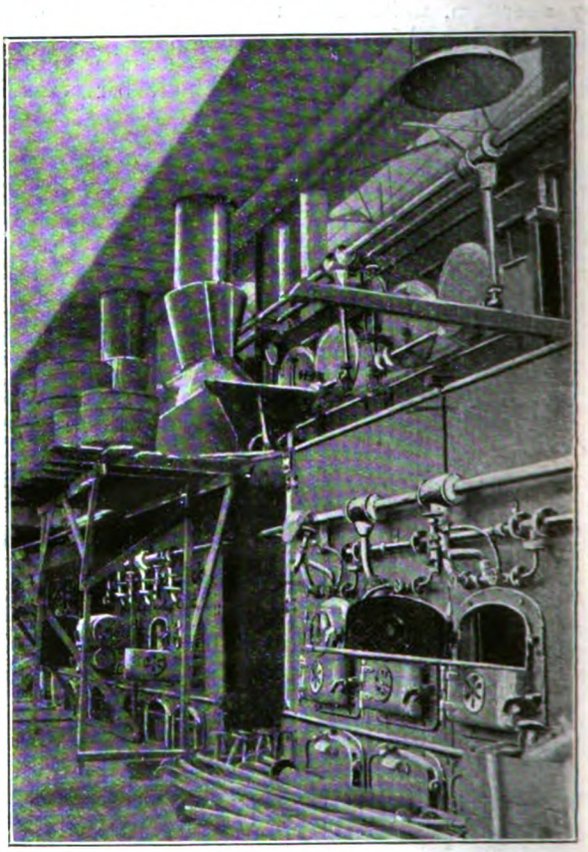


FIG. 12.—BABCOCK & WILCOX BOILERS WITH HUSK FURNACES.

regulated as to speed and quantity, to obtain efficient combustion and a smokeless chimney.

With the present method it is impossible to make complete use of all the carbon contained in the husk. It seems that the carbon is held in a cell-like structure of silica, and that a certain proportion is masked by this. The ash is very largely black, but in certain places where it has been subjected to a higher temperature, and where possibly there has been an excess of air, it becomes a white glassy mass.

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It has been suggested to introduce steam into the red-hot mass at the foot of the grate, and it is intended to experiment in this direction at a later date. An Ados CO_2 recorder has helped us considerably in our experiments, and it is hoped when more steady load conditions prevail still further to improve our fuel costs.

Feed Pumps.—Two Weir feed pumps and an A.E.G. steam turbine-driven feed pump with automatic control supply feed water from the hot-well through a duplicate set of mains to the boilers. A Lea recorder measures the discharge from the air pumps before it enters the hot-well, which is an underground ferro-concrete tank.

Situated over this tank is a 40-in. Jewel filter, which takes its supply from the fire protection tanks on the roof of the husk hoppers over the boiler house, and which is capable of supplying 1,250 gallons an hour. It was found necessary to install this filter, as the river water was causing rapid corrosion, which has since entirely stopped.

Previously to this it was always accepted that the water of the Menam was remarkably good for boiler purposes, but this was doubtless due to the fact that in the vast majority of river launch boilers here the pressure is about 80 lb., and wood fuel is used. With the higher pressure, and consequently higher temperature, that we employ, it is probable that the matter in suspension undergoes chemical changes, and is split up into corrosive compounds.

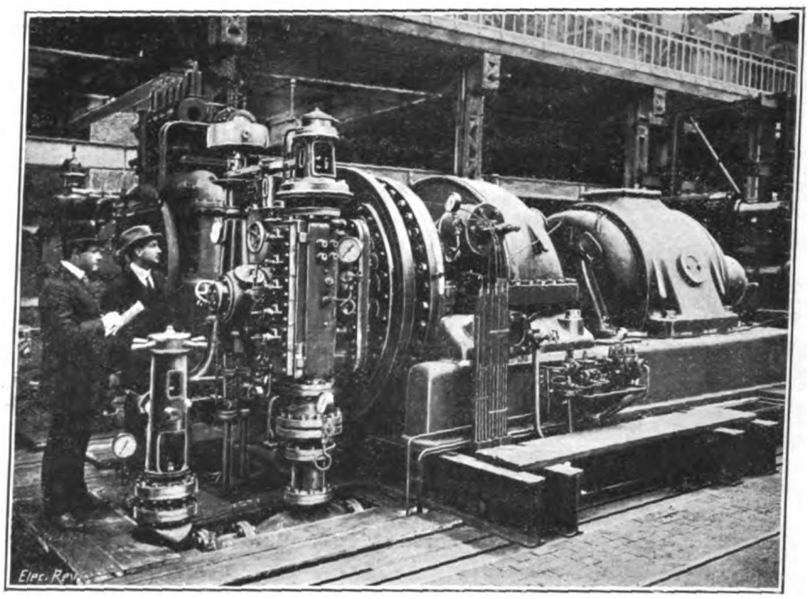

Fig. 15.—Turbo-Generator under Test in Makers' Works.

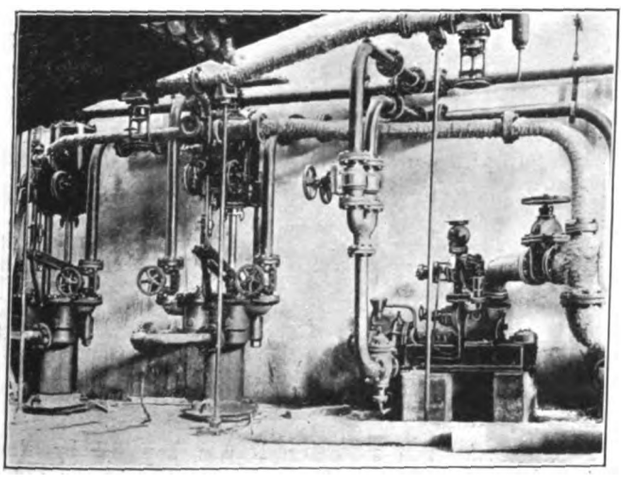

Fig. 13.—Feed Water Pumps.

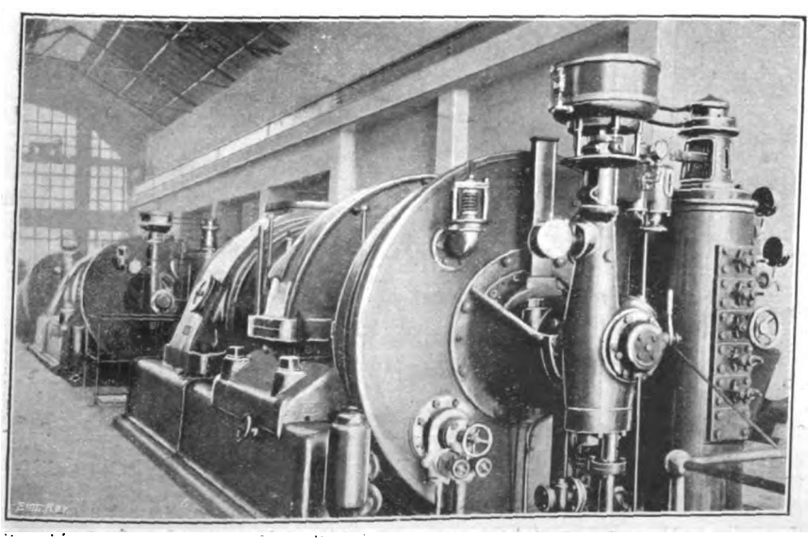

Fig. 14.—Turbo-Generators in Power Station.

An auxiliary supply for feed-water purposes is provided by a 4-in. main from the town supply.

Chimney.—The chimney is of steel, 8 ft. 6 in. in diameter and 162 ft. high, and was supplied by Messrs. Babcock and Wilcox ready for erection, the foundations and brick base being constructed to their requirements.

The erection was carried out without any external scaffolding, each half ring being hoisted into position by means of a jib and pulley block; the jib was fastened to the last ring of plates finished, and the next plate hauled up from below.

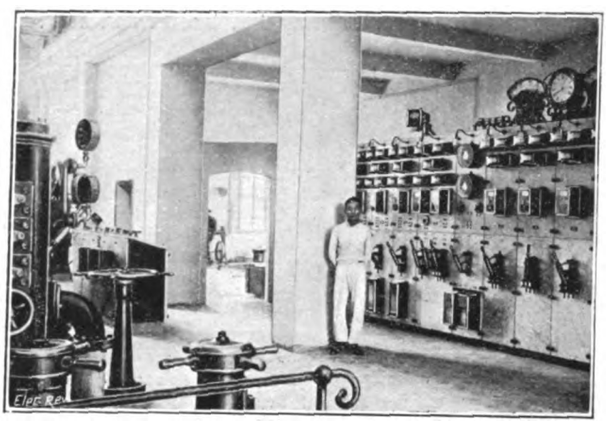

Fig. 16.—Main and Control Switchboards.

Some difficulty was at first experienced in finding natives accustomed to working at a great height, until a Chinese contractor was found who undertook the work, using Chinese sailors from a Chinese repairing dock. Chinese riveters were employed; a temporary staging was moved up inside and a small staging suspended over the side.

No accidents occurred throughout, and the work was finished to the guaranteed date, about three plates being got into position each day and riveted.

The chimney is stayed at two points by six stays, and has a heavy cast-iron coping carrying a lightning conductor with several points. All the metal structure is painted with three coats of bitumastic paint.

Turbo-Generators.—There are three A.E.G. Curtis type multi-stage impulse turbines, coupled to three-phase generators, with a continuous output of 1,335 K.V.A.

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or 1,000 KW., with a power factor of 0 75, voltage 3,500 and frequency 50 cycles, and running at a speed of 3,000 R.P.M. The exciters are mounted on the same shaft. In case of a breakdown on the exciters, exciting current may be drawn from the battery, provision having been made for this.

The system of automatic lubrication is very complete, and

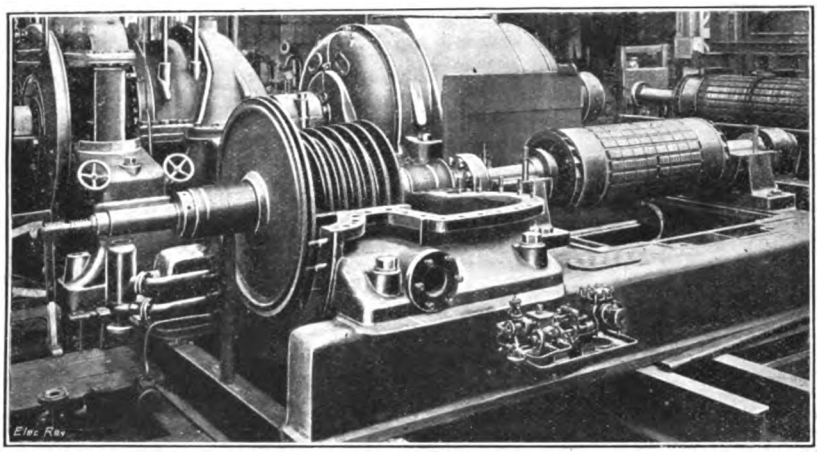

FIG. 17.—ROTOR OF TURBO-GENERATOR.

the oil supply is kept at a constant temperature by means of a cooling tank with water circulation.

A small reciprocating steam pump supplies oil under pressure to the bearings when starting up, running slow, or shutting down.

Tests at Works.—The three turbo-generators were tested for steam consumption, the results being as follows :—

No. 1 Turbine.—On an average taken during a six hours' full-load run, the consumption was 6·35 kg. per KW.-hour—the guarantee being 6·37 kg. per KW.-hour.

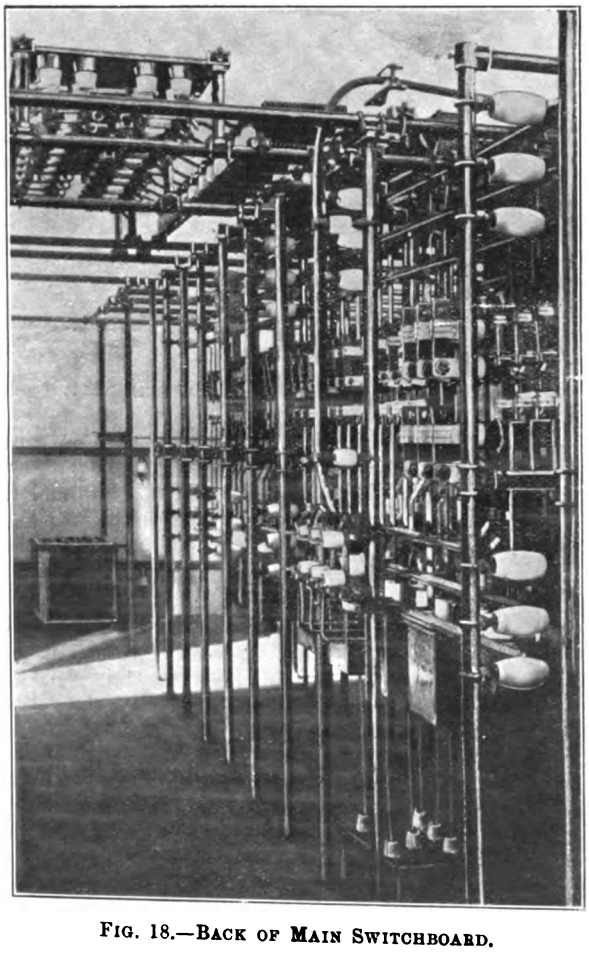

FIG. 18.—BACK OF MAIN SWITCHBOARD.

Immediately following this run, a 25 per cent. overload was put on for two hours, and immediately after shutting down the stator windings of the generator were submitted to a pressure of 8,800 volts against iron for one minute, and the rotor to a pressure of 1,000 volts. These tests were withstood satisfactorily.

The generator when running at full speed and voltage was short-circuited, and an oscillogram was taken. The short-circuit current was :—

Maximum 3,200 amperes = 19·4 × normal current.
Permanent s.c. current = 1·5 × „ „
Excitation maximum = 550 amperes.

The specification asked for 10 to 15 times the normal current only, but the makers in their specification could not guarantee less than 25 times the normal current.

The largest rise of temperature was on the rotor and was 63·7° C. This figure is satisfactory and well within the limits of the specification.

The condensers are of the usual surface type, placed immediately below the turbines, and immediately in front of them are the rotary air and circulating pumps, which are driven by a small turbine.

The circulating pump draws immediately from the culvert below, and at high tide the level of the river is the same as that of the pump ; thus the lift is very small at the average working level. The maximum variation in level between the highest and lowest known water levels is slightly over 3 metres.

During the first full-load trials on site vacuums as high as 28½ in. were recorded.

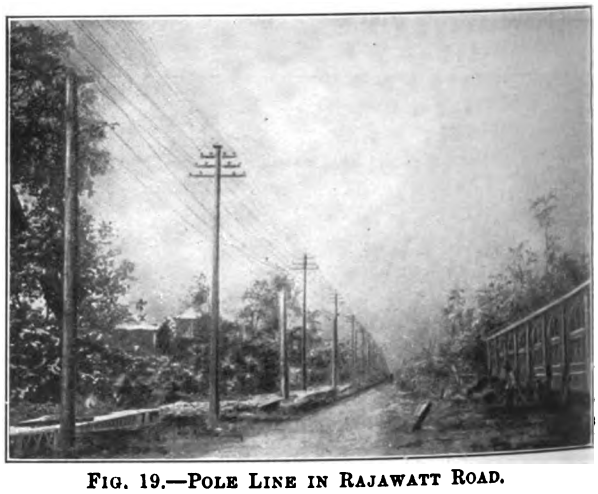

FIG. 19.—POLE LINE IN RAJAWATT ROAD.

Switchboard.—The switchboard was supplied by the British Thomson-Houston Co., Ltd., Rugby. At the back of the board an enclosed room contains all the H.T. switch-gear, which is mounted on pipe framework and operated from the front of the switchboard by means of automatic and hand remote-control levers.

FIG. 20.—SWITCH TOWER AND WATERWORKS PUMP HOUSE.

The switchboard is designed to control four turbo-generators of 1,000 K.V.A. capacity ; five outgoing feeders ; one motor-generator of 300 K.V.A. capacity ; one battery

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panel, to operate a battery of 1,200 ampere-hours capacity; one Tirrill voltage regulator panel.

Suitable ammeters, voltmeters, power-factor indicators and integrating wattmeters are fixed on the front of the marble panels, and in the case of the generator and feeder panels one ammeter has been placed in each phase in order that any out-of-balance may be observed.

The feeder oil switches are fitted with automatic overload trip circuits, it being possible to adjust the trip for instantaneous or time-limit release by placing various sized fuses in parallel with the trip coil.

The generator switches are designed to trip by means of reverse-current relays, which will operate on a reverse current of 30 per cent. of the normal full load. All oil switches have a rupturing capacity of 10,000 K.V.A.

Duplicate high-tension bus-bars have been provided in order that, if required, power feeders and lighting feeders may be supplied off separate generators, and if desired these two bus-bars can be connected or synchronised by means of a non-automatic oil switch.

Isolating switches are provided in each section, so that portions of the switchgear may be isolated for examination if necessary.

A separate switchboard in the form of a desk board has been provided for adjusting the generator voltage.

The necessary field switches are mounted on the front of the panels, and it has been arranged that should an exciter break down, the particular field switch may be connected to an auxiliary set of bus-bars which are fed from the battery.

Each panel controls only one unit, and everything has been arranged, as far as possible, to prevent trouble on one unit affecting the other units.

A motor-generator of 300-K.V.A. capacity is used for charging the battery. The H.T. alternating-current synchronous motor is started up by means of a special compensator, and can be run up to speed and connected to the H.T. bus-bars without the operator actually synchronising. The motor-generator may also be started up from the direct-current side if it is desired.

(*To be concluded.*)

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—November 19th. Six or twelve months' supply of telegraph material and other supplies, for G.N. of Scotland Railway. Particulars, &c., from Stores Superintendent, 80, Guild Street.

Atherton.—November 18th. One 250-KW. single-phase transformer. Mr. C. T. Astbury, Resident Engineer.

Australia.—MELBOURNE.—December 16th. Victorian Railways. Rubber-covered copper wire. Contract No. 27,705. Contractors' Room, Spencer Street.

December 16th. Victorian Railways. 100 neutral track relays for electrical circuits. Contract 27,712. Contractors' Room, Spencer Street.

December 28th. Victorian Railways. Three 50-KW. static transformers. Contract 27,737. Contractors' Room, Spencer Street.

BRISBANE.—December 15th. Switchboard, common battery, automatic or semi-automatic, for the Postmaster-General. See "Official Notices" October 9th.

December 21st. City Council. Motor-generators and switchgear suitable for electric vehicle battery charging. Specifications, 10s. 6d, from City Electrical Engineer.

January 6th. P.M.G. Paper-insulated, lead-covered cable (Schedule 328). See "Official Notices" November 6th.

January 6th. Copper wire and accessories, paper-insulated lead-covered cable, for P.M.G. See "Official Notices" to-day.

PERTH.—December 16th. Telegraph and telephone instruments for P.M.G. See "Official Notices" to-day.

Barnet.—December 7th. B. of G. Electrical power and lighting plant, electric lift, &c., for the Guardians of Barnet Union. Particulars and forms of tender from Williams & Cox, architects, 34, Henrietta Street, Covent Garden, W.C.

Blackpool.—November 19th. Corporation. Water-tube boiler, mechanical stokers, economiser, steel chimney, coal-storage hopper, one 1,500-KW. turbo-alternator, surface condenser and auxiliaries. See "Official Notices" October 23rd.

Canary Islands.—Tenders have just been invited by the municipal authorities of Santa Brigido, in the Canary Islands, for the concession for the electric lighting of the town during a period of 20 years.

Cheshire.—Cheshire Lines Committee.—Telegraph materials and carbons for 1915. Forms from Stores Superintendent, Cheshire Lines, Warrington.

Croydon.—November 17th. Two electric motor pumps and connections, at South Norwood Sewage Farm. Particulars from Borough Engineer's office, Town Hall, Croydon.

Dartford.—November 18th. U.D.C. Steam, exhaust and other piping, extension of H.T. cubicles, control board and cabling. See "Official Notices" to-day.

Dublin.—Corporation. Electric time switches for street lamps, and radial wave reflectors. See "Official Notices" Nov. 6th.

Edinburgh.—Edinburgh and District Tramway Co., Ltd. Various articles for the year, including electric light supplies. Mr. C. W. Shepherd, General Manager.

Leigh.—November 20th. Corporation. 5,000 tons of steam slack for the electricity works. Borough Electrical Engineer.

London.—L.C.C. December 8th. (*a*) H. and L.T. switchgear, (*b*) gravity bucket ash conveyor in connection with tramways. See "Official Notices" to-day."

Manchester.—November 17th. Pitch for paving purposes, for the Tramways Committee. Mr. J. M. McElroy, General Manager.

Block tin for the Tramways Department. General Manager.

November 18th. Complete electric light installation at Old Hall Drive Municipal School, Gorton. Specifications, &c. (21s., returnable), from the Education Offices, Deansgate.

December 16th. Corporation. Ten 50,000-lb. water-tube boilers complete, two 15,000-KW. turbo-alternators complete. See "Official Notices" to-day.

Newport (Mon.).—November 18th. Corporation feed-water heater for the Corporation. Particulars from Mr. A. N. Moore, Borough Electrical Engineer, Town Hall.

Normanton (Yorks.).—November 16th. Renewing plates of storage battery for 34 amperes capacity, for the Normanton and District Joint Isolation Hospital Committee. Mr. J. W. Martin, Clerk.

Port Elizabeth.—November 26th. Municipal Council. (*a*) Engine-room plant, turbo-generators, H.T. switchgear, converting plant; (*b*) boiler-house plant, boilers, coal conveyor; (*c*) E.H.T. and telephone cables. See "Official Notices" November 6th.

Spain.—The municipal authorities of Olvega (province of Soria) have just invited tenders for the concession for the electric lighting of the town during a period of 15 years.

December 28th.—Junta de Obras del Puerto de Alicante, Alicante. Three electric cranes. Deposit £55. Some particulars may be seen at the Commercial Intelligence Department of the Board of Trade, 73, Basinghall Street, E.C.

Stockton-on-Tees.—November 20th. Corporation. Paper-insulated, lead-covered and armoured cables. See "Official Notices" to-day.

South Africa.—December 17th. Five electric bed lifts for the Alexandra Hospital. Tenders to the Chairman of Tender Board, Provincial Auditor's Office, Cape Town. A specification and blue prints can be seen at the Board of Trade (C.I. Dept.) in London.

Wakefield.—December 4th. Yorkshire (W.R.) Electric Tramways Co., Ltd. Twelve months' supply of electric lamps, fittings, insulating materials, &c. Schedules can be obtained from the Central Offices, Belle Isle.

Walsall.—November 17th. Corporation. Extra-high-tension cables. See "Official Notices" November 6th.

December 1st. Corporation. E.H.T., medium and L.T. switchgear for sub-stations. See "Official Notices" to-day.

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CLOSED.

Australia.—The following tenders have been accepted :—

VICTORIA.—P.M.G.'s Department. Five tons galvanised iron wire (60 lb. mile), £79 ; 50 tons ditto. (200 lb. mile), £585 ; 10 tons steel wire, S.W.G., £203.—R. Johnson, Clapham & Morris, Ltd.

BRISBANE.—P.M.G.'s Department. 5,200 No. 6 gauge zincs, £347 ; Lawrence & Hanson Electrical Co., Ltd. 1,000 No. 1 carporous pots, £112 ; British General Electric Co.

VICTORIAN GENEBAL STORES.—Supplies of electric lamps (fittings and materials) to June 30th : Edison & Swan U.E.L. Ltd. ; Noyes Bros. (Melbourne) Pty.. Ltd. ; Siemens Bros. Dynamo Works, Ltd. ; India-Rubber, G.P. & Telegraph Works, Ltd. ; B.I. & Helsby Cables, Ltd.—*Tenders.*

Bacup. — A tower wagon has been purchased by the E.C. from Mr. J. L. Adamson.

Glasgow.—The Works Committee of the T.C.'s Tramways Committee has accepted the following tenders :—

Traction street poles.—Stewarts & Lloyds, Ltd.
Trolley feeder cable —St. Helens Cable Co.
Steel plates for manholes —W. Baird & Son.
Asphalt buckets.—P. & W. MacLellan, Ltd.
Special track work.—Titan Trackwork Co., Ltd.; Edgar, Allen & Co., Ltd.; and Hadfields, Ltd.
Cast-steel pipe connections for Pinkston.—Stewarts & Lloyds, Ltd.

It was agreed that the above offers be accepted, subject to the Committee being satisfied, after inquiry by the manager, that Messrs. P. & W. MacLellan, Ltd., and Messrs. Stewarts & Lloyds, Ltd. (the latter on the first contract), and their respective subcontractors, are paying the standard rate of wages, and otherwise conforming to the Standing Orders of the Corporation.

Ipswich.—Messrs. Chamberlain & Hookham, Ltd., have received the contract for the supply of meters to the Corporation for the coming year.

Keighley.—The Education Committee has accepted the tender of the Keighley Electrical Engineering Co. for motors for the textile department at the Technical Institute, at £138, and that of Messrs. Richards & Rhodes for wiring and lighting the textile and chemical departments at the Institute, and providing a switchboard, at £106.

London.—STEPNEY.—The following tenders have been received by the Electricity Supply Committee for a new power board at the Limehouse Generating Station :—

General Electric Co., Ltd...	£106	Edison & Swan Co., Ltd. ..	£133
W. White & Co.	127	Morris & Lister, Ltd. ..	195

The Committee recommends the acceptance of the lowest tender ; also the tender of Strachan & Henshaw, Ltd., at £329, for extending the telpher track at the above station.

The Electricity Supply Committee has accepted offers from Messrs. Rickett, Cockerill & Co., Ltd., and Messrs. Harris, Hardman & Co., Ltd., to supply 100 tons wharf small coal, at 11s. 6d. per ton, and about 200 tons of Scotch washed peas, at 14s. per ton respectively.

Manchester.—The Electricity Committee has accepted the following tenders :—

One 250-KW. motor-converter.—Bruce Peebles & Co., Ltd.
Sub-station switchgear to September, 1915.—Ferranti, Ltd.
Lead-sheathed service cables to June, 1915.—W. T. Glover & Co., Ltd.
One mile 87/15 cable.—Chas. Macintosh & Co., Ltd.
Service boxes.—Joseph Stubbs, Ltd., and Hardy & Padmore, Ltd.

New Zealand.—The tender of the Brush Electrical Engineering Co. has been accepted for the supply of hydro-electric plant and transformers for the township of Tauranga, N.Z.

Normanton. — The Joint Hospital Committee has accepted the tenders of Mr. C. J. Cox, amounting to £132, for erecting overhead electric wires, and to £15 12s. for wiring and fixing electric fans.

Northampton.—The tender of Messrs. J. A. Baker & Co. has been accepted, at £422, for wiring the Secondary School for Girls and supplying the necessary lamps and fittings.

Sheffield.—The City Council has been recommended to accept the tender of Messrs. Cammell, Laird & Co., Ltd., to supply 50 special tramcar tires at 31s. each ; also the offer of the Dart Motor and Transport Co., Ltd., to supply a 15-H.P. Armstrong-Whitworth motor chassis for the Tramways Department for £375, with an additional 5 per cent. for contingencies, if required. The tenders of Messrs. R. S. Whitworth, Ltd., and the West End Clothiers are also recommended for acceptance for a supply of uniform clothing to the Tramways Department.

Stretford.—The tender of Messrs. George Bullock & Co. is recommended for acceptance, at £831, for the installation of electrical pumping plant at the Sewage Farm.

Sunderland.—The T.C. on Wednesday accepted tenders as follows :—

Box frames and covers.—W. G. Farrow & Co.
Spare parts for stokers.—E. Bennis & Co., Ltd.
E.H.T. expansion joints.—B.I. & Helsby Cables, Ltd.

Walsall.—The Electricity Committee has accepted the tenders of Messrs. Reyrolle & Co., at £2,200, for extra H.T. switchgear and at £260 for L.T. switch-gear ; also the tender of the British Westinghouse Co., at £527, for station transformers.

Wirral.—The Joint Hospital Board has accepted the tender of Messrs. Collins & Price for the electrical installation at the Fever Hospital, at £196.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, November 13th. At 8 p.m. At 39, Victoria Street. Paper on "The Engineer and Malaria," by Mr. F. D. Evans.
Friday, November 20th. At 8 p.m. At 39, Victoria Street. Paper on "Building Contracts and Sub-Contractors," by Mr. J. H. Pearson.

Wireless Society of London.—Friday, November 13th. At 8 p.m. At Institution of Electrical Engineers. Address on "The Function of the Earth in Radio-Telegraphy," by Prof. J. A. Fleming.

Electro-Harmonic Society.—Monday, November 16th. At Holborn Restaurant. Ladies' night.

Institution of Post Office Electrical Engineers.—Monday, November 16th. At 6 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Papers on "Stores Accounting," by Mr. W. T. Harris ; "Cash," by Mr. J. A. Payne.

Institution of Civil Engineers.—Tuesday, November 17th. At 8 p.m. At Great George Street, S.W. Paper on "Economics of Electric Railway Distribution," by Dr. H. Field Parshall.

Institution of Electrical Engineers (Manchester Local Section.—Tuesday, November 17th. At 7.30 p.m. At Engineers' Club, Albert Square. Paper on "Cables," by Mr. C. J. Beaver.

Physical Society of London.—Friday, November 13th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "A Bridge for the Measurement of Self-Induction," by Mr. D. Owen, and "On the Coefficient of Diffusion in Dilute Solutions," by Mr. B. W. Clack.

Institution of Electrical Engineers (Birmingham Local Section).—Wednesday, November 18th. At 7 30 p.m. At the University, Edmund Street, Chairman's inaugural address, by Dr. A. H. Ralling.

Iron and Steel Institute.—Thursday, November 19th. At 11 a.m. At 23, Victoria Street, S.W. General Meeting.

Institution of Mechanical Engineers.—Friday, November 20th. At 8 p.m. At Storey's Gate, S.W. Paper on "The Effect of Vacuum on Steam Turbines," by Mr. G. G. Storey, F.R.S. ; Thomas Hawksley lecture on Pumping and other Machinery for Waterworks and Drainage.

North-East Coast Institution of Engineers and Shipbuilders.—Saturday, November 21st. At 7.15 p.m. At Bolbec Hall, Westgate Road, Newcastle-on-Tyne. Paper on "Lighthouses and Lightships," by Mr. C. Suckan.

NOTES.

Foreign Trade.—THE OCTOBER FIGURES.—The following are the electrical and machinery figures given in the official returns for October :—

IMPORTS.	*Month of October.*	*Inc. or dec.*	*Ten months, 1914.*	*Inc. or dec.*
	£	£	£	£
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	59,980	— 86,878	1,089,192	—188,589
Machinery	435,516	—221,023	5,742,789	—358,361
EXPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	212,997	— 143,766	2,597,387	—1,523,765
Machinery ...	...2,032,738	—1,238,558	28,139,304	—2,621,556

Late Correspondence.—We have received the following letter with regard to our review of "Picture Play Photography" :—

"Will you allow me, if not too late in the day, to thank you for your most sporting criticism of my little book, 'Picture Play Photography.' For you to review it—even though it was to find fault with one of its statements—is very flattering to me.

"With reference to the part that you criticise, may I say that I thoroughly agree with the spirit of your original article, which, I take it, was written against the absurd scares, and ideas of 'lurking danger,' in which the general public from time to time indulges. I carefully used italics when quoting your article, to show that the only thing I found fault with was the *unqualified* statement that none of the so-called ultra-violet rays could penetrate glass. That I did know of the shorter wave-lengths, is obvious from the fact that in the very chapter from which you quote I plainly stated that there were rays which would not pass through glass.

"The unqualified statement was possibly an oversight on your part, and, if so, pray accept my apologies for having criticised it in print, instead of having pointed it out to you by letter.

"Of course, the definition 'harmful' rays is very ambiguous, yet quite clear enough for our purpose ; 'selectiveness,' 'acclimatisation,' and consequent ultimate 'immunity,' all play their part. I might remark that for fear of prejudicing the unscientific reader, and doing an injury to certain manufacturers, I refrained from going into the matter of mercury-vapour lamps, and the injurious rays that either pass through the glass of their tubes or else are induced in that substance. Dr. Steinmetz would probably define the light of these tubes as of 'excessive intensity.'

"We must always remember that there *may* be an action the inverse of fluorescence, and also the fact of induction of pulsations, *vide* the Crookes tube, &c. Also, our knowledge of the whole matter of higher vibrations and pulsations, their atomic, electronic, and organic effect, and the permanence or otherwise of the latter effect (for instance, on cancerous growth) is as yet only in its infancy.

"Again thanking you for your most courteous criticism.

"H. M. LOMAS.

"Teddington, *November 10th*, 1914."

[We admit that our statement should have been more guarded. We have, however, recently published abundant evidence confirming the fact that we wanted to emphasise—namely, that the *harmful* rays cannot pass through glass.—EDS. ELEC. REV.]

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Copper.—In a circular letter accompanying their statistical tables for October 31st, Messrs. H. R. Merton & Co. note that the consumptive demand for copper during the month of October has been on a fair scale, good orders emanating from those engaged in work for the Government. There was also a continuation of orders for Russia. American producers, however, pushed rather keenly for business, causing prices to recede. At the close of the month the downward trend appeared to be arrested for the time being.

European visible supplies at the end of July were 33,612 tons, at the end of August 34,806, at the end of September 34,594, and at the end of October 36,566 tons, an increase of 1,972 during October. In these quantities stocks at Hamburg and Bremen are reckoned as the same as on July 31st, since when no returns have been received. English stocks have run:—August 31st, 17,572 tons; September 30th, 18,610 tons; and October 31st, 21,457 tons.

Supplies during October ran as follows:—Total European arrivals from North America, 19,933 tons (average for the 12 months ending July 31st, 34,400 tons); Spain and Portugal to England and France (pyrites excluded), 727 tons (average as above 1,650); England and France from other countries, 1,148 (average 4,910); shipments from Chile to Europe, 1,925 tons (average 3,280); shipments from Australia to Europe, 2,000 tons (average 3,310); total deliveries, 23,761 (average 47,740).

Apparently the price keeps down in spite of limited supplies, from which one would be inclined to argue limited consumption, which must obviously be the case with the electrical industry on the Continent. The activity of the past year may be ascribed to the preparations for inducing the present industrial conditions, and the direction of all the energies of so large a portion of the human race to works of destruction only must influence the whole aspect of commerce for some time to come.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The opening meeting of the Manchester Local Section for the new session was held at the Engineers' Club, Manchester, on November 3rd, when the chairman, Mr. P. P. Wheelwright, gave his inaugural address. Prof. Marchant, in proposing a vote of thanks to the chairman, said that Mr. Wheelwright had come forward at very short notice to act as chairman of the Section, owing the resignation of Dr. E. Rosenberg in August last. The meeting then took the form of a smoking concert. The programme consisted of a number of musical items, which were well rendered, and very much enjoyed by the company present.

Birmingham Local Section.—The programme for the first half of the Session contains the following items:—

November 18th.—Chairman's Inaugural Address (Dr. Railing).
December 2nd.—"Power Plant Testing," by Mr. W. M. Selvey.
December 16th.—"Automatic Protective Switchgear for Alternating-Current Systems," by Mr. E. B. Wedmore.

The inaugural address of the Session of the Scottish Local Section was given on November 10th by the chairman, Mr. James Lowson, who dealt almost exclusively with the branch of the profession with which he has been more intimately identified—electrical equipment on board ship.

On November 3rd a paper was read before the Birmingham branch of the Ironmongers' Association, by Mr. W. E. Milns, of the Birmingham Corporation electric supply department, entitled "The Electrical Ironmonger." Mr. Milns dealt with the present position of electric lighting and heating, and the relationship existing between the ironmonger and the electrical trade, and concluded with suggestions for a closer relationship between these trades. The paper was read in the Birmingham electric supply department's showroom, and was followed by a demonstration of the most up-to-date lighting and heating appliances.

At a recent meeting of the Midland Institute of Mining, Civil, and Mechanical Engineers at Leeds, Mr. E. A. Hailwood (of Messrs. Ackroyd & Best) read a paper on electric miners' lamps compared with the combustion tube oil lamp. He denied the contention that it was impossible to create an ignition of gas by the breaking of a small bulb of an electric lamp; he had experimentally secured hundreds of ignitions in that way. He thought it might be explained by the gas rushing into the bulb when the vacuum was destroyed, becoming momentarily compressed against the red hot filament, and exploding. He doubted whether the insertion of a fuse would get over the difficulty.

On the question of candle-power, certain authorities stated that an illumination of 1 C.P. would prevent nystagmus, and it was natural, therefore, that the electric lamp which was supposed to give 1½ C.P. should be favoured.

From tests, however, at large collieries, he found 63 Ceag lamps at the end of the shift to give an average of '61 C.P.; 20 such lamps ready for the incoming shift averaged '77 C.P. In another case he found at the end of the shift average candle-powers of '54 and '7 for two types of Sussman lamp, '6 for 12 Ceag lamps and '68 for 10 Oldham lamps. The author then gave particulars of the Hailwood combustion tube oil lamp, weighing 3 lb. 7½ oz. fully charged, which gives 1½ to over 2 C.P.

Turning to the question of cost, the flame lamp was cheaper than the electric, and, apparently, owing to the robust construction, the latter were more carelessly used, the cases were often holed with the pick, the outer glasses smashed, &c.

As the light deteriorated towards the end of a shift the men drew the lamps nearer to the working face, and within range of the pick, and, according to the author, the electric lamp was apt to get placed in a dangerous position for igniting coal dust and air more often than would be the case with the flame lamp. The discussion was postponed, the chairman intimating that he would like to criticise a good many things in the paper.

Railway Students' Association.—In his recent Presidential address to the Railway Students' Association, on the subject of "Electrical and Steam Railway Costs," reported at length in the *Railway Gazette*, Mr. R. H. Selbie, general manager, Metropolitan Railway, covered a number of interesting points. He mentioned the formidable nature of modern high speed, road competition, particularly the motor-'bus. Experience has proved that only beyond 3 miles can the electric railway fully hold its own against such vehicles, owing to its extra speed counterbalancing delays in booking, &c. With the multiple-unit electric train, shunting of engines is obviated and the occupation of platform roads is reduced by one-half, which is equivalent to doubling the terminal accommodation. The average increase in speed of an electric train during accelerating periods is about 1·02 miles per hour per second as against only ·31 miles per hour per second for a steam train, and while the gearing and size of the driving wheels of the former prevent it from reaching the same maximum speed as the latter, this is not a drawback with frequent stops, while acceleration is of the utmost importance under those conditions, and allows of the operation of a greater number of trains and shortening of signal sections, &c., leading to increase in capacity and earning power. The flexibility of the electrical train allows its composition to be altered while still maintaining the frequent service. In the case of a steam service, slack-hour traffic is in practice met by reducing the frequency of service itself, tending to drive waiting passengers to street vehicles. With the modern electric railway plant with an output of 50 million units, the cost (generation, distribution, maintenance, interest and depreciation charges) per unit would amount to about ½d. A six-car 200-ton train requires on the average 18 units a mile—cost 9d.; other train expenses (including interest on cost of trains and equipment, maintenance and depreciation of same, wages, lighting, &c.) work out at 2½d. per car-mile, or 13½d. per six-car train mile, giving a total of 22 5d. per train-mile. These can be regarded as fair average figures based upon experience of several lines. The cost of working a similar steam train may be taken as 17d. per train-mile, or 5½d. less; but the number of such trains is in no case likely to exceed 15 per hour into a terminus, while under electric working 30 trains could be handled and 40 to 45 on the same rails when not confined to one terminus. If the cost incurred for the express purpose of enabling extra steam trains to be run involves heavy outlay, the interest becomes a direct charge against the service, and the cost of working per steam train-mile will then most probably be in excess of electrical working costs. The figures for cost do not differentiate between peak load and normal times; peak load and slack hours also apply to steam working, and it would be a fortunate company that was able to so fill in the whole of its locomotive time as not to suffer in any way from peaks. It is a far easier and more economical process putting generating plant in commission, than calling out and sending to shed steam locomotives. A railway company owning its own generating plant has various uses for its surplus power during the slack traffic hours, for instance, the working of cranes, capstans, running machinery, &c., by which means the load factor can be much improved. The author refers to a generating station containing five 5,000-KW. sets, the load factor for which, based on the machines in operation reduced to turbo-generator hours, is 75·6 per cent. The author states his conclusion that there is hardly any case of a suburban line running out of London that would not repay the cost of electrification.

Faraday Society.—On Monday, November 23rd, this Society will hold a discussion at the Chemical Society, Burlington House, W., on "The Hardening of Metals." The president, Sir Robt. Hadfield, will be in the chair, and many well-known men have promised to take part.

Physical Society of London.—At the meeting held on October 23rd, Prof. Sir J. J. Thomson, O.M., F.R.S., delivered his Presidential Address, the subject being "Ionisation," the process by which ions—particles charged with electricity—are produced in a solid, liquid or gas. The address was confined to the consideration of ions in gases, and dealt with two questions—(1) the nature of the ions; (2) the process by which they were produced. The evidence as to the nature of ions is derived from experiments on their mobility. Two theories of the mobilities of ions were considered, one founded on the view that the action between ions and molecules is analogous to impacts between hard elastic spheres, the other on Maxwell's theory of forces between ions and molecules varying inversely as the fifth power of the distance between them. With regard to the process of ionisation, the first stage of this in the vast majority of cases consisted in the detachment of an electron or corpuscle. Evidence as to the method by which this took place was afforded by determinations of the velocity with which the electrons were ejected from the body. In the case of ionisation by light or Röntgen rays, this velocity depended primarily on the wave-length of the radiation, not upon its intensity, nor, at any rate to any great extent, on the nature of the molecule from which the corpuscle was ejected. This velocity was far greater, even when every allowance was made for resonance, than could be accounted for if we supposed that the energy of the light was uniformly distributed, and that the corpuscle acquired its velocity by the action on it of the electric force in the wave. Another explanation not open to these objections was put forward.

When ionisation was due to the action of moving electrified particles, whether positive or negative, the results were quite different. The velocity of the ejected particles did not seem to vary much, if at all, with the velocity of the particles which ejected them, and was of the same order whether these particles were positive rays or the much swifter cathode rays. The method of ejection by the impact of such particles was considered and suggestions as to a possible theory and some of its consequences were thrown out.

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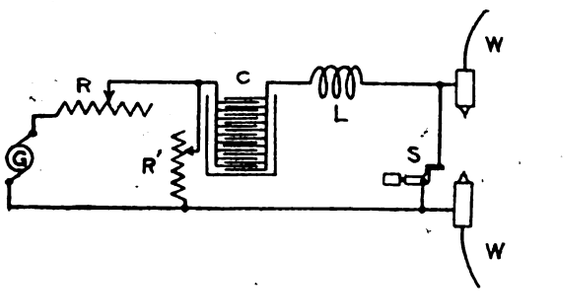
Junior Institution of Engineers.—Mr. H. N. Munro recently gave some interesting notes on the subject of "Aluminium." He stated that for electrical purposes, aluminium was fast becoming common. Overhead transmission lines constructed in aluminium showed a saving over equivalent copper lines of as much as 10 to 25 per cent. For insulated cables, aluminium was extensively used on the Continent. The use of aluminium for magnet coils, busbars and battery connections was described. Lantern slides and samples of cables and joints, &c., kindly lent by the British Aluminium Co., Ltd., were exhibited.

Wireless Society of London.—A lecture will be given by Dr. J. A. Fleming to-night, at 8 p.m., at the Institution of Electrical Engineers on "The Function of the Earth in Radio-Telegraphy," illustrated by experiments. Members of the Institution of Electrical Engineers are invited to attend.

Electro-Percussive Welding.—A paper prepared by Messrs. C. E. Skinner and L. W. Chubb for the recent meeting of the American Electrochemical Society, at Niagara Falls, was devoted to a discussion of the method of electro-percussive welding of wires, based on the principle of a simultaneous condenser discharge and percussive engagement. The diagram reproduced below shows the arrangement.

The welding circuit consists of a direct-current line or a generator G, which charges an electrolytic condenser C through a resister of high resistance R. Adjustment of the voltage of the charged condenser is obtained by field control of the generator or by varying the resisters R and R'. The wires W W to be welded are secured in the wire grips of the welding tool, which are connected to the terminals of the condenser through an inductance L of from two to ten turns of cable. A spring switch S, with carbon contacts, normally held closed, is connected across the jaws of the welder, so that their potential difference will be zero while the wires are being put in or the finished product is being removed. The welder is connected to the auxiliary apparatus by means of long flexible cables, which allow welding within a radius of about 50 ft. without moving the condenser and other heavy apparatus.

The process of welding is as follows:—The wires are secured in the wire grips, and the ends are cut off as short as possible with a suitable pair of cutters. The switch S is then opened, which charges the condenser to the proper voltage; a catch is then released, which lets the sliding member fall by gravity, and brings the ends of the two wires into percussive engagement. At the instant of contact the short-circuit current of the condenser builds



up to such a value that the ends of the wires are melted by the explosive discharge, and instantly forged together by the blow of the falling mass. The weld is then complete, and after being removed from the machine, will be found to have the strength of the original wire.

The generation of the heat is so localised, so sudden and so intense, that there is not time for unequal heat conduction through the shanks of the wire, and the ends will be melted, and even vaporised, whether the melting point is high or low. For this reason metals of different kinds can be welded together independently of their electrical resistance, melting point or heat conductance.

While the development of this welding method was brought about primarily by the necessity for the successful joining of aluminium wires and the joining of copper leads to such aluminium wires, the method is capable of an extremely varied application. Since metals varying as widely in characteristics as platinum and tin may be easily welded, it follows that almost any metals may be joined where the joint is within the limits of the capacity of the welding apparatus. While the apparatus up to this time has been made only for the welding of wires 0·072 in. diameter and smaller, the application to larger sizes is merely a question of the design of suitable apparatus.

Electro-percussive welding has already been used to a considerable extent in the joining of aluminium wires, in the welding of copper and aluminium wires, of platinum and nickel, and of platinum and copper, and in the welding of various types of thermocouple wires. It has also been used for the reclamation of short pieces of wires of various kinds, such as aluminium, platinum, spring steel, &c.—*Electrical World.*

British Honduras.—The United States Consul reports that the Government has begun the erection in Belize of concrete foundations for the towers of a wireless telegraph station, which it is planned to have in operation before December, 1914. The appropriation of $15,000, available in 1915, has been made available immediately, because of the European war, and the order for the apparatus and towers has been placed in the United States. The receiving apparatus has been in operation for some time past. The two towers will be 250 ft. in height, and the power developed will be 5 kw.

Electric Vehicle Operating Costs.—With a view to obtaining reliable data as to the operating cost of electric vehicles, the *Electrical World* has been conducting an investigation among the various industries employing such vehicles, a selection having been made of, approximately, 150 installations, embracing about 2,500 machines of all sizes, serving about 30 different lines of business in about 40 different towns.

Our contemporary points out that with authentic operation cost from each of these cities there should no longer be any question as to the relative value of the electric machine in any locality, as the topographical and climatic conditions in the cities mentioned cover every variety likely to exist elsewhere.

Taking at random 50 installations from the data so far assembled, there are 927 machines included in these with more than 100 of each of the following load capacities:—700 lb., 1,000 lb., 4,000 lb., 7,000 lb., and 10,000 lb. The following cost figures were developed collectively:—

Investment	$2,953,828
Annual expense	$2,319,658
Average daily operating costs	
700 lb.	$5·68
1,000 lb.	6·34
2,000 lb.	7·56
4,000 lb.	8·92
7,000 lb.	10·38
10,000 lb.	11·74

The investment covers cost of machine, garage equipment and spare parts.

The annual operating costs include for both machines and equipment, interest, depreciation, fire and liability insurance, licences, upkeep of tires, batteries and mechanical parts, electrical energy, supplies, provision for garaging and care, drivers' wages and supervision.

The transportation charge should refund the merchant the current rate of interest, which he could secure otherwise upon the money invested in the equipment, and should also restore to him the gradual depreciation which his equipment is undergoing while in the consumer's service.

It is expected that the returns will show in many cases that machines can be operated for less cost than that given, but the figures are considered sufficient to demonstrate the superiority of the electric goods vehicle.

The "Electrical Review" during War Time.—As announced in our issue of a fortnight ago, we shall be pleased to send the Electrical Review gratuitously to any of our readers who may be serving with the naval or military forces and would like to keep themselves in touch with doings in the electrical world. This offer particularly relates to readers who have left these shores since the beginning of the war, either for active service in the fighting line in France and Belgium or in the Fleet, or for service in Egypt, India or other foreign parts. As the men concerned may not have an opportunity of seeing this notice, we shall be greatly obliged if their friends or acquaintances who know their whereabouts will let them know of our offer and ask them to communicate their names and addresses to the Manager, Electrical Review, 4, Ludgate Hill, London, E.C. The matter will then have immediate attention.

Hong-Kong University.—The University Session 1914-15 commenced on September 14th with a good entry of students. Eight entered from the Province of Chile, and several from the Straits, Shanghai, &c. Since the last session the staff has also increased, the latest addition being Mr. Walter Brown, M.A., B.Sc., a lecturer in Mechanical Engineering. There are now 76 students in the University studying Engineering, and the British staff of the Engineering Department consists of the Taikoo Professor, five Lecturers and an Electrician. Several Chinese mechanics run the workshops and various engine rooms. A large number of visitors are attracted to the University by the splendid equipment presented by British manufacturers, while the Engineering students are drawn from an area including Penang in the south, Pekin in the north, Yunnan to the west, and the Philippines in the east.

Electro-Harmonic Society.—The next concert (ladies' night) will be held at the Holborn Restaurant (King's Hall) on Monday evening next, November 16th, at 8 o'clock. The artistes are as follow:—Miss May Huxley (soprano), Miss Carrie Herwin (contralto), Signor Moraes (tenor), Mr. Harry Thornton (baritone), Mr. Albert E. Sammons (violin), Mr. Herbert Collings (magician), Mr. Charles Wreford (humorous), Mr. Finlay Dunn (entertainer). Solo pianoforte and accompanist, Mr. Bernard Flanders, A.R.A.M.

Australian Trade.—A firm of agents, which has hitherto represented German firms, desires to get into touch with United Kingdom manufacturers of conduit tubes and electric light accessories. The name of the firm can be ascertained at the Board of Trade (C I. Department).

Inquiries.—Actual makers of machines for winding coils are asked for.

Range-finder Wanted.—The range-finder asked for in our last issue, on behalf of the Royal Naval Division Engineer Unit, is not yet forthcoming, and as the makers named are extremely busy, it may be necessary to have recourse to another type, which costs £80 to £100. Will, say, 20 of our readers contribute £5 each towards the purchase of this most necessary equipment? The Electrical Review will start the list with £5. Contributions should be sent to the Officer Commanding No. 2 Field Company, Royal Naval Division Engineer Unit, Martin Mill, Kent.

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Fatalities. — A Foolish Joke. — Deputy Coroner Shepherd conducted an inquiry on the 4th inst. into the circumstances of the death of Joseph Ridley Wells, a miner, who was killed by an electric shock at the Willie Pit of the South Derwent Coal Co. Fred. Nicholson, banksman at the Willie Pit, said he met Wells at supper time on the night of November 2nd, when the man seemed quite well. About midnight, Wells, two men named Errington and Toole, and witness were together in the donkey-engine house, and they arranged to give a man named Joseph Westgarth an electric shock as a joke. Neither Errington nor Toole said they had interfered with the wires, and neither Wells nor witness did so. Witness left the engine house for a moment and almost immediately heard the deceased man shout, and at once went back. He found Wells fast to the "sneck" or fastener of the engine-house door. Errington tried to pull Wells off, but he was not able to do so; Toole was there too. Witness told Toole to get through the window and cut off the current (220 or 240 volts), which he did, whereupon Wells fell to the ground. They tried to revive him, and sent for a doctor. Witness said he knew nothing about electricity, and did not know its dangers. This kind of trick had been done before, and had been played on witness just about a week previously. He did not get a severe shock, and he took it as a joke. In reply to Mr. Poole, H.M. Mines Inspector, witness said on the occasion when he got the shock the night was dry; on the night when Wells was killed, it was wet. Both of Wells's hands would be wet, as well as his clothes and the ground. The four of them had all talked over the joke of giving the horsekeeper Westgarth a shock, and all were equally responsible. William Errington, a mason at the pit, spoke to them all concocting a plan to give Westgarth a shock. Toole removed the cap from the switch, and Wells put a wire loop on to the sneck of the engine-house door, and told Toole to put the two other wires on to the switch. He heard Wells say there was nothing in it, and saw him tapping the sneck with his fingers. A moment later he heard Wells shout, but thought he was larking; when he shouted again witness went to him, and put his arm round Wells, and himself got a shock but was unable to get Wells off the sneck, until the current had been turned off by Toole. They tried artificial respiration for one and a half hours. Dr. Cook stated that death was due to electric shock. The Coroner said it was a silly trick to play on anyone, and the youth's death was due to skylarking. A verdict was returned that death was due to electric shock.

Southport.—An inquest was held at Southport last week on Jas. Curran, a wireman employed by the General Post Office, who received fatal injuries through the snapping of a ladder on which he was working. Fred Berry, lineman, said he had used the ladder frequently, and had not noticed any defect, and Mr. Rolfe, who appeared for the Post Office, said that the ladder was made according to specification. "Accidental death, caused by the defective condition of the ladder," was the verdict.

Eccles.—A Coroner's inquiry was held at Peel Green on November 5th, respecting the death of George Lee, electrician employed by the Eccles Corporation. George Jackson, electrician's labourer, of Patricroft, said that on the previous Tuesday he went to the house 160, Worsley Road, where a just-completed electrical installation had to be tested. He held a candle in the cellar whilst the deceased pulled out a fuse. The deceased performed the operation with his cap and received a shock. Answering the Coroner, witness said he did not remonstrate with the deceased when he saw him using his cap, as he was not the electrician, but the labourer. Mr. Angus, the borough electrical engineer, said the deceased, who was 30, was a jointer who had been working for the Corporation for four months, and who had had previous experience. In removing a high-pressure fuse from a transformer at the house in Worsley road the deceased did not use the rubber gloves provided for the purpose, but took hold of the fuse with his cloth cap, and his fingers must have come in contact with the live wire. His death was probably instantaneous, as he would receive a shock of 2,000 volts. Deceased had probably used his cap many times, but it was a most dangerous thing to do, especially in damp weather. A verdict of "Accidental death" was returned, and sympathy was expressed with the deceased's widow, the Coroner remarking that it was a tragic occurrence, but they must regret that the accident was due to the man's carelessness.

A report appears in the *Times of India* of an inquiry into the death, at Bombay, several weeks ago, of Luxmon Subhana, a railway labourer, who was killed at the Colaba Causeway by a live telephone wire. Mr. Baker appeared for the Bombay Telephone Co., while Mr. Tenant was for the Bombay Electric Supply and Tramways Co. Mr. Francis W. Wilson, electrical inspector to Government, said that the deceased met his death by coming in contact with a telephone wire which had become charged through making contact with a tramway test wire. The test wire became charged owing to its breaking at some other spot and falling on a trolley wire. The tramway wires had been erected in accordance with Government requirements. The telephone wire was fixed up between proper iron standards. He had tested the telephone wire that broke; it was up to standard requirements. He was not in a position to state how the telephone wire broke. The Government were going to hold an expert inquiry into the technical points which arose in this case. The wire might have broken owing to general causes, or it might have been burnt by coming in contact with the live test wire. The test wire never, even when being used, carried such a high pressure as it did on that occasion. In his opinion that was an accident. The jury returned a verdict that the death of the deceased was caused by electric shock owing to his having accidentally come in contact with a broken telephone wire which had accidentally become alive.

Patents and Alien Enemies.—For the information of the public, the Board of Trade has published the general principles upon which it will act in dealing with applications for the avoidance or suspension of Patents and Trade Marks under the Patents, Designs, and Trade Marks (Temporary Rules) Acts, 1914. The principles given below may be taken as generally applicable, but special cases must necessarily receive exceptional treatment.

Patents.—Licences will, as a general rule, be granted, where the applicants fulfil the necessary conditions, set out in Rule 1 of the Temporary Rules:—

1. Where there is no manufacture in this country under the patent, and also—

2. Where what manufacture there is, is carried on by a company or firm on behalf of *alien enemies* resident abroad, and there is any reason to doubt that the manufacture will continue to be carried on, or where it is in the interests of the country that some other manufacture should be started in the British interests.

Trade Marks.—Suspension will, as a general rule, only be granted in the following cases:—

1. Where the trade mark is the name of a patented article, and a licence is granted under the patent protecting it.

2. Where it is the only name or only practicable name of an article manufactured under an expired patent.

3. Where it is the name or the only practicable name of an article manufactured in accordance with a known process or a formula which has been published or is well known in the trade.

Generally speaking, suspension will *not* be granted in the case of *pictorial* devices.

Application has been made by Messrs. Ed. Bennis & Co., Ltd., for the avoidance or suspension of patent No. 8,966 of 1903, granted to Bousse, for an endless elevator. The hearing is set down for November 17th.

Application has been made to avoid or suspend Letters Patent No. 12,724/10 (Siemund) for fusing metals electrically, by J. Roberts, 31, Strafford Street, Westferry Road, Millwall, E. Date of hearing, November 23rd.

Case Decided.—Patent No. 12,871/13 (Ruthardt). Licence to be granted to Messrs. C. A. Vandervell & Co. (See Elec. Rev., p. 492.)

Notifications and documents relating to foreign patents, designs, and trade marks, which agents or others are unable to forward to their destination abroad, may be deposited in the Patent Office (Room 27), with the object of recording the intention on the part of the depositor to do any act or to file any document on a certain date at a foreign Patent Office. No guarantee can, however, be given that such procedure will be of any advantage to the persons concerned. The Chartered Institute of Patent Agents is opening a trust account into which money in regard to such matters may be paid, subject to such rules as the Institute may make.

Electricity Supply in Germany.—The prevalence of a state of war is having a varying effect upon supply undertakings in Germany. In the capital, where the Berlin Electricity Works Co. possesses practically a monopoly of the business, the company experienced an increase of 3·2 per cent. in the total supply of energy in kilowatt-hours in July, as compared with the corresponding month in 1913, but in August a decline of 21·9 per cent. took place, as contrasted with the equivalent month in last year, whilst the official figures for September show a reduction of 20 per cent. Towards the end of October, however, it was estimated that the return for the whole month would show an improvement. The company's financial statement for the year ended with June 30th, 1914, indicates that the sum of £256,000 has been written off for ordinary depreciation, as against £279,000 in 1912-13, and a further amount of £50,000 has been devoted to special depreciation of investments on account of the war. The balance of net profits, which is not definitely stated for the moment, permits of the payment of 4½ per cent. on the preference capital of £1,000,000, and 12 per cent. on the ordinary shares of £2,200,000, being the same rates as in the preceding year. The number of customers advanced by 4 639 to 48.455, and the connections in kilowatts increased by 24,963 to 280,684 kw., and the sales reached 267,590,000 kw.-hours, or 15,490,000 in excess of 1912-13. In the case of the Elektrizitäts Lieferungs Gesellschaft, which owns a number of supply works as well as being financially interested in others, the number of customers recorded in September was several thousands greater than in the same month of last year, but the output in kw.-hours was less than in September, 1913. Since the beginning of January, however, the deliveries to the end of September have amounted to 45,594,532 kw.-hours, or 8,057,178 kw-hours more than in the equivalent nine months of 1913. The Sachsische Elektrizitäts Lieferungs Gesellschaft, which is one of the so-called overland supply undertakings, occupies a similar position, inasmuch as the consumption decreased in September, notwithstanding a considerable augmentation in the number of customers over the corresponding month in last year, but the total turnover in the nine months shows an appreciable increase in kw.-hours.

Appointments Vacant.—Foreman wireman, age 25-35 (£250 +), for Gold Coast Government; two switchboard attendants, overhead lineman, arc lamp repairer and wireman, for Newport Corporation; engineer and manager (£250 to £400), for Erith electricity and tramway undertakings; station superintendent (£150), for Rawtenstall Corporation electricity works; cable jointer, for Keighley Corporation; switchboard attendant (30s.), for Portsmouth Corporation; switchboard attendant (27s. 6d.), for Lancaster electricity works. Particulars are given in our advertisement pages.

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London's Electricity Supply.—In a letter to the *Daily Chronicle* of November 10th, Mr. J. Horace Bowden, borough electrical engineer, Poplar, replies to certain arguments advanced by that paper in favour of the Greater London electricity scheme. As very few London municipal undertakings are under any obligation to the ratepayers for financial assistance, and the prices charged in Eastern London are actually lower than in any other part of the world, when the price of coal is considered, he does not agree that present methods are wasteful to the ratepayer and expensive to the consumer.

As to the statement that only a bulk station can supply really cheap electricity, he points out that the Chicago stations in 1913 had an output of 930 million units, sold at an average price of 1·09d. per unit, while in the eastern area of London comprising Poplar, Stepney and West Ham, with an output of only 67½ million units, the average charge was ·99d. per unit, but in Chicago coal costs 8s. per ton, while in London the cost was 14s. 5d. per ton.

The public is asked to invest a maximum amount of capital with a minimum return; before the consumer can participate in profits private capital will receive a return of 8 per cent. The actual amount to be spent in labour in the East End would be about £40,000 or £50,000 a year for three or four years. He disagrees that many of the Borough Councils are of opinion that delay would make it worse for them; the Councils are practically unanimous in opposing the scheme.

Had the L.C.C. offered similar financial facilities to the Borough Councils, as they now propose to do in connection with the new authority, the consumer would long ago have enjoyed the benefits of a universal supply of electricity at prices far and away better than in any other city in the world.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Swansea Council, on Friday last, appointed MR. J. W. BURR, the deputy electrical engineer of Croydon, to be borough electrical engineer of Swansea, in succession to Mr. C. A. L. Prussmann, resigned. There were 123 applicants, and the runner-up in the final vote was Mr. H. A. Nevill, the city electrical engineer of Wakefield. The salary is £500 per annum. Mr. Burr hopes to take up his new duties in a month's time.

MR. WILLIAM MIDDLETON, of Gillingham, and MR. E. E. POPE, of Fulham, have been appointed shift engineers at the Watford electricity works, at a commencing salary of £90 per annum each.

MR. A. WILSON has been appointed temporary charge engineer at the Dover Corporation electricity works.

General.—We are informed that some changes have recently been made in the directorate of the St. Helens Cable and Rubber Co., Ltd., of Warrington, and that the board now consists of:—Mr. T. O. Callender (chairman), Mr. D. Sinclair, and Mr. J. J. Easton.

ALDERMAN GEO. H ROBINSON, J.P., who has continuously held the office of chairman of the Bradford Electricity Committee for the past 11 years, has been appointed Lord Mayor for the ensuing year. Ald. Robinson has naturally had much to do with the growth of the undertaking, the annual output of which he has seen rise from 13 to 28 million units. With the extension and improvement of the plant he has also been closely associated. We understand that prior to the rateable value system of charging being introduced into Norwich, he suggested the practicability of such a system for Bradford, and when some time later it was definitely decided to recommend the City Council to institute a rate on these lines, Alderman Robinson very strenuously contended, as a result of his personal experience, that if the heating and cooking load in domestic premises was to be catered for in Bradford, the secondary charge should not exceed ½d. per unit. This proposal was approved by the City Council in July, 1910, and the results which have accrued have been very beneficial to the electricity department. Alderman Robinson has on several occasions attended the Conventions of the Incorporated Municipal Electrical Association.

The *Canadian Engineer* states that the HON. SIR ADAM BECK, chairman of the Hydro-Electric Power Commission of Ontario, has retired from the Ontario Cabinet, and the HON. I. B. LUCAS, Provincial Treasurer of Ontario, has been appointed a member of the Hydro-Electric Power Commission of Ontario, to succeed LIEUT.-COL. HON. J. S. HENDRIE, whose appointment to the Lieutenant-Governorship of the Province left a vacancy on the Hydro Board.

MR. F. A. YERBURY has now returned from Vancouver, and has again definitely settled in England. He has joined, as a director and manager of the sales department, the Premier Cooler and Engineering Co., Ltd., of Broadway Court, Westminster, S.W., and hopes in due course to again meet the many friends made during his connection with the Mirrlees Watson Co., Ltd.

MR. ALBERT JOSEPH WEST, electrical engineer, of 7, Mary Street, Taunton, has been re-elected on the Town Council.

At last Wednesday's meeting of the Nomination Committee of the Manchester Corporation, MR. W. T. DAGNALL was re-elected chairman of the Electricity Committee. ALDERMAN WALKER was chosen as vice-chairman.

At the recent municipal elections at Wakefield, MR. W. EMMETT, electrical engineer, of Southgate, the retiring councillor for the Kirkgate Ward, was returned unopposed.

At the annual meeting after the November election, the Glasgow T.C. reappointed BAILIE W. B. SMITH as convener of the Electricity Committee. BAILIE HANNAY has been appointed sub-convener. There has been no change in the convenership or sub-convenership of the Tramways Committee, EX-BAILIE KIRKLAND retaining the convenership and EX-BAILIE ALSTON the sub-convenership.

MR. WILLIAM R. NOWELL has resigned his position with the Brush Electrical Engineering Co., Loughborough, after 19 years' service.

MR. W. E. POTT has resigned his position as general manager to Messrs. Krupka & Jacoby, of Westminster.

Will.—The late MR. FREDERIC SMITH, whose death was announced in our issue of September 4th, a director of Frederic Smith & Co., wire manufacturers, Ltd., of Halifax, and of the London Electric Wire Co. & Smiths, Ltd., left £128,279 gross.

NEW COMPANIES REGISTERED.

"Ceag" Miners' Supply Co., Ltd. (138,208).—This company was registered on November 4th, with a capital of £10,000 in £1 shares (1,000 7 per cent. preference), to carry on the business of manufacturers, importers and exporters of and dealers in electrical and other safety lamps for use in mines, and all kinds of electrical and mechanical lamps, accessories, tools, implements and articles, etc. The subscribers (with one share each) are:—M. J. Stocek, 9, St. Dunstan' Hill, E.C., merchant; F. M. Rodgers, 5, Kelso Place, Kensington, W., engineer; P. F. Rouse, 85, Gracechurch Street, E.C., solicitor. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Remuneration not more than £100 each per annum. Solicitors, Cruesmann and Rouse, 85, Gracechurch Street, E.C.

Booth and Bomford, Ltd. (138,232).—This company was registered on November 6th, with a capital of £2,000 in £1 shares, to carry on in Great Britain or elsewhere the business of manufacturers or makers of or dealers or contractors in or consultants with regard to electrical or general engineering installations, etc. The subscribers (with one share each) are:—A. R. Gibbs, Avenue Road, Stratford-on-Avon, solicitor; J. G. Bomford, 1, Connaught Road, Roath, Cardiff, electrical engineer. Private company. The number of directors is not to be less than two or more than five. The first are J. G. Bomford, R. L. Booth, and A. R. Gibbs. Qualification £1. Remuneration as fixed by the company's solicitor, A. R. Gibbs.

C. H. Mason and Co., Ltd. (138,207).—This company was registered on November 4th, with a capital of £2,000 in £1 shares, to adopt an agreement with D. S. Davies and C. H. Mason for the purchase of the business of electrical, motor, mechanical and general engineers carried on by them at Gateshead, Durham. The subscribers (with one share each) are:—D. S. Davies, Park View, Gateshead, ironmaster; C. H. Mason, 121, High Park Road, Newcastle-on-Tyne, engineer. Private company. The number of directors is not to be less than two or more than seven. The first are D. S. Davies and C. H. Mason (both permanent). Qualification £250. Remuneration as fixed by the company.

Witt and Beesley (Blackpool), Ltd. (138,217).—This company was registered on November 4th, with a capital of £4,000 in £1 shares, to take over the business of a letter on hire of motor cars, motor garage proprietor, motor and electrical engineer, and dealer in electrical plant, fittings and accessories, and in motor cars and accessories, carried on by S. Witt at Blackpool. The subscribers (with one share each) are:—J. J. Beesley, Ash Dene, Park Road, Lytham, retired licensed victualler; S. Witt, 1, Castle Gate, South Shore, Blackpool, garage proprietor; J. Holden, 2, Mythop Avenue, Lytham, taxicab proprietor. Private company. The number of directors is not to be less than two or more than seven. The first are J. J. Beesley, S. Witt (chairman), and J. Holden (managing directors). Qualification £500.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

London Electron Works Co., Ltd.—Issue on 30th Oct., 1914, of £4,000 debentures, part of a series of which particulars have already been filed.

Birmingham Guild, Ltd.—Mortgage on certain land and properties in Great Charles Street, Birmingham, dated 27th October, 1914, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd., 71, Lombard Street, E.C., not exceeding £2,500.

James Keith and Blackman Co., Ltd.—Issue on 2nd Nov., 1914, of £100 debentures, part of a series of which particulars have already been filed.

Rural Districts Electric Undertakings, Ltd.—Particulars of £2,500 debentures, created by resolutions of 22nd and 25th February, and secured by trust deed dated 27th October, 1914, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £1,700. Property charged: 2,278 fully paid shares in the Woodbridge and District Electric Light Co., Ltd., and company's other assets, present and future. Trustee, E. C. Lydon.

W. H. A. Robertson and Co., Ltd.—Mortgage on certain land in Bedford with the Lynton Engineering Works thereon, dated 30th October, 1914, to secure all moneys due or to become due from the company to London City & Midland Bank, Ltd., 5, Threadneedle Street, E.C.

Yorkshire Cable Co., Ltd.—Debenture, dated 8th Oct., 1914, to secure any sum, not exceeding £800, which may be paid by the debenture holders under a deed of guarantee of even date; charged on company's undertaking and property, present and future, including uncalled capital. Holders, R. R. Stell, 2, Kirklands Avenue, Baildon, and J. Stell, Wellington Crescent, Shipley.

North-Eastern Electric Smelting Co., Ltd.—Second mortgage debenture, dated 8th October, 1914, to secure £130, charged on company's property, present and future, including uncalled capital. Holder, J. A. Parkes, 18, Fleet Street, E.C.

Lester B. Betts and Co., Ltd.—Second debenture, dated 28th October, 1914, to secure £100, charged on company's undertaking and property, present and future, including uncalled capital. Holder, A. E. Robinson, 30, Whitefriars Crescent, Westcliff-on-Sea.

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CITY NOTES.

Edison & Swan United Electric Light Co., Ltd.

The directors report that for the year ended June 30th, 1914, after providing for interest on both classes of debenture stock, and depreciation upon freehold properties and plant, there is a net profit of £4,696, plus £1,036 brought forward, making a total standing to the credit of profit and loss of £5,732, which is to be carried forward.

During the past year, the business previously carried on at 36, Queen Street, and College Hill, has been removed to the new showrooms and offices at 123-125, Queen Victoria Street, and although the transfer did not take place until after the close of the period covered by the accounts, the results already obtained from the new showroom have been distinctly favourable. A further showroom has been opened at 71, Victoria Street, S.W., to deal with the West End trade, which is also showing satisfactory results. In addition, the provincial depôts have been overhauled and rearranged, and the premises at Newcastle, Manchester and Nottingham have been closed and the business transferred in those towns to more suitable premises there.

Taking the business as a whole, very considerable expansion has taken place during the past year. This is reflected in the improved position of the company shown by the accounts, and judging by the volume of business which has been done since the date of the balance-sheet, the directors are looking forward with confidence to the coming year.

The meeting will be held at Winchester House, E.C., on November 16th.

United Electric Tramways Co., of Caracas, Ltd.

The eighth ordinary meeting of the above company was held on Tuesday, at Dashwood House, London, E.C. The proceedings were private, but the report, to which brief reference was made in our last issue, was adopted.

The percentage of operating expenses, in its ratio to gross receipts, was 48·28, which was less by 3·09 per cent. than in the previous year. This continued decrease, combined with the proper maintenance of the company's property, reflects great credit on the staff of the local company.

	1913-14.	Inc. or dec.
Passengers carried	5,391,809	+ 553,431
Car-miles run	985,055	+ 17,469
Percentage of operating expenses to gross receipts	48·28	− 3·09
Receipts per car-mile	Bs. 1·57	+ Bs. 0·13
Operating expenses per car-mile	Bs. 0·76	+ Bs. 0·02
Number of cars	44	—
Miles of track	16½	—

Mr. Wallis reports that all the company's property is maintained in first-class order, and further short extensions to the tramways are in course of construction. The continuous increase in traffic necessitated the provision of more cars, and four were ordered. These have been delivered and put in service since June 30th last.

Official Notices re Companies.—Unless cause is shown to the contrary, the following companies will be struck off the Register at the expiration of three months:—

British Engineering and Fume Condensers.
British Speedometer Control Co.
British Wireless Telegraph Syndicate.
Civil Engineering Press.
Electrical Fittings Co. (1911).
Electric Amusements.
Electrocoustics.
Insulators.
Internal Combustion Engines Cooling Agent Co.
National Electric and Motor Corporation.
Patent Tube Covering and Lining Co.
Smoke Abaters.
W. I. Oil Fuel Syndicate.

Manufacturing in Germany.—Some information has just become available in regard to two companies in Germany. The first is the Siemens & Halske Co., whose financial year ended on July 31st, which is said to have been a very favourable period. It is uncertain what deliveries will be effected in connection with the large orders which have been accepted in the current year, as the company has numerous relations with hostile countries. During the early weeks of the war old contracts were frequently cancelled, and the stock of orders for various non-warlike manufactures immediately declined. The work of manufacturing was not inconsiderably restricted through the mobilisation, and operations in all departments are declared to be fully maintained to the extent of this limitation. It is intended to take into account the change in circumstances by the provision of a war reserve fund in the preparation of the balance-sheet, which will still occupy attention for several weeks.

The directors of the Allgemeine Elektrizitäts Gesellschaft had under consideration the accounts for the financial year 1913-14 at a meeting held on October 29th. After defraying general expenses, taxes, interest on loans, and making the customary provision for depreciation, and also in view of the state of war, the accounts indicate net profits amounting to £944,000, as contrasted with £1,445,000 in the preceding year, the total being derived solely from manufacturing. It is proposed to pay a dividend of 10 per cent. on share capital of £7,750,000, this rate comparing with 14 per cent. in 1912-13. The directors add that the company has a banking credit of £3,850,000, as a year ago; that both the invoiced turnover and orders on hand in the new financial year show a further increase; and that it cannot be foreseen at present to what extent the foreign orders included in the orders on the books will reach the stage of delivery. A year ago the sum of £175,000 was placed to the reserve fund, but no similar appropriation is shown for 1913-14, although it is assumed that such provision has been made in the form of undisclosed reserves.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange business this week has been virtually suspended by reason of the uncertainty surrounding the situation with reference to a settlement on November 18. There has been no settlement, in the proper Stock Exchange sense of the word, since July 29; and the Government put strong pressure upon the House to bring about a clearing-up of accounts next Thursday. A scheme was propounded, passed by the Government, and issued by the Stock Exchange Committee, wherein it was ruled that buyers who had been carrying over stock should be required to pay for it, or to deposit 10 per cent. of the total money involved, the latter operation enabling them to postpone final settlement until twelve months after the conclusion of peace.

For the past ten days nothing but the scheme has been talked about. It has been violently assailed from all quarters. A few declared that the Committee had done the best thing possible in the circumstances; others maintained that it was hopelessly illegal, and that they would flatly refuse to be bound by any of its provisions. Hasty meetings were summoned between Lord Reading, the Stock Exchange Committee, Mr. Lloyd George and a few of the Treasury officials. Excited messages went backwards and forwards. The Government stuck to its contention that, at all costs, there should be a settlement, and in this many of the thirty Stock Exchange committee-men readily concurred.

At the same time, evidence accumulated rapidly that the effort to enforce such a settlement would precipitate calamity and financial disaster. Stock Exchange men dependent upon German and Austrian connections vowed that they saw no reason why they should be called upon to pay 10 per cent. deposit on shares which their clients were never likely to take off their hands. Throgmorton Street has seethed with excitement. On Tuesday evening—that is, to-night—the Stock Exchange Committee are sitting, an extraordinary meeting having been convened for 8 p.m. To the outsider, the whole affair may seem trivial; but to those who know the issues at stake and the consequences which any false step might have upon national credit in the course of the war, its importance is profound. Modifications of the previous scheme were announced at midnight, and the settlement is to take place subject to these.

The fundamental rule of Stock Exchange business, upon which every other is built, and upon which the whole edifice of Stock Exchange credit rests, is that a bargain is inviolate. This principle it has been sought to attack during the past few days, and conceivably it may yet have to go for the time being, in company with a good deal else that most people have regarded as essential to the well-being of their existence. I know of cases in which men sold shares a day or two before the Stock Exchange closed, the bargains having been done for the mid-August account—which, of course, has not yet been settled. The money realised by the sales has been required by the sellers, in order to carry on their every-day life; and that they have been forced to do without it has proved, in at least some of the instances with which we are acquainted, a real hardship. If it had been held that the conclusion of such sales could be deferred, at the option of the buyer of the shares, until a year after the conclusion of peace, it would have looked like a case of real injustice being inflicted by the Stock Exchange Committee, and as though the primary principle of a bargain being inviolate had been repudiated.

Conceivably, if such a seller took his certificate to the Bank of England and asked for 60 per cent. of the value of the stock, he might receive financial accommodation, but, up to the time of writing, such an act would be simply one of grace. No porcupine ever bristled with so many quills as the present situation does with perplexities; and the bewildered stockbroker may well envy those of his fellows who are able to cast off office responsibilities and join the Army with a light heart. There are hundreds who would do this to-morrow, if it were not for the haunting impression that such a step would savour of the cowardice which seeks to evade responsibilities by running away from them.

In the matter of prices, the disposition has been to allow them to slide on to slightly lower levels because of the anxiety of holders to realise what they could, in order to provide the 10 per cent. margin already referred to above. Consols still remain at the minimum of 68½, without anybody wanting to buy them, except a few small investors. There is money about. We have a letter in front of us from a friend in the West country, who says that his neighbours are storing up cash in preparation for the new issues which are certain to come before very long. An important Argentine railway company offered the other day a million pounds 6 per cent. notes, and its shareholders alone applied for the amount five-and-a-half times over.

The bargain-hunter continues to reproach his stockbroker because the latter will not hunt about for securities offered at knock-out prices; but, at the same time, the former is chary of making bids for stock, even at fancy quotations. Buyer and seller are alike suspicious of each other, lest either should be "done" in the process of negotiation; and the uncertainties surrounding the Stock Exchange settlement go to shackle the energies of the enterprising broker who might otherwise be engaged in beating up business. Everyone admits that the news from the theatre of war is encouraging; and the sinking

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of the *Emden* would have acted as a bullish factor, had not markets on that particular day been completely overweighted with the considerations attaching to the Stock Exchange settlement.

This week's debate by the London County Council on the proposed Electric Supply Bill can scarcely be expected to have much immediate effect upon prices. Certainly this is the time of the year when interest should revive in such securities as are connected with illumination, but the market in electric lighting shares had scarcely recovered from the shock occasioned by the outbreak of war before it encountered the added caution induced by the dimming of the London lights. There is scarcely a bargain doing in any of the principal shares, while business in the pre-ordinary issues has dwindled to next to nothing.

Traction descriptions keep very steady. Metropolitan Consolidated at 30 and District Ordinary at 18½ have not been greatly influenced by the weaker disposition displayed by most of the Steam stocks. Both companies should do well this week, in consequence of the vast crowds which assembled in London for the two processions. At the Lord Mayor's Show on Monday the crowd was certainly the densest ever experienced—as to which, testimony, were it needed, can be borne by anyone who stood outside this office in Ludgate Hill, packed in a sardine-like position, with a small boy astride his shoulders for the space of nearly an hour. (This, however, is an aside; and, incidentally, it was worth it.)

There is a slight improvement in some of the railway preference discriptions. British Electric Traction 5 per cent. Debenture stock is steady at 88. Rio Tramway Firsts are better at 85, an improvement of about 4 points since a fortnight ago. Sao Paulo 2nd Debenture at 88 is about 3 points higher than the company's 1st Debenture—explained, of course, by the former carrying interest at 6 per cent., while the latter is a 5 per cent. bond. A few Mexico Tramways Ordinary shares were done the other day at 55.

Brazil transactions have risen to 50, and the Preference improved to 90½. The Edison and Swan report gave rise to a little disappointment, until it was concluded that the company had tucked away profits which it might justifiably have exposed had the directors decided upon a less sound method of treating the figures; the Ordinary shares are 5s. British Westinghouse Preference remain at 30s., the Prior Liens at 98½, the 4 per cent. Debenture stock at 72. In other manufacturing shares there is not much doing. Enquiries have been made for Castner-Kellners, in consequence of the increased business that the company should secure through German competition being suspended.

The Eastern Telegraph group has given way a little here and there. Eastern Ordinary, for instance, dropped to 122½, but Eastern Extensions are firm at 11¾. A few Globe Preference have come in, with the result that the price, at 12⅜, is ¼ down. Direct United States are unchanged at 6¼. Western Telegraphs at 12½ are a shade easier. Amongst the manufacturing shares, Henleys are quoted at 14¼, Callenders 11½. Telegraph Constructions at 36½; the Preference shares of the first two both stand at 4¼. Automatic Telephone Ordinary can be negotiated on the basis of 20s., the 6 per cent. Preference shares standing 1-16th higher. The Armament group is quiet, prices varying very little from day to day. There is a hardening disposition, however, in the case of the Rubber market; and with the price of the raw produce quietly improving, corresponding advance is noticeable in a few of the leading rubber companies' shares

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	Oct. 28	3,273	— 471	43	42,353	— 14	..	..
Blackpool-Fleetw'd	Nov. 7	1,695	— 178	44	86,976	— 5,052	8	..
Bristol	Oct. 30	32,005	+1,292	44	374,008	+21,150	80·5	..
Brit. Elec. Trac. Co.	..	..	..	..	..	..	429·8	..
Chatham and Dist.	Oct. 22	4,245	+ 263	42	40,579	+ 1,005	14·98	..
Cork	„ 29	1,946	— 65	43	21,810	— 42	9·89	..
Dublin	„ 30	22,691	+5,771	44	255,222	+14,814	54·25	..
Hastings	„ 28	3,556	— 297	..	..	— 2,886	19·8	..
Lancashire United	„ 28	6,059	— 502	43	71,671	+ 8,942	42	..
Llandudno-Col. Bay	„ 30	764	— 69	43	15,003	— 2,046	6·5	..
London United	..	..	..	..	..	..	..	..
Tyneside	Oct. 28	2,685	+ 451	18	11,468	+ 1,791	11	..
Anglo-Argentine	„ 28	204,452	—16,869	44	2,322,996	—54,095	..	..
Auckland	„ 28	19,777	— 427	17	85,127	+ 3,370	25·42	1·06
Brisbane	August	33,172	+3,402	31	231,827	+24,649	..	..
Calcutta	Oct. 31	14,628	—1,349	..	..	+ 4,587	..	..
Kalgoorlie, W.A.	Aug. 1	3,042	..	35	21,116	..	..	..
Madras	Oct. 14	1,602	— 141	41	16,086	+ 2,063	..	..
Montevideo	Oct.	26,500	—2,725	52	361,465	—12,062	..	..
Cen. London Rly.	..	..	..	..	..	..	..	..
City & S. Lon. Rly.	..	..	..	..	..	..	..	..
Dublin-Lucan Rly.	Oct. 30	514	+ 55	17½	2,784	— 86	7	..
L'pool Overh'd Rly.	..	..	..	..	..	..	..	..
London Elec. Ry. Co.	..	..	..	..	..	..	..	..
Mersey Railway	..	..	..	..	..	..	..	..
Metropolitan Rly.	..	..	..	..	..	..	..	..
Met. District Rly.	..	..	..	..	..	..	..	..

* Two weeks.

MARKET QUOTATIONS.

Owing to the war, the prices given below are, of course, more or less nominal.

Wednesday, November 11th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	Nom.	..
a „ Nitric	„	..	..
a „ Oxalic	per lb.	8d.	..
a „ Sulphuric	per cwt.	Nom.	..
a Ammoniac Sal	„	£49	..
a Ammonia, Muriate (large crystal)	per ton	£49	..
a Bleaching powder	„	£8 10	..
a Bisulphide of Carbon	„	..	..
a Borax	„	£18 10	..
a Copper Sulphate	„	£20	..
a Lead, Nitrate	„	£30	..
a „ White Sugar	„	£29 10	..
a „ Peroxide	„	..	..
a Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	7d.	..
a Potash, Caustic (88/90 %) ..	per ton	..	..
a „ Chlorate	per lb.	8d.	..
a „ Perchlorate	„	6d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	Nom.	..
a Shellac	per cwt.	55/-	..
a Sulphate of Magnesia	per ton	£12	..
a Sulphur, Sublimed Flowers ..	„	£11 10	..
a „ Recovered	„	£8	..
a „ Lump	„	£8 10	..
a Soda, Caustic (white 70/72 %) ..	„	£10 2 6	..
a „ Chlorate	per lb.	7d.	..
a „ Crystals	per ton	45/-	..
a Sodium Bichromate, casks ..	per lb.	8d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£88	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£112	..
b „ Sheet, in ton lots ..	„	£112	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8d.	½d. inc.
c „ Tube (brazed)	„	9¾d.	..
c „ „ (solid drawn) ..	„	8¾d.	..
c „ Wire, basis	„	8½d.	½ inc.
c Copper Tubes (brazed)	„	9¼d.	..
c „ „ (solid drawn) ..	„	9¼d.	..
g „ Bars (best selected) ..	per ton	£72	..
g „ Sheet	„	£72	..
g „ Rod	„	£72	..
d „ (Electrolytic) Bars ..	„	£56	..
d „ „ Sheets ..	„	£74	..
d „ „ Rods ..	„	£62	..
d „ „ H.C. Wire	per lb.	7¾d.	..
f Ebonite Rod	„	8/-	..
f „ Sheet	„	2/6	..
n German Silver Wire	„	1/7	..
h Gutta-percha, fine	„	6/10	..
h India-rubber, Para fine	„	2/6½	½d. dec.
l Iron Pig (Cleveland warrants) ..	per ton	49/2	11d. inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£16	..
g Lead, English Pig	„	£18 5 0	..
m Manganin Wire No. 28	per lb.	..	..
g Mercury	per bot.	£11	..
e Mica (in original cases) small ..	per lb.	4d. to 2/6	..
e „ „ „ medium	„	8/- to 5/-	..
e „ „ „ large ..	„	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	„	Nom.	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0½ to 1/3	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
e Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	£141	..
g Tin, Block (English)	„	£143	..
n „ Wire, Nos. 1 to 16	per lb.	2/1	..
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh's (Vieille Montagne bnd.)	„	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Bullers, Ltd.—The report for the year states that, after paying the directors' fees, salaries, and allowing for depreciation the accounts show a profit of £34,367, plus £2,058 brought forward, making £36,426. The directors recommend a further dividend of 5 per cent., making 7½ per cent. for the year on the ordinary shares, and, in view of the unsettled condition of the country, to place £10,000 to reserve, bringing that account up to £63,000, and to carry forward £7,676.—*Financial Times.*

Amazon Telegraph Co., Ltd.—The directors' report for the year ended June 30th, 1914, states that the gross revenue amounts to £82,751 and the working expenses to £52,460. After providing £22,966 for debenture interest and sinking fund, the directors recommend a dividend of 3 per cent., less income-tax, on the share capital. £5,840 is to be carried forward.

Mexico Tramways Co.—The intervention of the Mexican Government in the affairs of the company is likely to continue for an indefinite period, and it is rumoured that the Government intend to appoint a Commission to study the company's franchises

New British Ever-Ready Co., Ltd.—A dividend at the rate of 7 per cent. per annum on the preference shares for the half-year ended September 30th is announced.

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THE PRACTICAL TRAINING OF ENGINEERS.

(*Concluded from page* 638.)

Another witness, Mr. E. Kitson Clark, whose own training had been purely classical, went into his father's works at the age of 22 and found it very difficult. He, however, made up his mind to master it, and did. Having succeeded, it is, perhaps, natural to suppose that others could do the same, and his views are no doubt based on his own personal experience. They differed in many respects from those of Mr. Alexander.

Mr. Clark said that the pupils coming to his works paid a premium of £100 a year for three years. They got no wages at all. There were no indentures nor any agreement, as it is difficult to get rid of a boy who is of no use if he is bound by indentures. Several of the boys are wards sent to them by lawyers who do not know what to do with them, and the only thing they can think of is to make them into engineers. Young men with money are rather difficult to deal with, and if they were indentured there would be sure to be trouble, as the employer would have to deal with the lawyers who drew up the agreements. As a rule these youths do not survive their first year.

Mr. Clark did not think the difficulty would be got over by insisting on the youths having an engineering degree before coming to them, because some of them had no intention of joining the Institution of Civil Engineers, but had an idea of subsequently starting a works of their own.

Speaking from an experience of something like 2,000 young fellows, Mr. Clark's view was that the best training was a two years' workshop training and then two years' college training. Unfortunately these colleges *would* make it three years, and if that must be so he would say one year in the works, then three years at a technical college, and then return to the works in a position involving a little responsibility. The men who came from Cambridge were capital fellows, in Mr. Clark's opinion. He gives them a little experience at the lathe, then in the pattern shop. They cannot be put alongside boys who know more than they do, because they are already men. Mr Clark did not believe at all in the old-fashioned apprenticeship system.

On the question of premiums, he considered that a premium was a line of defence for the employer. They were inundated with applications from people who had brothers and sons, and the reply was: "If you pay £100 we will take him in," and that generally settled the question.

Mr. Alexander Siemens here interposed that that was the reason why his firm did not take a premium, because they did not want to put the power into the hands of the parents of an undesirable son to say: "Here is £100, take this man."

Mr. R. R. Bevis agreed with Mr. Clark generally. He considered that the twelve months' preliminary practical training was very important. If men of 21 or 22 come into the works after a full technical course they are quite raw as regards workshop experience, and the other men simply make fun of them; and if, later on, they are put into positions of responsibility, they cannot maintain proper discipline. If, on the other hand, before taking their college course they had spent about a year in the works they would be in a much better position to enforce discipline when they came back to it.

The bearing of the above on the training of electrical engineers is very general, and it is unfortunate that none of the manufacturers who gave evidence was connected with the electrical side of the profession—with the exception of Mr. Alexander Siemens, who said very little, and that had relation chiefly to the form of agreement to be adopted in lieu of indentures.

The only evidence bearing particularly on the electrical side was given in the section devoted to "Engineers in Private Practice," that is to say, consulting engineers, and this was from one firm only, viz., that of Messrs. Preece, Cardew & Snell.

Mr. A. H. Preece said that his firm did not make a practice of taking pupils at all, as there is really very little scope for pupils in an electrical engineer's office. When it comes to finding a man for an appointment outside, they pay no attention to whether he has been in an engineer's office or not, but see that he has had a proper college training, say three years or so at Cambridge or the City and Guilds' Institute, and that he has had a practical works training. Even if the appointment were for an electricity works they would expect at least one year's workshop training in addition to about two years in a generating station. It makes no difference whether the applicants have paid a premium or not so long as they have had the practical training. As a rule, when a youth goes to a manufacturing works he has to do as well as he can for himself in regard to getting into different departments; there is generally no one to assist him. If he justifies himself the works manager will push a lad along.

Mr. (now Sir) J. F. C. Snell prefaced his remarks by saying that it would help the co-ordination of practical and theoretical training to some degree if the Institution could arrange for an intermediate examination for associate members dealing with the college or theoretical training, and then at the end of their apprenticeship candidates might sit for the practical examination in order to gain their diploma. This point was, however, ruled outside the scope of the inquiry.

In electrical engineering our ideas, said Mr. Snell, are not yet completely crystallised; it is not the custom for practising electrical engineers to take pupils either with or without premium, but Mr. Snell thought it a mistake not to do so. His experience was that those who received their technical before their practical training were the best men. The practical training should be on broad lines, not merely electrical engineering; a complete knowledge of tools, a first-hand knowledge of men, experience on contract work and the use of tackle should form a part of the training, and this can be obtained in a railway engineering or mechanical shop as well as in one devoted to electrical engineering only. It is in this respect that electrical engineers differ from civil engineers; the electrical engineer pupil *must* have a mechanical training before he is taken into an office, which he then enters not as a pupil but as an assistant. It might be an advantage if he could finish up his training in a practising engineer's office, where he might obtain a knowledge of costs, which he cannot do in a workshop.

The question of the costs was raised in the manufacturers' section by Mr. Clark, who considered that the Institution requirements were deficient in that respect. He found that young men were utterly incapable of making records or taking any interest in costs.

A point was raised also by Mr. Bevis, who wished to know if it was for the benefit of the Institution of Civil Engineers that the inquiry was being held. It was a pertinent suggestion, as frequently in reading through the report one has the feeling that there is a tendency to assume that the profession of engineering exists for the Institution rather than the Institution for the profession. Of course, in raising the status of the Associate Member it follows that the status of the whole profession will be raised, but it is important not to reverse the point of view, the real aim being the ultimate benefit of engineering as a whole; nor should it be forgotten that a man may be a good engineer and not a member of any institution.

Perhaps the time has now arrived for the Institution of Electrical Engineers to appoint a committee to consider the training of electrical engineers, so that our ideas may become more "completely crystallised" on the subject.

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INSTITUTION OF ELECTRICAL ENGINEERS.

(Abstract of Inaugural Address delivered by the Chairman, Mr. Thomas Roles, *to the* Yorkshire Local Section, *November 4th,* 1914.)

In the present serious crisis through which our country is passing I find it difficult to turn my attention to anything other than the war and its effects; I therefore propose to make a few remarks on the subject of the war as relating to the electrical industry.

The first question each one of us who is of suitable age and build and is in good health should ask himself is: "Should I take up arms for my country?" The army has vital need of many more men than have yet enlisted, but our electricity supply undertakings must be kept going, otherwise the supply of power for driving factories and mills which are turning out material of all descriptions for our army and navy will be stopped or considerably curtailed. Many of our members, to do their duty, must, therefore, perforce remain to control and run these undertakings, however martial may be their spirits. Others are doubtless engaged with firms which are manufacturing war material or other goods needed directly or indirectly in connection with the campaign, work which must be pushed forward in the most efficient and energetic manner.

Having taken these facts into consideration, and satisfied himself that he is fit to bear arms, if his position can be left vacant or reasonably well filled, it seems apparent that the place of the electrical engineer is in the fighting line.

The technical corps are apparently well filled, and the man behind the gun is the necessity. It is to be hoped that electrical engineers will not hold back from the path of duty because they are unable to assist the military authorities in work of an engineering character. The training received by an electrical engineer should enable him to display individuality in a marked degree and considerably assist in the carrying out of any military operation in which he might be engaged.

Turning now to the immediate duties devolving upon those of our profession who remain in civil life, some of the most important are these:—

To execute with energy all work on which they may be engaged which is in any way connected with military requirements.

To assist and encourage those who are capable of bearing arms, and are in a position to do so, to enlist.

To assist in and to encourage all efforts made to contribute to the comfort of our troops on active service and the welfare of their dependents at home.

To do all possible to support the sentiment "Business as usual" with regard to the electrical industry in particular and all other British industries in general.

To assist in every way possible the efforts which are being made by British manufacturers to capture and retain foreign and colonial trade which until recently has been in the hands of alien enemies.

To consider carefully the methods of educating and training young electrical engineers with a view to re-organising and improving such methods, in order that in future the designing as well as the manufacture of all electrical apparatus required for the naval and military services shall be carried out by British-born subjects. Special attention should also be given to business training, so that the business methods of British firms may be entirely up-to-date and their sales organisation controlled by Britishers.

Those of us who are actually engaged on work required for military purposes should remember that very much may depend on the work of the humblest worker, and that time is the essence of the contract just now. It therefore behoves each of us to give of his very best in the carrying out of all such work, and, if necessary, to deny himself of leisure and recreation to prevent delay in delivery, even to the extent of risking one's health as a result of his endeavours.

It is undoubtedly the duty of employers at the present time to assist and encourage their employés to enlist, provided that the loss of the employés' services will not cause delay in the carrying out of Government contracts or risk of failure in public services. Fellow employés can render valuable assistance by helping to instruct newcomers in the work of the positions vacated by their colleagues who are leaving to fight on their behalf. If by working overtime employés remaining at home can facilitate the early departure of those desirous of leaving for military service, they are rendering assistance to their country. Employers should also accept any inconvenience, caused through loss of hands leaving to enlist, in a patriotic spirit.

The least that can be expected of those who remain at home is that they should assist in bearing the burdens of the men giving personal service, and I would earnestly request those of our members who have not up to the present arranged to do so, to set aside regularly during the period of the war, and as long as necessary after, a definite percentage of their incomes weekly or monthly for the benefit of relief funds formed to assist persons affected by the war. Small sums given regularly will prove of far greater help to this end than a comparatively large sum given with the idea of covering our indebtedness for all time. May I also suggest to our members to do everything possible to impress on our legislators the necessity of, without delay, making provision for those broken in the war and their dependents, and also for the widows and dependents of those who have fallen? Whatever it costs us, let it never again be said that even one of our soldiers or of those dependent on them has to beg his or her bread or find shelter in the workhouse. This is a matter that should not be left over for dealing with at some later date. A definite and adequate scale of pensions should be decided upon immediately and paid, whatever the cost to the country. Many employers have arranged to pay their employés a proportion of their usual salaries or wages during the period the men are performing military or naval duties; such patriotic action has decided many men to enlist who otherwise could not have seen their way to do so.

The motto "Business as Usual during the War" is a good one, but one that can only be acted upon to a limited extent. The right course for us to pursue is to lead as nearly as possible similar lives as hitherto. The main object to keep in view is the provision of work for all in this country during the period of the war, and the probably yet more trying period which will immediately follow when men who have joined the colours resume civil life. After these periods of depression a boom in trade may reasonably be anticipated, and it should be our aim in the meantime to prepare for such a boom by steadily increasing the efficiency of our manufacturing machinery, so that full advantage can be taken of improved conditions by turning out large quantities of the finest possible goods. While trade is slack obsolete plant should be replaced, and improved methods of driving adopted. If manufacturers with capital will adopt this counrse the electrical industry will be benefited at a critical time, and the manufacturers will reap their reward later. Electricity supply undertakings in particular should take the opportunity of carrying out schemes of re-organisation which will provide work during any period of depression which may be experienced, and render them ready to meet the large demands which will undoubtedly be made on them at a later date.

By gradually increasing, within reasonable limits, stocks of meters, motors, and other apparatus for hiring, during any period in which trade in the electrical industry is at a low ebb, electricity supply engineers will not only exhibit patriotism, but economy and business prescience, as my faith leads me to believe that within a comparatively short time after the conclusion of the war matters electrical will go forward with great rapidity.

If manufacturers would from time to time notify purchasers for which lines of goods orders are required to keep their hands employed, steps might be taken to assist them by placing orders for stock purposes. Advertising and canvassing for orders should in no way be diminished, but rather increased, and our salesmen should more than ever use their powers of persuasion, remembering that on the results of their efforts depends the employment or otherwise of many workmen during a critical period.

The duty of assisting in the capture and retention of foreign and colonial trade which until recently has been in the hands of alien enemies naturally chiefly devolves upon those of us who are connected with manufacturing concerns. A careful study of the requirements of customers abroad would appear to be the first essential, after which our designers and workmen must endeavour to meet such requirements to an extent at least as great as, if not greater than, they have previously been met by foreign competitors, at the same time doing everything possible in the direction of reducing the cost of manufacture, while retaining the British reputation for good workmanship and solid reliable products.

A large amount of foreign trade has been obtained on the merits of the goods supplied. There can be no doubt whatever that the electrical industry of this country owes much to foreign inventors and designers for the headway which has been made in electrical matters during recent years. When we come to consider electrical apparatus and machinery made in this country, it is astonishing to find the extent to which British firms work to designs originally obtained from abroad, and that in many of our large works one or more of the chief designers are of foreign extraction. Is it wise that we should be so dependent upon foreign designers and foreign-made apparatus not only in connection with Government requirements, but in respect of the industry generally?

How is it that such important posts in our manufacturing firms are occupied by persons of alien birth, either naturalized or otherwise? It cannot, I think, be suggested that they are content to accept lower salaries than British engineers, and, therefore, there seems to remain but one answer to my question, namely, that such persons are more capable in their particular line than the home-trained engineer.

Our educational system is at fault; it is high time that the system was revised. The educational question is one which might, with advantage, receive in all its bearings the very careful consideration of our Institution.

With regard to business training, there seems to be a fairly general feeling prevalent that British commercial methods in many cases compare unfavourably with those of firms abroad. If we are to obtain the share of the world's electrical trade which we desire, our business organisation must be thoroughly up-to-date. We may manufacture the best of goods, but without skill in our sales departments the major portion of them will probably remain in our warehouses. It would seem especially desirable that all persons who are emplyed in our sales departments should be of British

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birth, as under such circumstances there would be far less chance of valuable business information being conveyed to foreign firms than exists under present conditions.

(Abstract of Inaugural Address delivered by the Chairman, Mr. P. P. Wheelwright, *to the* Manchester Local Section, *November 3rd,* 1914.)

I may be permitted to survey the work and scope of the electrical engineering industry, particularly do I want to emphasise the business side, which has had a rapid development under varying conditions. Opinions of commercial engineers based upon experience, are most valuable, and I think the Institution would be wise in doing all in its power to cultivate their co-operation. In the earlier stages of the profession, the Institution was accepted as a purely technical body, and rightly so. Those days have passed, and what is required now is to widen the scope of the organisation, make it as comprehensive as possible, and its benefits valuable so as to attract members.

There is something lacking. The fault seems to be that the Institution does not give to its members the acknowledged status in the engineering profession which one would like to see. The Institution might with advantage widen its field of operation, make its presence more felt, and its value to the individual very much greater. For instance, I hope the time is not far distant when advertisements for positions of responsibility will state that applicants connected with the Institution will have preference.

The inducements offered to young men to join the profession are insufficient, in view of the qualifications required; considering that these attainments are only achieved by considerable expense, time and experience, when one is given a position of trust, the remuneration should be more in proportion to his responsibilities than it is in many cases. In the near future, unless greater inducements are offered, there will be a dearth of suitable men willing to undergo the drudgery of an engineer's training when advancement can be gained so much more rapidly in other professions.

When the war clouds lift, the electrical industry will be in a position to resume its vigorous work with increased strength and in different markets, and each of us must do his best to aid the industry by purchasing only materials made in this country. The practice of many large purchasers of securing material at the lowest price, regardless of quality, in many cases, has helped the foreign trader to the detriment of the British trader; and the waiving of the general conditions of contract has made it possible to place large contracts with German firms, whose guarantees cannot be compared with those of the British manufacturers.

A great deal of the foreign competition has not been based upon sound financial trading, but rather with the idea of dumping material at prices not even covering cost, solely to set back, if not destroy, the British industry. International trading is perfectly sound so long as the principle of fair trade is acknowledged; the reputation of the British manufacturers is a surety of good work, and they will now rise to this unparalleled opportunity and regain the trade that of late years has passed them by.

The importance of keeping our manufacturers' works employed is fully realised, and all purchasers who have orders to give should place them without delay. The Colonies and Dominions over the sea have done all in their power to help the mother country, and the importance of going forward with "Business as usual" is fully recognised; time and money are necessary to develop the organisations for extending the field of operation, but the possibilities of the situation are such that too much cannot be done to encourage every one to assist in the capture of a fair proportion of the trade that Germany has taken from us during the last 10 to 15 years. The tide of patriotism runs high, but it is not strong enough to be a national defence of our industry; the creation of a nucleus of a demand at reasonable prices, by governments, municipalities, and large purchasers setting the example of buying in the home and colonial markets, would provide electrical manufacturers with a sound foundation upon which to build and extend the industry.

In the near future the electrification of railways will come up for consideration on a larger scale, as trade conditions generally are becoming more and more severe. The erection of a number of power stations for railway purposes alone would not be progress in the right direction, as there are many corporations and companies capable of supplying the necessary power at moderate prices. Such loads are suitable for addition to the ordinary demand on an electricity works.

In purchasing plant the price is not the primary consideration, but rather efficiency, reliability, and sound mechanical design. The purchaser should state fully what is required of the plant, and not specify the design, material, etc., which are the concern of the manufacturer.

Manufacturing operations can be greatly improved by the use of labour-saving appliances, together with the adoption of electricity, and developments in this direction are becoming more and more noticeable. The whole of our requirements ought to be within our own control, and new trades will have to be commenced in the future so that we shall be less liable to be adversely affected by external causes. Labour-saving does not increase unemployment; labour is so adaptable that as the supply required in one direction decreases new openings appear in another.

During the last few years the question of smoke abatement has come into prominence, and it is well worth working for. Investigation of the amount of coal used in a Lancashire town per horse-power results in a scarcely credible figure, and the cost is far greater than when the coal is purchased and consumed in bulk at one place; with the source of power situated away from the town, smoke can be partially eliminated. Every electrical engineer must be constantly on the alert for opportunities of benefiting his profession and the industry by keeping the advantages of electrical applications ever in view of the public.

ELECTRIC COOKING.

At the last meeting of the "Point Five" Association, held on October 16th at Manchester, Mr. Ayton, of Ipswich, was elected a member.

The Chairman (Mr. Pickvance, of Wrexham), in addressing the meeting, said the object of the Association was to secure the purely domestic load, and it was apparent to him that they would have quite enough to consider in this, without including any scheme for the furtherance of the sale of electricity at one-halfpenny per unit or under for any other purposes. The difficulties attendant upon the object behind the Association were such as to call for concentrated attention. He disagreed with the belief held by some members, that the domestic load would eventually exceed industrial requirements, although it might approach it in magnitude, and in some non-industrial areas it would exceed the power requirements. Central station engineers were not entirely responsible for the extremely rapid development in the application of electricity for power purposes; the motor hiring department run by a few undertakings some 14 or 15 years ago created a market for electric motors, and enabled the manufacturing firms to collaborate with the engineers and standardise production, etc. It should also be considered that the rapid development of electric driving was primarily due to the impetus given to the movement by the fact that some local authorities owning supply undertakings had powers *and availed themselves of those powers* to hire motors. They created the demand, and he suggested that the Association should use all its endeavours and energies to rope into its ranks those engineers who were in a position to hire cookers and heaters, so that the ultimate results would be such as to secure the hearty co-operation of manufacturers, by reason of the fact that, collectively, they would be able to place orders in quantities much greater than was possible at the present time. At the present moment only those members of the Association who possessed powers to hire fittings could do any good, but even they realised the extent of the limitations cast upon them by the inability of other supply authorities to fall in on the same lines. They realised that if selling and hiring powers became general, apparatus for heating and cooking would, by reason of the enormously increased demand, rapidly decrease in price. It was incumbent upon the Association to use all means at its command to induce those central station engineers who already had powers to supply and wire, to adopt the "Point Five" tariff, become members of the "Point Five" Association, and thereby increase the potentialities of the Association, not merely in the direction of increased purchases of heating and cooking apparatus, but in the weight and influence the body would acquire by reason of the influx into its ranks of engineers representing authorities who in the past had been sufficiently businesslike to secure all powers necessary for the development of electric supply undertakings. He drew their attention to the attitude some gas companies adopted to those unfortunate undertakings which had not full powers to develop. Such authorities had so far had only the Electrical Contractors' Association to deal with; it seemed, however, that the E.C.A. were to be strongly supported by their natural enemy, the gas companies. There were ways of meeting the line of action threatened by the gas companies. The method he had adopted was to join hands with an electrical contractor, but while this scheme provided a show-room in the town, it could not bear any fruits so far as the development of cooking was concerned, while its influence on electrical heating was considerably limited. Had they powers as a local authority to have a show-room, and to run a hiring department in connection with that show-room, they could enter into all the expenses required in the lay-out of a properly designed business-getting department. A suggestion made by a prominent lawyer, when referring to a threatened action by a gas company who proposed not only to close down the electrical show-room, but to obtain an injunction against wiring and fitting, was to the effect that the engineer himself should be permitted to open up such business on his own account; he calculated that the time spent by the engineer in supervising such an enterprise would be all to the good of the electrical supply department of the local authority; the engineer was already, more or less, supervising all the wiring, and as such work was hardly intended for him when appointed, it was only fair that extra remuneration should accrue to him, which would automatically be provided for if his committee would

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remove, to that extent, the restriction prohibiting him from entering into any private business. The lawyer evidently relied on prejudice in favour of the supply undertaking on the part of their engineer; he calculated on the establishment of a sort of rent free arrangement to the Corporation. Doubtless an engineer under such circumstances could provide for adequate recompense. To those who were already producers of heavy currents at low rates for power purposes, the mains question was not likely to prove disturbing as yet, since their three-phase high-tension and heavy low-tension existing mains might act as a sufficient time lag. Perhaps a favourable diversity factor had not a little to do with their equanimity, but it would seem, if the domestic supply was likely to exceed the demand for power in the industrial areas, that large supply undertakings must consider the mains question. Whatever the positions of these large undertakings might be, there was no doubt in his mind that a proper consideration of the "Point Five" tariff for domestic purposes, on the part of small undertakings, must include the question of mains, to which must be added the extension of generating plant, and it was impossible for any small station engineer to dissociate from these two points the present cost of electrical cookers. Just as large undertakings had to re-design their system in order to cope with the power load, so would the small undertakings be compelled to consider whether their plant was capable of dealing with a domestic load. Whatever the difficulties were, he was satisfied that the only hope for the small supply engineer was the domestic load; he was threatened by a reduction of his lighting revenue, due to improved efficiency in lamps, he had no power load to fall back upon; he must consider cooking. Those engineers of to-day who had charge of medium and large-sized central stations, who years ago, when their undertakings were just such small ones as those they were now considering, had an efficient, economical, and cheap electric motor—the manufacturers were with them. Had the present-day small central station engineer a cheap and reliable cooker at his command? Electrical cooking as applied at present might very reasonably be termed a luxury. The vast body of artisans and the working-class generally could not be approached. It was to this class that the small station engineer with his negligible power load had to look to save him from extinction. With the exception, perhaps, of one undertaking, the rest of the advocates of electrical cooking were toying with the subject. He had a suspicion that those of their members controlling larger undertakings found sufficient outlet for their energies and attention in the large and fruitful field of industrial power requirements to be found in their areas. The engineer with a large demand for power lying at his door could not afford to waste time in trying to sell or hire to poor people expensive electrical cookers. The engineer with a comparatively poor demand for power, but a numerous wealthy class, did spend his time in selling and hiring expensive cookers; his customers could and did pay. But what of the engineer who had neither a power load or a wealthy residential class to fall back upon? He naturally turned to residential property, and as the bulk of the people were tenants of houses under, say, £25 per year rental, what hope had he? The landlord would not wire the houses, the tenant could not afford to pay for it, neither could he afford to buy cookers, which was the only alternative to hiring from the local authority. It was comparatively easy to secure the £50 house if the resident was the owner, but tenants of such houses were just as reluctant to spend money on wiring other people's property as the tenants of cheaper houses.

In the discussion which followed Mr. Allen (Wolverhampton) agreed with the chairman that the energies of the "Point Fives" should be concentrated on domestic supplies. He referred to the urgent necessity of hiring powers being available in every town. He mentioned there were 80 towns having these powers already, but very few exercised them on account of the apathy either of the local council or of the engineer. The difficulties were especially great where the local authority ran its own gas works as well as the electricity works. He did not think the question of mains was any more serious than it was when power was first being introduced. New mains put down should be designed with the view of dealing with a large increase in the domestic demand. He did not agree at all that electric cooking was generally a luxury.

Mr. Gray (Accrington) had full trading powers and exercised them, the reason being the very logical one, that the town clerk, who was also clerk to the gas board, thought, without any further prompting, that the two businesses ought to be in an equal position as regards competition. If one had trading powers the other should have the same. He did not think the principle of hiring heaters and cookers was at present altogether sound, owing to the fear of obsolescence; they only hire-purchased this apparatus. He found that it was not the wealthier class of consumers who adopted domestic electric contrivances; it was the small consumer, to whom a saving in domestic labour was a very important matter. He agreed that the mains question was a serious problem, especially in side streets, and his evening load was increasing, due to the increase in domestic heating.

Mr. Fedden (Sheffield) did not agree that there was any prospect that the domestic load would be greater than the power load. He emphasised very strongly the importance of hiring, and he also agreed with Mr. Gray that it was easier to get the smaller consumer for cooking and heating than the larger one. He did not think that there was any special difficulty in the case of small undertakings with regard to mains, as in most towns, large and small, the power area was a totally different area from the residential. Different systems and sizes of mains were required in each, and the residential district of a manufacturing town could be placed in the same category as a small residential town which had no factories. The speaker pointed out that the bulk of cooking in provincial towns was done in the day-time, and formed a most profitable non-peak business; he agreed that cookers must be reduced in price. The speaker was strongly in favour of the electrical engineer attempting to get all the load in the district that was available; it improved the diversity factor of the whole system. He was convinced that in a short time a number of the "Point Fives" would be selling electricity for domestic use at a secondary rate of ½d. Hiring powers were of the most vital importance, and gas and electricity undertakings should have equal advantages in this respect.

Mr. Bertram Thomas raised the importance of the question of educating the public in the use of electric cooking. He referred to the great problem of electric cooking, which was that of boiling water, and the remarks of subsequent speakers indicated that this difficulty was about to be overcome, if not overcome already.

Mr. Purse (Carlisle) also regretted the stultifying effect of the want of hiring and general trading powers. Those undertakings, without these powers, could not even engage demonstrators or run show-rooms, substantial progress in heating and cooking could not be made, and the electrical contractors were losing a considerable amount of business. The speaker strongly advocated the selection of one type of cooker, and then to stick to it. Many types in the same show-room only confused the consumer. Personally, he had found the Carron cooker gave very great satisfaction, but he hoped that soon there would be a big decrease in the purchase cost. He found that a great deal of prejudice existed amongst domestic servants against electric cookers, and this showed the necessity for frequent demonstrations. Once a cook was used to an electric cooker, he or she could rarely be induced to use anything else. He also considered that the mains difficulty was a real one, but by no means insuperable any more than it was in years gone by, when electric motors first came into general use.

Mr. Shaw (Ilford) joined in the general chorus of complaint that it was almost impossible to introduce a new thing or a new service, such as cooking and heating, to consumers in the absence of proper trading powers; in Ilford they had not experienced any opposition from contractors in this direction. The whole of the opposition had come from the natural competitors—the gas company—and contractors had worked very well with them indeed. In spite of his difficulties in the lack of proper powers, he had met with great success in heating and cooking, although it was only six months since he had adopted the "Point Five" tariff. The district not being inhabited by wealthy people, but by residents with very moderate incomes, it was remarkable to note the way in which they seized on any apparatus which would save trouble and labour in the house. Mr. Shaw thus confirmed other speakers who referred to this; he was of opinion that such a district offered much greater possibilities for cooking and heating than a district composed of more well-to-do people. He was not a bit scared about the mains problem; he had, for instance, three cookers, taking nearly 3-kw., one in each of three adjoining houses, all supplied from one 7-16 main. There had been no trouble, merely an occasional drop in voltage, which was not serious. Mr. Shaw did not at all agree that electric heating and cooking were a luxury, and had proved the opposite in his own district.

Mr. T. Roles (Bradford) congratulated the chairman on his courage in becoming a "Point Five," because Wrexham must be one of the most difficult of towns to cater for as regarded domestic electricity. The speaker gave an interesting description of an electric heater manufactured by the British Electric Heater Co. for hot-water supply purposes. From what he knew of this heater and apparatus of other makes he was convinced that they were just about on the point of solving the domestic hot-water problem.

Mr. Cooke (Luton) complained of the high cost of domestic electrical apparatus, and also insisted on the importance of trading facilities for electricity undertakings. He did not think any alarm should be felt on the mains question; the problem would be solved just as easily as the problem of the introduction of electric power. He agreed with Mr. Shaw that the house of small rental was the most likely consumer for electric heating and cooking.

Mr. Nevill (Wakefield) was very emphatic on the question of the cost of maintaining electric cookers. He used chiefly the Carron cooker, and so far had had no maintenance trouble, the cookers being very reliable apparatus. He also referred to the importance of hiring and trading powers. He mentioned that in his district the increase of electric heating was very remarkable.

Mr. Councillor Barge (Poplar) had seen the successful result of a suitable domestic tariff as applied to a district like Poplar, and he was convinced that the price of current was right from the point of view of the smallest consumers. As to the fear of possible mains trouble referred to by several speakers, Mr. Barge put the obvious question: "Surely if your tariff is right it will cover the cost of the necessary mains extensions? If you fear abnormal mains costs, and if that

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fear is based on practical experience, then your tariff or some other vital portion of your organisation is out of gear."

Mr. Bowden (Poplar) had experienced no trouble whatever on the mains question, and gave some interesting figures of how the supply had increased in the Poplar area, without necessitating increase to the network. He was adopting a very advanced practice at the present time in connection with artisans' dwellings. These were fitted with six lights and a hot plate, which latter would do nearly all the cooking required in that particular class of residence. The wiring was included in the price charged, and the prepayment system by slot meter was adopted. The total charge to the consumer (including wiring, supply of hot plate and current) was from 1s. 6d. to 2s. per week. This was probably the first time that electric cooking had been attempted in property of this class.

Mr. Hame (York) supported Mr. Nevill in regard to the reliability of cooking apparatus. It was perfectly true that even as recently as a year ago electrical cooking apparatus was liable to give trouble, but he thought the efforts of the designers and manufacturers ought to be recognised, in their having succeeded to such a great extent in eliminating faults. He also used the Carron cooker and found it quite reliable, and was able to speak on this point from personal experience. He did not agree that electric cooking was a luxury. He had put a complete electric cooking equipment into 32 new houses, the rental of the latter being as low as 6s. 6d. per week, and in these houses had had practically no breakdowns of any description, although the treatment received by the cookers would be probably somewhat more severe than in houses of a higher rental.

The Hon. Secretary (Mr. A. H. Seabrook, Marylebone) instanced his own experience as to the reliability of electric cookers; in Marylebone they inspected once a month instead of once a fortnight, and the bulk of the inspector's work consisted in cleaning the cooker, which work should be done by the domestic staff. The ratio of faults to cookers installed per month was astonishingly less than for the same period last year. He gave his experience of a red-hot hot plate which was not yet a commercial article, and referred to the probability of a cooker coming out shortly, the top of which was designed in such a way that the saving in current would be approximately 50 per cent. as compared with the present hot plate system. He supported the remarks of speakers on the immediate prospects of electrical supply undertakings being able to deal with the domestic water problem as well as cooking, and instanced an experimental installation on a fairly large scale where the cost had been slightly less than the previous cost of gas. He mentioned the valuable results of adopting Mr. Allen's system described by that gentleman some months ago *re* hiring radiator wiring. The result of this was a considerable increase in the number of consumers for heating. Consumers could now get both wiring and heaters on a quarterly rental. Each point had a capacity of 4-kw., and cab tire sheathed, or similar easily removable cable was used, and a definite schedule had been got out per yard run per radiator point: (a) From main supply, (b) from nearest distributing board, provided the latter would carry the load. The speaker mentioned that there were at least two satisfactory thermostatically-controlled heaters for water heating which gave results immeasurably superior to hand switching or constant heat units. A new one was now being brought out which he believed would be better than any existing one. combined with a time switch, so that the station engineer would be able to control the load and diversity factors of this branch of the business, the extent to which he could control it being settled by the size of storage tank adopted.

The Chairman, in replying to the discussion, regretted that the principal point in his address, which had for its object the promulgation of a scheme for the more rapid attainment of the ideals to which the Association was pledged, had been overlooked by the speakers; he suggested that such a subject might reasonably be considered at the next ordinary meeting. Whatever the circumstances confronting the small station engineer, they formed a greater problem than those to be dealt with by engineers of larger undertakings. It was clear that some divergence of opinion existed as to what class of consumer should be regarded as wealthy. He believed that people in houses of rentals varying from £25 to £50 would be the most likely to adopt electric cooking, and no doubt the speakers did not refer to houses of less rental. The York experiment was, he believed, on Corporation property.

THE ELECTRICAL INDUSTRY IN AUSTRIA-HUNGARY.*

During the second half of 1913 there was a marked decrease to be observed within the electrical trade of Austria-Hungary, but notwithstanding this the electrical companies were able to distribute very satisfactory dividends. Those of the largest companies are as follows:—Felten & Guilleaume A.G., 15 per cent.; Die Vereinigte Elektricitäts-A.G., of Ujpest, 12 per cent. (+ 1½ per cent.); Die Kabelfabrik & Draht Industrie A.G., 12 per cent.; the A.G. for the Exploitation of the Waterfalls of Dalmatia, 9 per cent.; A.E.G. Union Elektricitäts-Gesellschaft, 8 per cent.; Austrian Siemens-Schuckert Works, 7 per cent.; Elektricitäts A.G., 7 per cent.; Vereinigte Telephonen und Telegraphenfabriks A.G., 7 per cent.; Tramway und Elektricitäts-Gesellshaft, of Linz-Urfuhr, 6½ per cent.; Oester-Ganzsche Elektricitäts A.G., 6 per cent. (— 1 per cent.); Steiermärkische El. Gesellschaft, 6 per cent.; Die Gesellschaft für el. Industrie, 5 per cent.

These favourable results may chiefly be attributed to the large number of orders in hand, which were not yet executed. As time went on, the orders in hand were gradually reduced, and it was very difficult to get new ones. No new companies were started, and the existing companies neither increased their capital nor extended their works. The only new company in connection with the electrical industry which was formed was the Karlsbader-Kaolin-Elektro-Osmose A.G., with a capital of 1,000,000 kronen, or francs. Among new buildings completed were the new electrical works at Parschnitz, from which, in all, 60 parishes are supplied with electrical energy. These works involved a capital expenditure of 7,000,000 kronen. Of works in progress may be mentioned the Faelwerke, in Steiermark, which first were going to be completed in the beginning of 1916, and in which are to be installed five rotary current generators of 5,200 kw. capacity each, at 10,000 volts, 50 periods and 150 r.p.m. The engines are to be connected with exciters, which will be driven by water turbines. The foundation was also laid for a projected new works at the Bad-Gastein, which will have a capacity of 1,500 kw. In regard to new projects, it may be mentioned that the Donaukraftwerk Wallsee intends harnessing the Danube waterfalls at Wachau, and further, to harness the water power of the Kampf River, from which 12,000 kw. can be easily obtained, but this amount can be increased to 35,000 kw. on the basis of 3,000 working hours per year.

The railway authorities have secured a number of waterfalls for the purpose of utilising same in connection with the electrification of various railways, as, for instance, the falls of the River Mur, at which a station will be erected and furnished with six double Francis turbines of 1,070 kw. each, and further the falls of the Pötsback River, from which can be derived from 800 to 2,600 kw. At the Ober-Murtal is also projected a new electrical station with a capacity of 4.000 kw.

Die Elektricitäts A.G. has obtained a concession for the erection of the Wottawawerk at Pisek, from which 17 000 kw. can be supplied according to the estimate. Two firms are also working with the plan of harnessing the Elbe between Lobositz and Aussig, and the plan has, in principle, been approved by the authorities. The "Siemens" Elektrische Betriche A.G., which previously acquired the North Bohemian Electrical Works from the Bergmann Works, intend, apart from the existing station at Türmitz, to build a new central station, with a capacity of from 15-22 000 kw. for the purpose of supplying energy to the Brüx district along the Erzgebegirge. In West Bohemia two firms are going to build a new electrical works at Aumühle, and for the districts of Pilsen, Blowitz and Bokyean there is projected another central station, at a total cost of 1.14 million kronen. In Voralberg on Mingbach at Ninzing there will also be built a large electrical works, with an estimated capacity of 9,000 kw., and with a pressure from 25,000 to 50 000 volts, which will involve a capital expenditure of 4 million kronen. Of smaller works there are several projected in different places.

As regards electric railways the line between Bozen and St. Jakob was opened for traffic at the beginning of the year and concession granted for the aerial electrical railway at Zambana. Among the numerous projects for which permission has been given, may be mentioned the line between Kastelruth and St. Ullrich, in Grüben, which is chiefly a tourist line, and the line

* By C. Honigmann, in *Elektrotechnische Zeitschrift*.

Foreign Electrical Trade of Austria-Hungary During the First Half of 1914.

	Imports.				Exports.			
	Quantity in double centner (100 kilos).		Value in million kr.		Quantity in double centner (100 kilos).		Value in million kr.	
	1914.	1913.	1914.	1913.	1914.	1913.	1914.	1913.
Dynamos, motors, transformers &c.	12,847	17 717	4 005	4,890	2,294	2,129	0,535	0,450
Telegraph, telephone, safety apparatus, &c....	354	422	0,386	0,461	388	257	0.343	0.218
Meters, switches, safety apparatus, &c. ...	9.322	10 535	7,233	7,548	2 985	2.053	1.571	1.029
Arc and incandescent lamps	1,123	957	2.457	1,993	6,521	4,189	3,884	2 535
Cables and insulated wire	434	690	0,109	0,224	3,176	3,136	0.541	0,394
Accumulators and lead plates for same ...	152	390	0.018	0.045	220	123	0 021	0 011
Carbons for arc lamps and electrodes ...	1,733	2,112	0.593	0,694	2,147	3,520	0,381	0,636
Total	25,965	32,823	14,801	15,860	17,728	15,707	7,276	5,273

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connecting the Freistadt railway stations with the tramways of Prossnitz. The tooth-wheel railway to Kahtenburg, at Vienna, which, according to the terms stipulated in the concession, should already be in operation, remains still in the stage of a project on account of various financial difficulties that have arisen. As regards the electrification of the Stadtbahn at Vienna and the building of the underground at the same town, no progress has been made.

The position of the electrical industry and the trade in electrical goods is shown from the statistical figures of the exterior trade in the table given on p. 675. The quantity of the total imports has decreased from 32,823 to 25,965 double centners, and the value from 15 860 to 14,801 million kronen, the decrease in quantity thus representing about 20 per cent., and that of the value about 6 per cent. The exports, however, have risen considerably, viz., from 15,707 to 17,728 double centners, or by 12½ per cent., while the value has increased from 5,273 to 7,276 million kronen, or by 38 per cent.

When reviewing the different items, there is observed a considerable reduction in the imports of dynamos and electric motors, and a small increase in small motors. The reduction is chiefly in the larger types.

The export trade has, however, very good results to show, and this refers especially to small machines of a weight up to half a ton, for which the best markets were Italy, the Orient and Russia.

As regards apparatus for weak current there is an increase of the exports, while the imports have been reduced somewhat. Of considerably greater importance, however, is the trade in apparatus for strong current, and the value of the imports has thus been kept above 7,000 million kronen, although the electrical companies in their reports are complaining that the consumption of light and the number of consumers have decreased on account of the bad times. The exports have, however, risen by about 50 per cent., of which a part may be goods returned to Germany. For this class of goods Russia has been the best customer, others being Bulgaria, Roumania and Greece.

The imports, as well as the exports, of arc lamps show a decrease, and while previously the imports exceeded the exports, the opposite is now the case. The markets were chiefly Turkey, Italy, British India, Egypt and Greece. Of incandescent lamps the majority came from Germany, while the exports of such lamps are divided among nearly all countries; the best customers were Italy, Russia and Germany, after which come France, Great Britain and U.S.A.

The unfavourable position of the electrical trade has caused the installation, as well as the manufacturing firms, to combine in order to take care of their interests, and they have formed an Association entitled the Osterreichser Reichsverband der Installateure. The manufacturers have again taken up the fight for an improvement of the miserable conditions which are ruling in connection with the transmission and distribution of electrical energy, and an effort is being made to get the laws altered.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

21,501. "Anti-rheumatic or electric knitting needles." G. M. Simpson. October 26th.

21,509. "Systems for charging electric secondary batteries." E. B. Jacobson. October 26th. (Convention date, December 3rd, 1913, United States.) (Complete.)

21,510. "Ignition systems of internal-combustion engines." E. B. Jacobson & C. J. Gustafson. October 26th. (Convention date, December 3rd, 1913, United States.) (Complete.)

21,512. "Electric igniting and starting systems for internal-combustion engines, automobiles, and like vehicles." E. B. Jacobson & C. J. Gustafson. October 26th. (Convention date, December 3rd, 1913, United States.) (Complete.)

21,521. "Combined switch and electric-lamp holder." H. Lucas & O. Lucas. October 26th. (Complete.)

21,529. "Telephone switching apparatus." Western Electric Co., Ltd., & R. A. Mack. October 26th.

21,536. "Watertight electric bells and the like." J. Bein. October 26th.

21,538. "Printing-telegraphs." C. J. Wiley. October 26th. (Complete.)

21,578. "Fuses or cut-outs for electric circuits." V. Hope. October 27th.

21,583. "Dynamo-electric machines." C. T. Mason. October 27th. (Divided application on 29,655/13. December 23rd.) (Complete.)

21,590. "Method of generating high-tension sparks for ignition purposes." F. H. Teagle. October 27th. (Divided application on 25,855/13. November 11th.) (Complete.)

21,593. "Electric switches." C. H. Miller. October 27th. (Convention date, October 28th, 1913, United States.) (Complete.)

21,603. "Sparking plugs for internal-combustion engines." R. Wilkinson. October 27th.

21,609. "X-ray apparatus." E. E. Greville. October 27th.

21,610. "Dynamo-electric machines." C. T. Mason. October 27th. (Divided application on 29,655/13. December 23rd.) (Complete.)

21,613. "Wireless signalling systems." E. J. Rofsch & J. P. Roe. October 27th.

21,638. "Process for the removal of zinc from scrap galvanised iron." S. O. Cowper-Coles. October 28th.

21,639. "Process for the manufacture of needles." S. O. Cowper-Coles. October 28th.

21,640. "Process and apparatus for the removal of enamel from enamelled articles." S. O. Cowper-Coles. October 28th.

21,643. "Electrically-operated alarm devices for use in connection with door locks and catches." T. Kerr. October 28th.

21,650. "Composite conductor cables and the method of making the same." E. C. R. Marks. October 28th. (Aluminium Co. of America, United States.) (Complete.)

21,676. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. October 28th. (General Electric Co., United States.)

21,680. "Telegraph, submarine sound-signalling, or similar systems." W. H. Shephard & A. E. McKechnie. October 28th.

21,706. "Span-wire side-traversing arc and incandescent or gas lamp automatic connecting, suspending, and lowering device." J. Stevenson & O. R. Williams. October 29th.

21,710. "Sparking-plugs for internal-combustion engines." Electric Ignition Co. (1913), Ltd., & A. Cox. October 29th.

21,727. "Electrolytic apparatus." G. Planco. October 29th.

21,743. "Dynamo-electric machines." C. T. Mason. October 29th. (Divided application on 29,655/13. December 23rd.) (Complete.)

21,761. "Electrical switches." Midland Electric Manufacturing Co., Ltd., & W. L. Barber. October 30th.

21,766. "Electric concertina." N. W. M. Holt. October 30th.

21,774. "Ignition dynamos." C. T. Mason. October 30th. (Divided application on 174/14. January 3rd.) (Complete.)

21,782. "Electric starters for use on motor-cars and the like." A. H. Midgley & C. A. Vandervell. October 30th.

21,785. "Circuit-breakers." British Thomson-Houston Co., Ltd. October 30th. (General Electric Co., United States.)

21,789. "Submarine mines." G. E. Elia. October 30th. (Convention date, January 19th, 1914. France.) (Complete.)

21,792. "Electric watt-meters." P. M. Lincoln. October 30th. (Convention date, November 5th, 1913, United States.) (Complete.)

21,793. "Automatic selecting devices for telephone systems." Siemens Bros. & Co., Ltd. October 30th. (Siemens & Halske Akt. Ges., Germany.) (Addition to and divided application on 29,883/13. July 16th, 1914.) (Complete.)

21,794. "Circuit arrangements for telephone installations." Siemens Bros. & Co., Ltd. October 30th. (Siemens & Halske Akt. Ges., Germany.) (Complete.)

21,798. "Electric incandescent lamp holders." C. G. M. Bennett & C. H. Jeffcoat. October 30th.

21,822. "Electric arc soldering." E. H. Jones. October 31st.

21,823. "Ignition systems." C. T. Mason. October 31st. (Divided application on 173/14 January 3rd.) (Complete.)

21,824. "Electro-magnetically-operated valves." A. H. Curtis & Igranic Electric Co., Ltd. October 31st.

21,825. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. October 31st. (General Electric Co., United States.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford, price, post free, 9d. (in stamps).

1913.

15,729. Methods of Changing the Frequency of Alternating Electric Currents. A. M. Taylor. July 8th. (Patent of addition not granted. Cognate application 16,269/13.)

19,603. Electric Insulation of Rail Joints for Rail or Track Circuits on Railways or Tramways. B. R. Wills & J. C. Sykes. August 29th. (Cognate application, 7,882/14.)

22,048. Magnetic Speed Indicators. R. Haddan (Stewart-Warner Speedometer Corporation). September 30th.

22,435. Band Brakes particularly applicable to Electrically-operated Band Brakes for Electric Cranes and the like. Lancashire Dynamo & Motor Co., R. S. McLeod, & H. B. Whitmore. October 6th.

23,127. Electric Motor Starters. H. J. Norballe & J. L. Lawson. October 13th. (Cognate application, 4,613/14.)

23,281. Air Filters for Electric Generators. Heenan & Froude, Ltd., & W. Wheal. October 15th. (Cognate application, 4,368/14.)

23,543. Electric Lamps for Motor-cars and other purposes. J. Collins & Optalyte, Ltd. October 17th.

23,557. High-frequency Alternators. Marconi's Wireless Telegraph Co., Ltd., & C. S. Franklin. October 17th.

23,741. Substance for use in Processes for Electroplating Non-metallic Objects. L. Waltispurger & C. A. Rivoal. October 20th.

25,415. Electrolytic Cells. H. C. Jenkins, H. F. Pattinson, & R. Wellesley. November 6th.

25,598. Leakage Protective Devices for Alternating Current Distributing Systems. British Thomson-Houston Co. & E. B. Wedmore. November 5th.

25,695. Reactance or Choking Coils. K. M. Faye-Hansen. November 10th.

25,919. Means for Regulating the Voltage of Variable-speed Alternating-current Dynamos such as are used on Motor-cars. A. H. Simmons. November 12th.

26,609. Process and Apparatus for forming Welded Electric Contacts. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.). November 19th.

26,635. Electric Switches. A. Bonnella & G. J. Bonnella. November 19th.

26,848. Anti-friction Bearings, chiefly for use with Trolley or Truck Wheels and the like. E. Midgley & F. E. Midgley. November 22nd.

29,449. Oscillating Electric Fans and the like. A. Bergtheil. December 20th.

1914.

65. Electric Torches. T. J. Williams. January 1st.

10,107. Cells or Boxes for Secondary Batteries. E. J. Clark & Hart Accumulator Co., Ltd. April 23rd.

10,185. Casings and Mounting of Speed Indicators. R. Hadden (Stewart-Warner Speedometer Corporation). April 24th. (Divided application on 22,048/13. September 30th.)

10,770. Electric-contact Makers. M. B. Cooper. May 1st. (Divided application on 20,562/13. September 11th.)

14,582. Electrode-making Machines. S. L. Casella. June 17th. (July 3rd, 1913.)

15,632. Signalling and Train-stopping Apparatus. H. Ballington & L. Shaw. March 7th. (Divided application on 5,807/14. March 7th.)

17,988. Multiple Contact Electric Switches. H. J. Norballe & J. L. Lawson. July 29th. (Divided application on 23,127/13. October 13th.)

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THE

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Vol. LXXV.] CONTENTS: November 20, 1914. [No. 1,930.

	Page
Co-operation	677
Lead	679
Ferro-Concrete Poles	679
Railway Electrification	679
Can we Capture the German Trade?	680
Russia as a Field for British Electrical Trade, by G. W. de Tunzelmann	680
New Electrical Devices, Fittings and Plant (*illus.*)	681
Correspondence—	
Trading with the Enemy	683
About Electric Radiators	683
Legal	683
War Items	684
Reviews	686
Business Notes	687
The Government Electric Power Station of Bangkok, by F. B. Shaw (*illus.*) (*concluded*)	691
The I.E.E. Local Sections (*illus.*)	695
An Australian Water-Power Plant (*illus.*)	695
Notes	697
City Notes	699
Stocks and Shares	702
Exports and Imports of Electrical Goods during October, 1914	703
Notes on Modern Continuous-Current Motors, by T. H. Dennis	704
Wireless Society of London	705
Economics of Electric Railway Distribution, by H. F. Parshall	706
Cables, by C. J. Beaver (*illus.*) (*continued*)	706
New Patents Applied For, 1914	708
Abstracts of Published Specifications	708
Contractors' Column	Advertisement page xx

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CO-OPERATION.

SEVERAL years ago suggestions were advanced for what was called "Co-operation" in the electrical industry. They received a certain amount of attention in our pages, and were for a few short weeks, or even longer, the theme of conversation, though looking back we must confess that neither the discussion nor the conversation seemed spontaneous, and it was not long before the initiators were the only ones who could manage to maintain enthusiasm for their cause, and in due course everybody else became weary of that blessed word "Co-operation," so that it was to them either anathema or the title of an amusing freak. Like many another proposal within our memory, it paled away before indifference, and died, and had no burial.

It is matter for regret when a great word is so used that it becomes common and bereft of its best meaning, so that it fails to conjure up before the mind all that it originally conveyed. It is so in respect to this word co-operation. It is so delightfully comprehensive that it will cover anything from a great world ideal down to the mutual business relations of a couple of burglars who share the spoils, and we have applied it to almost every effort of our day. Let the reader recall the variety of cases that have arisen in the electrical profession and industry where, when propositions have been made for dealing with particular conditions or situations, the very root idea has been co-operation.

We hazard an opinion that of the various co-operative electrical movements some have come to naught because their auspices, their time, and certain other important factors, were unpropitious. It may be that others have lapsed because it is but human that many members of the body corporate should have widely divergent interests, and that co-operation can only be harmoniously conducted when it limits itself to those matters where it can conduce to the good of the whole, and is ruthlessly harsh or unfair to none. But be the causes what they may, not many months elapse after the exhausting of one idea before another applying the broad principle of co-operation in some new way is produced. Indeed, since the outbreak of war that principle has been advocated persistently on every hand. As a nation we form one solid body co-operating toward one common end, the supersession of German militarism and barbarism. As a business people, we ought to be similarly engaged in connection with the supersession of German export trade. It is possible to spoil a case by having too large ideas, and perhaps some of the co-operative suggestions have not been acceptable on that account. But there is the general trade co-operation proposition, such as we have recently advocated, which is not too ambitious, and which ought to be carried into effect just as soon as ever possible.

We have urged electrical and allied manufacturing firms who are unable alone to tackle the new markets and the new lines of manufactures, to put their heads together for these express purposes, and there is a disposition on the part of a number of them to do so. We would that they were more numerous and more enthusiastic. We have advocated the combined consideration of the altered industrial position that confronts us by means of a Commission of the most capable representatives in different departments gathering under the motherly wing of the Government, and we firmly believe that something of this kind will have to come, and we hope that the Government will soon find time to attend to the matter. There are two other ways in which the

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principle of co-operation is applicable to the present situation. One of these was referred to in the extremely thoughful and timely address which Mr. Thomas Roles delivered as chairman of the Yorkshire Local Section of the I.E.E., of which we gave an abstract in our last issue. Mr. Roles was discussing some of the duties that devolve upon those of us who remain in civil life while our brothers are fighting in the trenches or are at work in camp, and one of his suggestions was that manufacturers and municipalities should work in co-operation during these critical times, as, if the former were to make a practice of notifying purchasers for which lines of goods orders were required to keep the works fully occupied, steps might be taken to assist them by placing orders for stock purposes. The speaker foresaw that there would be a boom in trade after the war, and the filling of orders of the above classes might enable the makers to deal more readily with the large demands that might be made upon them later. It would be extremely interesting to hear what response manufacturers have to make to this offer. Mr. Roles, though chief of an important municipal electrical undertaking, was probably not expressing the official views of the I.M.E.A., but we believe that he was speaking the mind of many another chief who is anxious to display a cordial spirit of co-operation with the manufacturers in these times of difficulty.

The I.M.E.A. has, as our pages have shown, been collecting information from its members concerning the extent to which they have in the past placed reliance upon foreign manufactures, and we are sure that they and the manufacturers' organisation can be trusted to take action along the lines advocated by Mr. Roles if such procedure is in the best interests of the industry. The proposition depends for its complete success upon a boom in the electrical trade as an assured certainty, as, if orders were executed in advance and the boom failed to mature, the depression in the curve would be aggravated.

Another of the local I.E.E. chairmen—Mr. P. P. Wheelwright has also drawn attention to the importance of keeping manufacturers' works employed and to the burden of responsibility that rests upon all purchasers who have orders to give out, to place them without delay. Mr. Wheelwright, like Mr. Roles, is also a borough electrical engineer, and he will know how far municipal men are inclined to indulge in capital expenditure at the present time, and how the Local Government Board and the Chancellor of the Exchequer will regard proposals for expending money in advance of actual needs.

Mr. Roles mentioned one other point which we may single out for comment. He said, as hundreds have said before him, that the first essential, if we were going to capture German trade, was to make a careful study of the requirements of purchasers abroad. Platitude? Yes, undoubtedly a platitude. But it is none the less necessary at this juncture on that account. It is one of those things that everybody gets into the way of saying. Would to Heaven that more of us would get down to the doing of it! The Colonies want us to meet their requirements from our own factories. Their hatred of everything German appears more and more pronounced every mail that comes in. After the war they won't take anything German if they can get its equivalent from England at a reasonable price. Our firms must have known something about the lines they have been losing to Germany in the competition of the last 10 years, and they cannot have been entirely ignorant of the reasons why these orders have passed them by. Their local branches will doubtless have kept them well informed on such matters, and will have more useful information filed away. How far local branches and local agents in the Colonial and foreign markets may be expected to report suitably upon the exact circumstances of their markets, it is not easy to say. Sometimes, no doubt, they will be able to afford a thoroughly capable and trustworthy report; but perhaps in other cases there may be an inclination to take too circumscribed and too superficial a view of things. But if firms' own representatives may seem from some standpoints not to be entirely the right kind of advisers required by the present situation, excellent as they may be for their own particular local operations, it is equally clear that the information vouchsafed by Consular officials and commercial attachés is still too general to entirely fill the bill for the electrical manufacturer. We do not desire in the least to depreciate the efforts either of the private firm's representative or of the Government Consul, but there seems to be a call for something more than these are able to tell us at the present time. We have read with profit many Government reports by general trade experts, but we have a very strong feeling that what would be of as great value to us as anything else just now would be reports from men of unquestionable electrical position and experience in each of the Colonies. We have asked for such reports before, but have not got them. Granted that if the British electrical manufacturer wants the business he ought himself to make the necessary efforts to secure it, but we take a long time to get to work either individually or co-operatively along those lines, and there is really no time to spare, and every electrical manufacturer cannot cover the world for himself. The American Consular authorities several years ago sent specialised experts to the different countries of Europe to report upon the possibilities of doing one particular kind of business. A certain representative knew the machine tool business from beginning to end, and he made it his business to worm his way into works and factories of all kinds in Italy, Turkey, and so on, and sent home most elaborate reports upon this one special line of manufactures. It seems to us that what is needed at the moment is for some organisation or other—even the Board of Trade—to dispatch experts who know the electrical and engineering business and are capable of making complete and reliable investigations.

The need is for the *specialised* trade representative in the interests of all in that trade, instead of a general representative who knows perhaps no trade at all to guide those in every trade. Now, is it reasonable to call upon the Board of Trade to dispatch such representatives at once? They have, we suppose, come practically to the end of the first phase of their campaign to assist us to capture German trade. Will the funds at their disposal admit of their doing immediately what we suggest? That matters require investigating in the interests of particular trades just now seems to us to be very clear.

The British electrical industry does not require merely a few old pieces of general reproof for having left this and that undone. These can all be turned up for reference and brought together in useful form for our instruction and edification; but no electrical or engineering specialist is required for making up that mixture. What we do want to know is such things as these:—

1. What electrical manufactures and materials have the Colonies bought from Germany?

2. Why have the purchasers favoured German electrical manufactures?

3. How far has price been a factor? Give us their prices against ours!

4. Has the German competition been due to a cheaper electrical article being supplied, or to dumping of good class manufactures?

5. Has the time of delivery been a matter in which British firms have been beaten?

6. What will be the electrical outlook and position in each Colony after the war?

We would have each of these items, and other besides, dealt with in the fullest possible manner by a man who appreciated exactly what it was that British electrical manufacturers needed to know in order that they might decide how to shape their course of action.

If the Board of Trade cannot undertake specialised investigations of this character, then perhaps our own electrical organisation can do it by a co-operative effort of the manufacturers, or if a sufficient number of them are represented in the Associations of a like class operating in the Colonies, perhaps, some mutual arrangement for the preparation of full and specialised material by the right men, or circles of men, can be made by cable. It is perfectly true that individual firms have divergent interests, but is it impracticable for them to make some grand united effort at this most exceptional time, in order that advantage may be taken of the prevailing opportunity? Certainly that blessed word Co-operation, with which we have opened this article, seems to call for reiteration at the end of it, for it can only be by co-operative effort on very broad lines that we can secure what awaits us.

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Lead. There has not been a great deal of feature in the lead market, but it is very satisfactory to be able to report that things in the metal trades generally are, by degrees, taking on a more normal appearance, and that this week trading has been resumed in the old way. Certainly, the market meets but once daily. This, however, is an important forward move, and it is only a matter of weeks at the utmost ere the usual two sessions a day are held. With things rapidly, therefore, getting back to the old way, confidence in the progressive nature of trade increases.

The home demand for lead has, on several occasions, been quite active, and, on the whole, a good deal of business has been done by the rollers and corroders, while there have been very large quantities taken for Russia. It is the Russian demand, indeed, which has been the great feature of the market for some weeks. Russia, like all the belligerent countries, has felt the need of preparing for a protracted and bitter campaign, and this has involved the laying in of enormous stocks of metals of all kinds. Of these lead and nickel have been the chief. The buying which has been going on, indeed, for shipment to our great ally has proved one of the chief supports of the market, and it seems to be pretty generally expected that the closing of navigation as regards Archangel, to which port all the supplies so far taken have been shipped, will bring about a weaker tone in the market. This, however, remains to be seen, for the production of lead in all parts has been cut down very sharply, and this must have an effect upon the general situation sooner or later. Not only has the Russian buying been a feature of the British market, but it has also been in evidence in the United States, and large quantities of metals have been dispatched from New York to Archangel while business is now being negotiated by way of Vladivostock. The cost of transport will, of course, be enormous, but this is a mere bagatelle when it comes to the smashing of the lunatic who has ruined some of the fairest areas of Europe, and has outraged every canon of decent living, besides wiping out of existence peaceful communities, under the conditions of the most revolting barbarism. Hence it is that high costs of carriage are not likely to check the influx into Russia of all the war material necessary.

The supplies coming in have been rather irregular, some weeks seeing hardly anything arriving, while, on the other hand, now and again a fair lot has come to hand. All the metal available has, however, been taken up without the least trouble, and what is more, lead has had to be withdrawn from the warehouses to meet the insistent demand for metal for shipment. As long as this sort of thing goes on there is no room for much drop in the price. America is a less pressing seller, and there are faint indications that by very slow degrees the trans-Atlantic industrial position is clearing up. Here there is no doubt things are steadying themselves, and the future is pretty hopeful now. As for Mexico, there is not the least improvement there; indeed, a further spell of anarchy, or something approaching it, seems to be in sight.

Ferro-Concrete Poles. The article which we conclude in this issue, describing the Bangkok power station and system of the Government of Siam, by Mr. F. B. Shaw, contains many interesting and novel features; but none of these, we believe, will be so useful to the electrical engineer as the particulars given by the author regarding his method of manufacturing lattice poles of reinforced concrete. Solid and hollow poles are not uncommon, but we have never before been enabled to publish a description of lattice poles in this material. From the illustrations which accompany the article it will be seen that the appearance of the poles is greatly improved, and at the same time a reduction in weight is effected, together with a better distribution of the material, without loss of strength or increase of cost. This is in strict accordance with sound engineering practice, and carries with it the result so often observed—that the best engineering design goes hand in hand with the most æsthetic form. We commend this section of the article especially to the notice of engineers who are in a position to make use of overhead lines, as well as to the makers of poles, who by turning out ferro-concrete poles in large numbers should be able to produce them at low cost.

Railway Electrification. The paper which Dr. H. F. Parshall read before the Institution of Civil Engineers on Tuesday last, on "The Economics of Electric Railway Distribution," is a notable contribution to the literature of the subject. It does not profess to discuss the merits of rival systems, nor does it deal with the operating costs of electric railways, except in so far as the distribution system is concerned, the equipment of the rolling stock being left out of consideration altogether; but it is a striking example of what Prof. Perry would call "the engineer's method of solving a mathematical problem." Reminding us in the official abstract (which we reproduce in this issue), but not in the paper itself, that Lord Kelvin formulated a law as to the economic design of conductors in transmission systems, the author points out that a similar treatment of the railway problem would involve so many independent variables that the mathematical expression from which the minimum cost of the distribution system might be deduced would be open to some suspicion; he has therefore adopted the plan of working out the cost for different distances between sub-stations and different voltages under various conditions, and embodying the results in curves, which show clearly the minimum values in each case. Other factors are, of course, considered, and the result is a paper comprising about 12 pages of text, 38 pages of tabular matter, and no fewer than 49 curve-diagrams—truly a unique production, representing a vast amount of labour. The information given as to the working of the Central London Railway has never, we believe, been previously published, and will be of great utility.

Dr. Parshall regards the paper as a labour-saving device, which can be utilised by the substitution of new data corresponding to any particular set of conditions, and claims for it great elasticity in this respect. Certainly the tables afford a very substantial basis upon which to found deductions, within the limits of their range, which is strictly confined to stated factors. Unfortunately, they take no account of the voltage drop in the line conductors, which, as the author admits, is often a controlling factor, irrespective of economic considerations. The tables, too, are based upon an average train service, whereas the normal conditions of traffic, at any rate on suburban railways, call for a greatly increased service at the rush hours; and the scheduled speed adopted (16 miles an hour) appears to be unnecessarily low.

We note that the author deals only with an overhead conductor throughout, for both D.C. and A.C. systems; and while he fully recognises the advantages of high voltages, he finds that little is to be gained in the case of D.C., by adopting a higher pressure than 2,400 volts.

The working results of the Central London Railway sub-stations show a diversity factor of the order of 1·4, and an average working efficiency of 90 per cent. The output from the generating station has remained fairly steady in the neighbourhood of 8½ to 9½ million units per half-year for 10 years, at a cost of about ½d. per unit; the sub-station operating and repair charges per unit are steady at 0·04d., and the total sub-station charges are round about 0·18d. per unit, the total cost per unit delivered from the sub-stations for the last five years averaging about 0·72d. Dr. Parshall expressly avoids committing himself to any estimate of the costs that should nowadays be attained, but it is obvious that this figure is high compared with what may be expected with up-to-date plant. It should be borne in mind that the Central London plant was installed 14 years ago, and that the railway was only the third electric line in London; and the fact that there has never been a cable breakdown on the system speaks well for the care and skill with which the work was done.

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CAN WE CAPTURE THE GERMAN TRADE?

By FRANK BROADBENT.

Although we did not take a hand in the European war for the purpose of capturing the German trade, it is hoped that this will be one of its results. And by German trade is meant not only the trade which Germany does in other countries, but in our own also. At the present time, even if it were not forbidden to trade with Germany, very few English people would voluntarily buy a German-made article, but it is freely and cheerily admitted that within a short time after the termination of the war we shall, as before, buy the cheapest, whether it be a German, Austrian or English product. We are an easy-going people, like most old folk, and we even laugh at our own weaknesses. We cannot expect a child to pay twopence for a toy just because it is English made, if he can get one, which looks the same, for a penny. Nor can we expect the father or mother of six to be any more patriotic when trying to make the most of every shilling. What is true in domestic lines may be equally true in the engineering market, and we should be foolish to rely overmuch upon the patriotism of the British buyer. A man may pay, say, 5 to 10 per cent. more for a British than for a German motor, but it is very doubtful if his patriotism would stand the strain of a 25 per cent. difference.

We have much to learn yet from German methods of manufacture. There is no doubt that they have applied scientific methods, not only to design, but also to works management; and those who have had opportunities of going through some of the leading electrical workshops in Germany must have been impressed with the splendid organisation, the machine-like order, and, not least, the respect for authority among all grades of employés. This latter may, or may not, be a result of military training, but whatever it is, it is a feature which is in marked contrast with the conditions prevailing in most British works.

We have been accustomed to regard this military discipline as destructive of initiative, but whilst this opinion may have some justification when applied to the rank and file of the army, who constitute the working classes, it cannot be justly applied to the official class, as their methods, both of warfare, and of manufacture and technical research, have shown. Whether we like it or not, we are indebted to Germany for many important inventions and new departures in electrical engineering, to say nothing of the gas, chemical, printing and other industries.

When three-phase work was first introduced we had to go to Germany for our motors, and for many years English firms would not make them.

"Let us wait," they said, "until there is a greater demand." Later on, when single-phase seemed likely to revive, it was left to Germany again to develop the repulsion motor, and to this day there is not among our large electrical manufacturers one that makes them. The great advance in arc lighting due to the introduction of the flame arc was largely due to German initiative, and still more recently we have been dependent upon the same source for the development of the metal-filament lamp.

In view of these facts, and many more might be cited, it is hardly fair of the British manufacturer to blame the purchaser if, having been compelled for a time to buy from an enterprising foreigner, he does not immediately transfer his trade to a tardy rival who, when the demand has been created, considers it worth his while to attempt to meet it, generally at a higher price.

Even now, when the German sources are dammed, it is a matter of great difficulty to induce a British manufacturer to make anything which involves stepping out of the rut which he has made for himself.

"We have no patterns for this;" "this is not quite in our line;" "we are now so full of orders that we could make no promise of delivery;" "this would involve our making new tools, for which we should have to charge you"; these are samples of the kind of reply sent to inquirers for goods which have hitherto been made in Germany in very large quantities.

If we are really in earnest about capturing the German trade, we shall have to study German methods, and find out why they are generally before us in invention and in initiating new and important advances in design; why they can copy our designs and manufacture them more cheaply; why their salesmen are better, and so on.

We generally attribute this to the more perfect scientific and technical training which their engineers receive; and if this be so, are our educational methods wrong, or is it that manufacturers do not appreciate the value of technical training?

It will be seen from the summary of the report of the Civil Engineers' Committee on Engineering Training that some manufacturers regard engineering graduates purely from the dividend-earning point of view, and others consider them absolutely useless. In a paper read before the A.I.E.E., Mr. A. J. Rowlands states that a chief engineer of a large corporation (himself a college man) recently said:—"I would rather have a man from the tool-room in the designing work than any college man. All they know is how to design a beam to support a fixed load a given number of feet from a wall, or other purely text-book problems. How the beam is to be held in the wall, or the load suspended from it, is beyond them." We do not know if the speaker was referring to American or Canadian colleges, but his attitude appears to represent fairly accurately the attitude of many of our manufacturers towards scientific education.

If this be a justifiable attitude, and if we admit that Germany's progress is largely due to her methods of scientific training, then there must be something wrong in our methods and not in scientific training *per se*.

Is it not time, therefore, that electrical manufacturers seriously considered this question from the point of view of its influence on manufacturing rather than wait for the Institution of Electrical Engineers to consider it from the point of view of qualification for membership?

RUSSIA AS A FIELD FOR BRITISH ELECTRICAL TRADE.

By G. W. de TUNZELMANN.

Recent articles in the Electrical Review have urged upon British electrical manufacturers the importance of immediate steps being taken to devise efficient schemes of co-operation, with a view to utilising to its utmost extent the unexampled opportunity now open to them of replacing Germany and Austria in the growing Russian market for electrical machinery and supplies of every description. M. Basile de Timiriazeff's letter to Prof. Pares at Petrograd was dealt with in a leaderette in the Review of November 6th. It is an express invitation to our manufacturers and merchants for immediate and effective aid in filling the immense gap in Russian industrial supply, which has been created by the war. And the invitation is official and authoritative; for its author, formerly Russian Minister of Commerce, is now the President of the Russo-British Chamber of Commerce in Petrograd, and in his letter he states that he sent a copy to Mr. Henry Cooke, who is the Commercial Attaché to the British Embassy in Petrograd, for communication, through the Board of Trade, to the British Chamber of Commerce.

M. Timiriazeff writes, with the authority of his official position and of his intimate knowledge of Russian industry, that "it is difficult for those not closely acquainted with Russian trade and industry to realise how enormous is the gap created by the almost wholesale withdrawal of German trade from Russia." And there is no section of Russian industry to which this weighty pronouncement is more completely applicable than the electrical industry.

Russia has hitherto been practically an unknown quantity—perhaps almost an unsuspected quantity—to our electrical manufacturers and merchants. Not so, however, to our

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German competitors. The Russian electrical market is even now very extensive, and is steadily increasing, with every prospect of phenomenal development in the immediate future. Hitherto it has been almost entirely in the hands of the three German firms—Siemens & Halske, Schückert & Co., and the Allgemeine Elektricitäts Gesellschaft. The headquarters of the latter are in Warsaw, and those of the two former in Petrograd. Officially and ostensibly the Russian electrical industry has been, with few and quite insignificant exceptions, in the hands of these three great firms, and it might be supposed that competition between them would sometimes, at any rate, open the way for the entry of other firms, native or foreign, into the field. But any efforts made in this direction have proved unsuccessful, and I am positively assured by Russian merchants fully conversant with the local conditions, that, as far as outside competition is concerned, these three firms practically constitute an extremely efficient combine, working under far-reaching, and apparently in many cases very subtle, agreements.

The control of the Russian market by these firms has no doubt been largely obtained by the efficient organisation, minute attention to detail, and ready adaptability to the requirements of their customers, which are characteristic of German industry. But the consistent and unceasing support of the German Embassy in Petrograd, both in obtaining information and in the exertion of every available diplomatic influence, has certainly been an important factor.

Diplomatic support from our own Embassies has hitherto been very generally regarded by both merchants and manufacturers as quite unattainable, and no doubt much more might be done, and very probably will be done in the future, to give diplomatic aid to British traders. But far more than is generally considered possible may be effected if the matter be gone about in the right way. Those who have found the way and benefit therefrom are very naturally indisposed to be communicative to possible competitors. Moreover, in the way of obtaining local information, and making it generally available, much has been done by our Consular service during the last few years, and a very good example is afforded by a report from H.M. Consul-General at Moscow, which was dealt with in the Review of October 30th. In this report we find :—(1) Thoroughly sound advice with regard to propaganda in Russia ; (2) an indication of the way in which the co-operation of German firms has given them command of sufficient capital to meet purchasers in regard to terms of payment ; (3) valuable information of the methods by which German firms have met the conditions arising from the payment of Russian import duties on machinery by weight. This last item I may supplement by an example of special interest to intending importers of electrical supplies. The import duty on mounted incandescent lamps with carbon filaments is 30 roubles per pood of 36 lb., and, without mounting, 60 roubles per pood for carbon-filament lamps, and 65 roubles for lamps with metallic filaments. The German firms meet these conditions either by importing the lamps unmounted and mounting them in their Russian factories, or by importing lamps specially constructed with very light mounts. The work of their Russian factories is, as a matter of fact, mainly the assembling of imported parts, and the construction only of such items as cannot as profitably, or more profitably, be imported.

At the present time, there is a great demand for 120-volt metallic-filament lamps and for low-voltage lamps, such as are used in pocket lanterns, and also for other electrical supplies more easily obtainable just now, such as flexible for incandescent wiring. Such business has recently been very greatly hampered by the recently prevailing abnormal rate of exchange of 120 roubles per £10, in place of the normal value of about 95, which has been equivalent to an additional heavy import duty, as far as the purchaser is concerned. I learn, however, from an authoritative Russian official source, that this difficulty is now removed.

There is a wide field now open for the supply of electric light and power, both for large plants and for innumerable small isolated ones. For these small plants and for some of the larger ones, cheapness is a primary consideration, and the German firms have successfully devoted their attention to the attainment of this object by plainness of construction without sacrifice of durability and efficiency. In many districts oil engines will have to be employed as prime movers.

A concession for an electric supply to Petrograd, from the Roshiala rapids in Finland, estimated to be capable of delivering from 300,000 to 400,000 H.P. was granted in the autumn of 1912, and the future development of water power electric supply in other districts is contemplated by the Russian Government. Extensive Government contracts for electric railway plant may be expected after the termination of the war.

British traders should not fail to note M. Timiriazeff's insistance on the urgency of the situation created by the immediate annulment of the Commercial Treaties of Russia with Germany and Austro-Hungary. The field has been cleared and is waiting to be tilled—now, and not merely when the war is over. And our traders should be encouraged to make immediate response to the invitation by his further assurance that Russia is seeking to provide "a permanent basis for normal times," when, "at the end of the war it will be necessary to revise and establish on a new basis the whole international commercial policy of Russia."

German traders secured the trade largely through the influence brought to bear by the German Government, but also because they took infinite trouble, first, in ascertaining the requirements of the Russian people ; and, secondly, in meeting those requirements at reasonably low prices. Yet their uncouth manners, and a psychology utterly antagonistic to that of the Russian, have made them personally disliked, so that for years past Russians would have preferred to do business with Englishmen, whom they like. This dislike for the German has now developed into a deep loathing and bitter contempt which the ordinary stay-at-home Briton would entirely fail to understand, were it not that he is now beginning to some extent to share it. And Russian and Briton are now cementing with their blood their brotherhood in arms for the maintenance of Christian civilisation against a decadent pagan barbarism.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"Nite Lite" Transformer Lamp.

The General Electric Co. (U.S.A.) has introduced a miniature transformer contained in a polished brass shell coupled to a miniature Mazda lamp to meet the convenience of those who desire a low burning lamp for all-night service. It is designed to operate on any A.C. circuit of from 100 to 125 volts, and 50 to 140 cycles, and is made to screw into the standard Edison lamp socket. The normal supply voltage is reduced to 6 or 7 volts, and the lamp receptacle fits a Mazda automobile lamp of 2 C.P. At the average cost of electricity a "Nite Lite" transformer will burn for 10 hours at a total cost of less than $\frac{1}{10}$ths of a cent (according to the *Journal of Electricity, Power and Gas*).

Continuity Grip Fittings.

Messrs. Credenda Conduits Co., Ltd., are introducing to users of conduit their "Spring" grip continuity fitting, which has received the approval of the electrical authorities and first-class insurance companies. The system is a substitute for screw contact

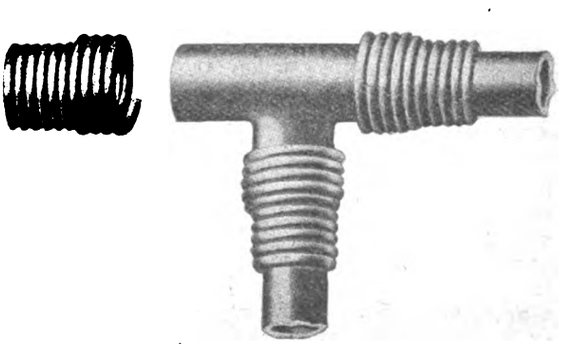

Fig. 1.—"Spring" Grip Continuity Fitting.

systems, and is claimed to overcome the difficulty of leaving continuity to the labourer or his assistant. Fig. 1 shows the arrangement ; the conduit is forced home or withdrawn by a

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turning movement, which tends temporarily to open the coil, and if tight fitting, a little oil or grease will make the operation easy.

We gather that the system can be erected in a little under half the time taken to erect one of the best screw device systems on the market.

The spring grip cleans the conduit of enamel, as shown in fig. 2, and thus it makes good contact as it enters the fitting or grip, and the latter allows for variation in size of conduit.

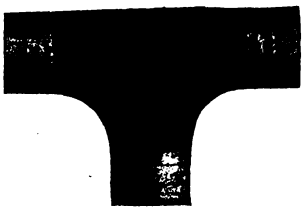

FIG. 2.—CONDUIT FITTING SCRAPED BY GRIP.

There is a point contact at either end of the grip, which cuts well into the metal of the fitting, and the cutting edges and general stability of the grip are secured by using the finest quality carbon steel, properly hardened and tempered; no tools are required to fit up this system, which is fully explained in List D.

Boiler-Plate Cubicle Switchboards.

A recent example of a large amount of switchgear compressed into a small space is a boiler-plate cubicle for A.C. work supplied by the GENERAL ELECTRIC CO., LTD., of Witton, Birmingham, to an important firm in the Midlands, for whose works the G.E.C. are undertaking the complete electrification. The firm takes extremely great pride in its works and insists upon the highest quality gear being installed throughout. This and a sister board had to be placed in a very cramped position, the dimensions being so small that two panels had to be mounted directly over each other. The board being composed of boiler-plate cubicles, it was necessary to provide inspection doors, which not only gave a good view of the interior, but enabled work to be carried out inside the board should it become necessary. Although many of the doors had of necessity to be utilised to accommodate the instruments, it is not anticipated that the opening and closing of the doors, which will not be of great frequency, will result in any damage to the instruments. In the interior of the board, too, the whole of the gear had to be compressed to the utmost. The whole of the board was of G.E.C. construction.

C. and I. Electric Hoist.

MESSRS. CAMPBELL & ISHERWOOD, LTD., of Raleigh Street Works, Bootle, have recently introduced a new type of electric winch for marine and general use, for which patents have been applied for.

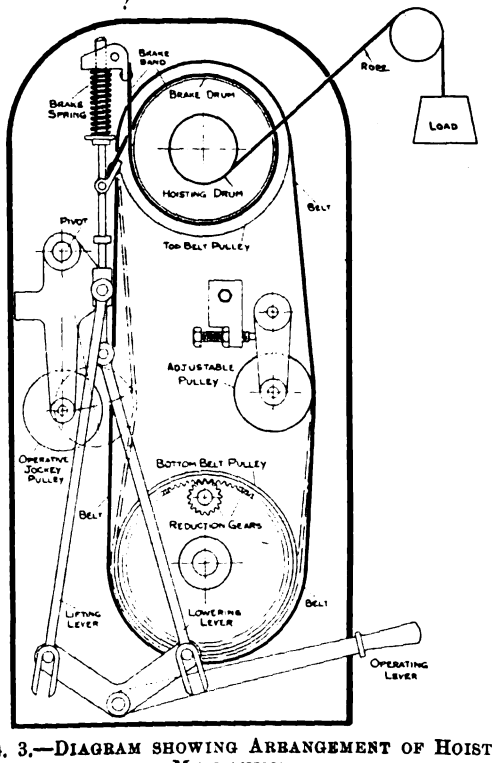

FIG. 3.—DIAGRAM SHOWING ARRANGEMENT OF HOIST MECHANISM.

The hoist is a self-contained unit, as shown in fig. 4, all the working parts being enclosed in a cast-iron case, only the winding drum and operating lever being outside. The case can be arranged for bolting to either the wall or floor. Fig. 3 shows the arrangement of the hoist diagrammatically. The hoist works on the principle of a slack belt, which normally remains stationary on the pulley to be driven, and is set in motion to lift the load by means of a pivoted jockey pulley, which brings it into driving contact with a continuously driven pulley. The bottom belt pulley is continuously driven by a motor through a pinion and internal gear. The hoisting drum is keyed to the top shaft, which also carries the belt pulley and hand-brake drum; the belt hangs slack when not hoisting and the spring of the handbrake keeps the latter applied with the operating lever in the neutral position. Depressing the lever releases the brake and tightens the belt; raising the lever beyond the neutral position allows the load to fall at a speed governed by a centrifugal brake (not shown in the diagram). Either A.C. or D.C. motors, with ball bearings are fitted, similar bearings being used throughout. The gears are machine cut and the hoists have been proportioned for rough handling. Three sizes are built, for lifting 1½, 3 and 5 cwt., all at a speed of about 180 ft. per min.

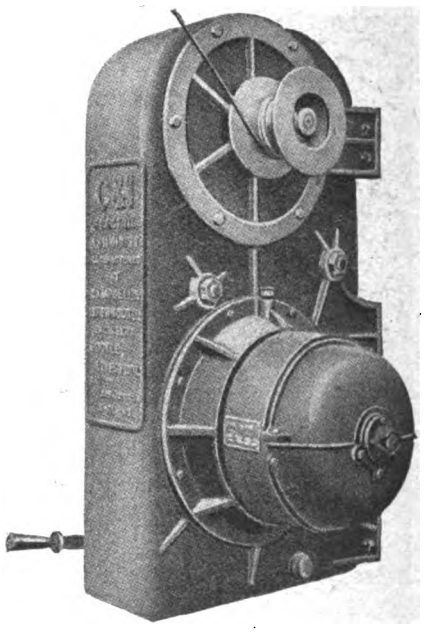

FIG. 4.—C. & I. ELECTRIC HOIST.

Two winding drums can be supplied; 50 ft. of wire rope with hook and weight, and swivelling guide pulley are provided with each hoist.

G.E.C. Main Regulators.

For the regulation of the exciting current of large generators, two forms of regulators are in vogue, the first frequently known as the rectangular type, and the second the face-plate or circular type. The illustration shows the latest form of rectangular type regulator constructed by the GENERAL ELECTRIC CO, of Witton, Birmingham. In this regulator the resistance is composed of resistance strip, though when the characteristics of the generator

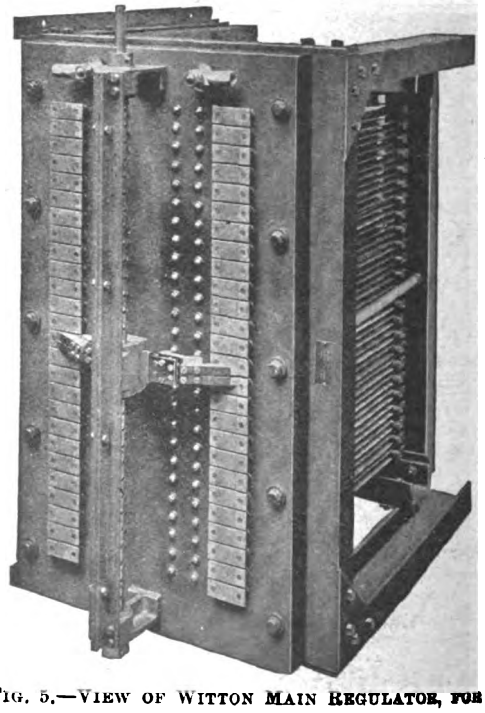

FIG. 5.—VIEW OF WITTON MAIN REGULATOR, FOR 5,000-KW. TURBO-ALTERNATOR.

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permit "unit" type wire resistances are employed. The expansion and contraction of the strip brings into play large forces which frequently buckle the framework of the regulator. To take these stresses, the framework is built up of mild channel steel, braced and supported at every point where the stresses are likely to be particularly heavy. A further source of trouble has been the sag of the strip, and means have to be provided for adjusting the strip tension; in this case individual adjustment is provided to each turn of the strip, instead of only one adjustment for the whole length. In this way the tension on any turn of the strip can be rapidly adjusted in a few seconds.

These regulators have of course to carry heavy currents and the design of the contact brushes is a matter of importance. Steps have been taken in the present design to give the brush self-aligning characteristics, and by means of two sets of screws the pressure on the contact and the position of the contact brushes can be adjusted independently. Fig. 5 shows a regulator for a 5,000-KW. Witton turbo-alternator.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Trading with the Enemy.

Referring to your correspondent's letter inserted in last week's REVIEW, dated November 13th (under "War Items"), as to payments due by English traders to German or Austrian merchants or manufacturers, my own view is that these accounts should be paid where the indebtedness is not disputed, and my suggestion is that payment should be into Court or to Receiver to be appointed, and paid out when the war is over, otherwise the firms of the enemy have no security against failures of their debtor in the meantime.

I consider that no honest trader should absolutely refuse to pay the enemy their just dues.

G. Weston.

London, *November 14th*, 1914.

About Electric Radiators.

We are somewhat surprised and amused to see from Mr. Sharp's letter referring to Messrs. Belling's electric fire advertisement that he is of the opinion that Messrs. Belling were aiming at the Jackson radiator, because we had the impression that our fire was referred to, and we are now wondering how many other people have tried "the fit of the cap." We must confess that after trying it we find it a misfit.

It is true our fire is concentrated, but we maintain it is not "too highly concentrated," and by concentration we are able to insure longer life.

Similarly, we claim that our fire is not "two much boxed up," although we intentionally enclose it to shield the heating elements from air currents and thus prevent oxidation.

As for being "too fiercely radiant," we should not have thought it possible to err in this direction, and we intend to do our utmost to make our fires more and more fiercely radiant without reducing their reliability.

We cannot understand why a "too much boxed up fire" should also be held guilty of burning dust. Surely the greatest dust burner is the greatest producer of "rising hot air circulation," for the dust is suspended in the air, therefore—more air, more dust. We would add that the bigger the proportion of radiant heat the smaller the heat loss in the room when the door is opened.

Mr. Sharp has already commented on the "radiant heat in every direction." We think perhaps there may be some mistake in Messrs. Belling's advertisement, because we note that the arrows indicating the direction all point the same way.

Ferranti, Ltd.

London, W.C., *November 17th*, 1914.

Your correspondents, the Jackson Electric Stove Co., state that Messrs. Belling refer to radiant heat as tending to dry up the moisture in the air.

May I suggest that radiant heat of high temperature only is responsible for any distress experienced in this connection—combined with an absence of air in motion.

Whilst elements of relatively low temperature are desirable, the public prefer high temperature elements, presumably because they look more "cheery." An evaporating dish will, however, be found quite effective in counteracting this effect.

The term radiant heat has, I notice in recent correspondence, been confused with luminous heat. May I remind those not fully conversant with physics that whether the elements are run at black heat or bright red heat, in both cases they transmit heat rays which are virtually all radiant—wholly so with black heat, and in the case of bright red heat operating at 1,000° F.—1,200° F. almost wholly, the latter representing 98·5 obscure or dark rays, plus 1·5 luminous rays. This may be proved by blocking all luminous rays by the interposition of a suitable filtering medium (such as bisulphide of carbon), when it will be found possible to toast equally well, using dark rays only.

Such rays exhibit broadly similar characteristics to light rays, in so far that they proceed in straight lines and can be converged and even focused if desired. It is questionable whether such luminous heat rays possess any virtue other than that of attaining more rapidly a high temperature—at least our leading text-books do not favour such a supposition.

F. Barron,

Electric heating engineer (late Carron Co.).

London, S.W., *November 16th*, 1914.

LEGAL.

GOODBODY *v.* POPLAR CORPORATION.

MR. JUSTICE DARLING and Mr. Justice Sankey, sitting as a Divisional Court of King's Bench, on November 12th, heard an appeal from a decision given by Judge Bray in the Bow County Court in an action against the Poplar Corporation by a Mr. Goodbody, who claimed damages for personal injury occasioned by an explosion of gas in an electric chamber beneath the footway.

MR. VACHELL, K.C., stating the case for the appellant, said that the action in the County Court was tried by a jury who assessed the damages in favour of the plaintiff at £25, but they answered a number of questions put to them by the judge in favour of the Corporation, for whom the judge entered judgment. He (Mr. Vachell) contended that, notwithstanding the answers of the jury, judgment ought to have been entered for the plaintiff for the amount of damages assessed by the jury. In September of last year the plaintiff was walking along the footpath of Bow Common Lane when there was an explosion in an electrical chamber under the pavement. It seemed that gas had escaped and accumulated in the chamber, where it was ignited by an electric spark, with the result that the cover of the chamber was blown up, causing the injury to the plaintiff in respect of which he sued. In reply to questions left to them by the judge, the jury found that the chamber did not constitute a nuisance, and that the Corporation had not been guilty of negligence. After hearing legal argument, Judge Bray held that he was bound by the findings of the jury, and gave judgment for the defendant Corporation. It was against his so entering judgment that the plaintiff now appealed. Counsel submitted that negligence did not matter, and that the Court was not concerned with the question of whether the chamber was a nuisance or not. He contended that according to recently-decided cases the Corporation had established "a dangerous thing" on the highway; they had control of it, and if in consequence of anything that happened, even if it was the act of a third party, the "dangerous thing" caused injury to anyone, liability would follow as a matter of course.

Without calling upon Mr. Thorn Drury, who appeared for the respondents, their LORDSHIPS dismissed the appeal, with costs.

MR. JUSTICE DARLING said it was not contended for a moment that the mere destruction of an electric fuse and the escape of a spark alone caused the injury to the plaintiff. No injury would have resulted had there been no gas in the chamber which the defendants had not put there and which they could not have kept out. The gas had escaped from a main over which the Corporation had no control.

MR. JUSTICE SANKEY, concurring, said the plaintiff might have joined the Gas Co. as defendants.

RONEO, LTD., *v.* W. H. MULLER & CO. (LONDON), LTD.

IN the City of London Court, on Monday, before Judge Rentoul, K.C., plaintiffs made a claim against defendants, of Bury Street, E.C., to recover £40 10s. for an electric Roneophone, an electric reproducing machine and 36 disks, at 25s. per dozen, supplied to their order. Mr. Douglas Hogg appeared for the plaintiffs, and Mr. Jowitt for the defendants.

Plaintiffs' case was that they sent a representative to the defendants and submitted their electric Roneophone. It was an electric machine which acted on the principle of the gramophone, as it took down letters to dictation, and then the disk could be sent out to a typist, who typed out the letter, saving the necessity of using shorthand. A great saving of time was effected, and the work was done more efficiently. Defendants first had a machine on trial, and when that had been approved two others and some disks were ordered. One advantage of the latter was that they could be used many times over, as the record could be shaved off when the letter had been typed. Defendants subsequently said that the machines were not satisfactory. They required a little experience to speak into them and to get the best result. There was another machine, the Parlograph, of German manufacture, and a little cheaper, and defendants seemed to prefer that, which accounted for their rejecting the plaintiffs' Roneophone. Plaintiffs called evidence to show that the machines were satisfactory, and a demonstration was given in Court, the Judge testing it personally.

Defendants' witness said that the electrical plug fired on one occasion and they could not get the machine to go properly.

Plaintiffs said it was practically impossible for the plug to fuse because the wires were all insulated.

JUDGE RENTOUL after the test said the machine would be of no use to him, because when he put the ear-pieces in his ear he could not hear all the dictation. He heard a great many of the words

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distinctly, but he could not have taken them down. He had tried talking machines and heard perfectly.

Defendants' typist said he had a shock when using the machine.

Judge Rentoul said he would like to hear the Parlograph used in Court, but it was stated that the voltage necessary was 220.

Mr. Hogg said that 900 of their machines were in use in London with approval.

Mr. Jowitt said he did not allege that all plaintiffs' machines were wrong, but only the two in dispute.

Judge Rentoul suggested that the case should be adjourned for further trials, and that was done.

The National Electric Construction Co., Ltd.

Mr. Justice Neville, on March 13th, heard a petition by this company for the sanction of the Court to special resolutions passed for the reduction of its capital.

Mr. H. E. Wright, in support of the petition, stated the proposal was to reduce the capital by £125,000, which had been lost, or was unrepresented by available assets. The company, as its name implied, was formed for the purpose of carrying out electrical construction work. Originally they were largely interested in a system known as free wiring, a principle which was now of less importance than it was once. The original capital of the company was £250,000 divided into 250,000 shares of £1 each, and of these 170,000 had been issued. A large number of the shares were issued as fully paid up, but all were issued under properly registered contracts, about which there was no question. The resolutions that had been passed proposed that the capital of the company should be reduced from £250,000 to £125 000 divided into the same number of shares of 10s. each. It was proposed to write off 10s. per share from each of the 170,000 issued, and reduce the 18,000 unissued shares to shares of 10s.

His Lordship asked whether the loss had been strictly proved.

Mr. Wright said there was exhaustive evidence of loss.

There was no opposition to the petition, and his Lordship sanctioned the reduction as proposed, directing the words "and reduced" to be used as part of the company's title for one month.

Action Against Tramway Contractors.

In the First Division of the Court of Session, judgment has been given in a reclaiming note in the action by a Glasgow manufacturer against the British Thomson-Houston Co., Ltd., Glasgow, and the District Committee of the County Council of Lanark. The pursuer, who sued for £500 damages, stated that while returning from Glasgow with a motor-cycle he passed through Bellshill, and at a bend in the Old Edinburgh Road, and near the electrical power station there, he ran into a heap of road metal and tar macadam which was encroaching on the surface of the roadway for a distance of about 6 ft., and about 3 ft. in height, with the result that he sustained serious injuries. The pursuer alleged that the heap of metal was unlit, unfenced, and unwatched, and he had no warning that such an obstruction was there. The British Thomson-Houston Co., Ltd., stated that in laying a tramway in the neighbourhood they were instructed by the District Committee, with whom they were contractors, to place the road metal and tar macadam on the grass margin of the road in question, but all deposits were made under the supervision of the servants of the District Committee. The Committee founded on their contract with the other defenders, and stated that the other defenders did not, in terms of their contract, deposit the heap of road metal on the grass margin, but deposited it on the roadway, and accordingly they were not responsible for the fault of their contractors. Lord Dewar, in the Outer House, approved of an issue for the trial of the action by jury. The First Division have now adhered to the judgment of the Lord Ordinary, with expenses to the respondent.

Cunningham, Ltd.

A petition by W. T. Henley's Telegraph Works Co., Ltd., for the compulsory winding up of Cunningham, Ltd., was before Mr. Justice Neville, in the Companies' Court, on Tuesday, November 17th. It was stated that it would be necessary to amend the petition, and for that purpose it was suggested that the hearing should stand over until next sittings. Mr. Wilkinson, for the company, did not object, and the matter was adjourned until the first petition day after Christmas, the company giving the usual undertaking not to go into voluntary liquidation in the meantime.

Read v. The Stella Conduit Co.

In the Chancery Division on Tuesday, Mr. Justice Joyce delivered a considered judgment in this case, it being an action brought by Mr. Albert Edward Read and Mrs. Ellen Brooks for an injunction to restrain the Stella Conduit Co., of Highfield Works, Bilston, Staffs., from infringing the plaintiffs' Letters Patent No. 18 375 of 1905 and No. 21,604 of 1906, for iron tubular elbows or couplings for connecting the ends of tubings and improvements in fittings for electrical conduits. Plaintiff also claimed damages. The main defence was that there was no subject-matter in the plaintiffs' Letters Patent.

Mr. Justice Joyce, in the course of his judgment, said that instead of covering wires for electric lighting with wooden casing a better, and, as he understood, a newer method was to enclose and carry the wires through metal tubes or conduits. This casing was formed of various lengths of tubing connected together by screwing one end into or over the end of the other length of tubing. Specimens of parts of these tubular electric conduits had been shown to him. Some of the lengths were shorter than others, and some were bent for the purpose of turning corners, and others in the form of a tee. Some were made with the screw thread outside at both ends, and some shown to him had the screw thread inside at both ends. What he had described appeared to be the usual mode of connecting tubes together and the usual way of forming a conduit of electric wires. His Lordship then described the way in which the frames of bicycles are joined or connected together, and said that that device was well known at the date of the plaintiffs' letters patent, viz., the ordinary bicycle grip and socket. In his opinion, there was no subject matter in the plaintiffs' alleged invention, and, therefore, their letters patent were invalid for want of subject matter. The action would be dismissed, with costs.

A stay of execution was granted for three weeks with a view to the plaintiffs considering whether they would take the case to the Court of Appeal.

WAR ITEMS.

Oldham Corporation and its Contracts.—What appears to be the end of the somewhat protracted discussions which have taken place at Oldham regarding a contract which the Corporation have with the Tudor Accumulator Co. was reached last week, when the matter was again before the T.C. The Electrical Committee, as reported in our columns, had decided that the firm should be requested to proceed with the work on giving an undertaking that no part of the money should be remitted to Germany during the continuance of war.—Councillor F. Brierly said that something like £47,000 of the £50,000 capital in the Tudor Co. was held by Germans, and he objected to the Corporation paying accounts to the firm and providing bullets to shoot British soldiers. He objected to the contract, and said the stipulation laid down by the Committee that no money should be remitted to Germany during the war was "bosh."—Councillor Dixon moved as an amendment to the acceptance of the minutes that the minutes pass with the exception of the contract referred to.—Councillor Sugden, who seconded the amendment, said that if certain material had been made under the contract they should pay for that but for no more.—Alderman Isherwood, supporting, urged for a definite and consistent policy on the part of all Corporation committees. The Tramways Committee, he said, had cancelled all the work that the company referred to was doing, and there should be consistency.—Councillor Turner said they were talking too much to the gallery. Whilst agreeing that they ought not to enter into fresh contracts he thought they should carry out the contracts on which they had already entered.—Councillor Frith said the decision of the Electrical Committee was almost unanimous. The Corporation had entered into a contract, and he urged that they should stick by it. Newspapers had only raised the outcry against German firms for political capital, and were playing to the gallery just as some individuals were now doing. He was bitter against the Germans, but the contract had been given, and they could not find a company which did such work that had no connection with Germany. It was "tommy-rot" to say that the money would be going to provide bullets with which to shoot British soldiers. The whole of the labour and material used would be English. If the contract was cancelled, Dukinfield workmen would be out of employment so far as that particular contract was concerned.—Councillor Schofield threw out the suggestion that the Committee should arrange to withhold 10 or 15 per cent. of the contract price until after the war.—Councillor C. Hardman (Chairman of the Electrical Committee) said the whole question had been very carefully considered. At the end of August the Committee passed a resolution relating to the contract without the slightest thought that the company had any association with Germany. Then they made inquiry and found that a large proportion of the capital was held by Germans. The contract was given at the end of August. They were not trading with an enemy country. He thought every member of the Council would be willing to follow Lord Kitchener. Well, Lord Kitchener had given a contract to the firm in August, and another in October. Would he provide bullets for the Germans to shoot at our soldiers? Nothing could be more ludicrous. The India Office gave the firm contracts in September and in October. Having this information, he suggested that the mover and the seconder of the amendment might be patriotic enough to withdraw their amendment. He would be willing to accept the suggestion as to making an endeavour to retain a small percentage of the account, equivalent to interest, until after the war. On October 10th, the Electrical Committee got an assurance from the firm that there had been no communication from or with the directors in Berlin, that there would not be any, and that no money whatever would be sent to Germany during the war.—The amendment was defeated by a big majority.—A contract for the supply of cable from a certain firm was withdrawn, but Councillor Hardman said the cause of the withdrawal had nothing to do with the nationality of the firm.

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After the War.—The Right Hon. Lord Inchcape, the President of the Institute of Bankers, in delivering his inaugural address last week, said that with the continent of Europe practically closed to international commerce, there must be a great shrinkage in most departments of trade so long as the war lasts. There will be a shrinkage in the consumption of this country also, which will adversely reflect upon most branches of trade. When the war is over the taxation which will be a burden upon Europe for many years to come, the enormous destruction of property on the Continent, the waste in non-productive expenditure entailed by the war, will set back international trade for some years. It may be some years before we see a return of the wave of prosperity which we have recently enjoyed, but we shall not repine if we have to shed some of that extravagance and luxury which has shown itself perhaps too freely in the past few years, if we are able to retain that place in the world which makes for culture, civilisation, peace and goodwill. —At the meeting of the Council of the London Chamber of Commerce last week, according to the "Financial Times," a resolution emanating from the manufacturers' section was adopted expressing the opinion that the Government should give some assurance that manufacturers will be assisted to carry on freshly established industries on the termination of the war, and that, apart from other measures, national interests might be advanced by giving to our Allies some sort of preference as regards goods in the production of which there were not the same facilities in this country as in the Allied countries.

Northampton Tramway Managership.—The management of the Northampton tramway undertaking is being considered by a special committee of the Tramway Committee, who are to report to a full meeting of the Committee next Monday. A certain section of the Committee favour the reinstatement of Mr. J. Gottschalk, who was dismissed owing to his German nationality, and they suggest that Mr. G. E. Mawby, a former chairman of the Tramways Committee, should temporarily manage the undertaking, but this does not meet with universal approval. The heads of the various departments have been made responsible for the management of their departments pending the appointment of a general manager. Mr. Gottschalk has written to the Tramways Committee thanking them for the kindness shown him at all times. There has been an agitation in the town for the removal of the German manager's name from the cars, and the Committee have promised that this shall be immediately effected. Stamp-paper has been placed over the name upon notices in the cars by persons who moved strenuously for Mr. Gottschalk's dismissal.

B.E.F. Men with the Forces.—With a view to stimulating enlistment, the periodical report of the British Electrical Federation Mutual Aid Fund urges all eligible employés of its fifty tramway, omnibus and electrical undertakings to join the Army, and assures them that their places will be kept open and their dependents properly supported in their absence. Pending the decision of the Government on the question of increased pensions, allowances to dependents of those employés who have lost their lives in action are being continued. Although the fund is subjected to the strain of departing subscribers and increasing dependents it is in a sound condition, with a balance of £622 in hand. Out of 7,432 men, 757 have gone to the war. These figures apply to all the companies of the Federation with the exception of the Metropolitan group, viz.: The Metropolitan Electric Tramways Co. and its allied companies, for the benefit of whose employés the T.O.T. (Tramway, Omnibus, Tube) Mutual Aid Fund has been established.

Board of Trade Reports: Russia.—The British Vice-Consul at Ekaterinburg reports that the cessation of Germany's import trade with Russia is already beginning to make itself felt in the Ural district, and enquiries are being made at the Vice-Consulate as to the possibility of substituting by United Kingdom manufacturers those goods which were formerly imported from Germany in large quantities. As regards machinery, the chief goods in demand are the following: Electrical plant of all kinds, including dynamos, turbines, and electrical fittings of every description, locomotives, mining machinery, wood-working machinery, and agricultural machinery.—"Board of Trade Journal."

Report No. 92 of the Board of Trade campaign series deals with German and Austro-Hungarian plate and sheet glass trade. Report No. 93 deals with animal-drawn vehicles.

Engineering Units of Royal Naval Division.—In the House of Commons on Monday Sir William Bull asked the First Lord of the Admiralty if the Institutions of Civil, Electrical and Mechanical Engineers were invited to obtain picked men for the divisional engineering units and signal company of the Royal Naval Division recently formed, and if a number of labourers and other recruits without engineering knowledge were afterwards added to these units on the same terms of enlistment.—Dr. Macnamara replied that the institutions were invited as stated to provide a considerable number of recruits, but owing to the nature of the work required of the engineer company, which included manual and skilled labour and also the care of horses, other recruits whose qualifications were suitable had to be taken.

Belgian Industries.—According to a financial daily, a meeting of the Commercial Committee was held last week at the House of Commons. M. Pollet, the Consul-General of Belgium, who attended the meeting, which considered what steps should be taken to co-operate in introducing Belgian industries in this country, said that there were several trades and interests affected in consequence of the war, and this was the time to secure for the allied countries a trade which, up till then, was exclusively German. Speeches on this point by members indicated a desire of co-operation in endeavouring to establish in this country factories and workshops to manufacture articles monopolised previously by Germany.

Appeal.—The Vegetable Products Committee (Alderman's House, Alderman's Walk, London, E.C.) has issued an appeal, signed by Lord Charles Beresford, the president, asking for financial assistance to enable it to continue sending fresh fruit and vegetables to the Fleet, especially to the torpedo boats and destroyers, submarines, and mine-sweeping trawlers, which are badly in need of such provisions.

Nothing German at Halifax.—Instructions have been given by the Halifax Tramways Committee to their manager not to purchase any more goods from German sources.

Metal Trade.—The "Times" correspondent at Melbourne says:—"Mr. Hughes, the Attorney-General, states that inquiries show the control of the metal market has long been to a great extent in German hands. The same control has still continued since the war began, and a great part of the trade profits are finding their way into German pockets, though steps have been taken to prevent metals useful to belligerents from reaching enemy countries."

Russian Supplies.—The Russian section of the International Commission of Supplies (192, Cromwell Road, S.W.) expresses its regret that it is unable to deal with the great number of communications from merchants, contractors, and others offering to contract for supplies. All communications, however, are filed for reference, and will receive due consideration when the supplies are required.—The "Times."

Aberdeen Tramwaymen.—Sixty-eight of the Aberdeen tramwaymen—motormen, conductors and other employés—are now serving in the Army or Navy.

Exports from Denmark.—The Danish Government has prohibited the export of electric cables, motor vehicles and parts thereof, rubber, and metals.

Personal.—Private B. Parker, an Accrington tram conductor, who was wounded at the front, is now at home on furlough.

Acting-Corporal W. Clegg, of the Burnley tramway department, who has been serving with the 3rd Rifle Brigade, is in hospital at Leicester suffering from wounds.

Sergt. Robert Greaves, of Ashton, formerly in the employ of the Tudor Accumulator Co., Dukinfield, has returned from the front wounded.

In the "Times" list of members of the House of Commons who are absent from Westminster serving in the Navy, Army or Auxiliary Forces, we notice the names of Major G. H. Bowden and Mr. C. G. C. Hamilton.

A correspondent whose services were accepted for the front in August writes:—"I beg to say that I was unfortunate enough to get in the way of a bit of shrapnel which struck me on the thigh. Since my return I have received my discharge as unfit for further service.—Frank A. Blood, late 6th Dragoon Guards."—The writer has now joined Messrs. Credenda Conduits, Ltd., as their representative for Yorkshire.

Mr. Ernest G. Baker, mentioned in our last issue, is mains assistant, not chief assistant, in the Morecambe Corporation Electricity Department. Mr. W. Mortimer, chief clerk to that department, is serving with the 5th (Reserve) Battalion King's Own Regiment, and Mr. A. Smith, an assistant on the outside staff, is serving with the Royal Army Medical Corps.

Roll of Honour.—Private Wm. Keen who had been employed at the Electric Works, Strand Road, Preston, has been killed in action.

Messrs. John Heywood, of Manchester, have made a handsome board to the order of Messrs. Chas. Macintosh & Co., Ltd., on which it is intended to inscribe the names of men from the works who have fallen fighting for King and country. So far only one name appears on the board, that of Corporal E. J. Walker, Manchester Regiment, who was killed in action at Le Cateau, August 26th, aged 20 years.

Corporal Alexander Mackenzie, 4th Dragoon Guards, killed in action on November 1st, was an electrical wireman in the employ of Messrs. Lowdon Bros. & Co., Dundee.

Electrically-Propelled U.S. Warship.—According to Reuter, the U.S. Navy Department has authorised the statement that the super-Dreadnought type battleship *California* will be electrically propelled with steam turbine-driven generators, motors, &c., giving a minimum speed of 21 knots an hour.

Accident.—John Parkinson (23), of Barrow, was admitted to North Lonsdale Hospital, on November 11th, suffering from severe injuries. He was passing an electric fan at Barrow Shipyard when his clothing was caught, and he was dragged into the fan.

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REVIEWS.

Factory Administration and Accounts. By Edward T. Elbourne. London: Longmans, Green & Co. Price 25/-.

This is one of the best and most comprehensive works extant as an analytical study of the problems pertaining to Factory Administration and Accounts as a whole, with contributions on the general problem of industrial works design by Mr. A. Horne-Martin, and on financial accounts by Mr. John Maughfling.

The work is divided into six sections and copiously illustrated. Section I discusses the problem of industrial works or factory design in a general way with a view to giving a mental conception of the broad principles that should be kept in mind in the setting up of a factory, whether conducted by a consulting engineer with the requisite qualifications or by an architect in collaboration with the works staff. Section II deals with general administration, and consideration is given to the factors dominating it independently of any particular office arrangements. This method of treatment has been also adopted throughout the discussion on works administration accounts and financial accounts. Section III comprises a study and discussion of the common elements in works administration. The treatment is fuller than that of general administration, partly because the principles seem to lend themselves to more definite demonstration and partly because a certain elaboration is necessary to show the inter-relation of the works organisation with the commercial and accountancy requirements. Section IV is devoted to works accounts in considerable detail with a view to providing a comprehensive grasp of the whole. Section V consists of a comprehensive set of routine forms, which broadly illustrate the principles outlined in tne preceding sections. The forms are grouped according to the departments first concerned with their use, each form having been either selected or designed for the special purpose of illustrating the work; but it is stated that the proved merits of successful practice have not been sacrificed in any modification for this purpose.

It is properly asserted that the illustrations do not apply equally to every set of conditions, and the tabular illustrations, supported by suggestive notes relative to the routine in each case, will aid as starting points in the consideration of the special requirements of various businesses.

The point is emphasised that no routine form should be adopted unless the local conditions require it, which is, of course, obvious. A more important fact which is sometimes overlooked, or neglected, is that no form should be adopted except as a considered step in the development of a co-ordinated scheme of organisation. The functions to be served by this section are therefore mainly to assist towards the taking of long views and to focus the arguments advanced in the course of the book.

The forms are arranged so as to be read in the ordinary horizontal way, and are printed on right-hand pages so as to allow ready reference from any other point in the book. In the text of the book marginal references are given to the forms illustrating the subject matter of discussion. The left-hand pages facing the forms are ruled for the user of the book to indicate comments and make notes from other sources, particularly for applying the forms to any given works where local considerations must almost necessarily entail some modification.

Section VI presents a definite set of financial accounts, adapted on the one hand to the system of works accounts advocated in Section IV, and on the other hand conforming with the requirements of English company law and the usual accountancy, a clear line of demarcation being drawn between works accounts and financial accounts, and the necessary interlocking exhibited. The section outlines a general system for an engineering and machine-work business.

The classification is simple, adequate and correct, and the descriptive and other observations which follow are to the point. In this particular section there is not advanced anything that can be characterised as being new, though it is only fair to add that the particular sub-division of the subject is of a somewhat formal and restricted character and contains comparatively little ground or fertility for the creation and cultivation of practical ideas unfettered or free from the trammels of orthodoxy. The system delineated is more or less in its main features in general vogue.

The general problem of industrial works design is exhausted under such heads as general considerations, determination of policy, choice of site, labour and labour conditions, general arrangement, power generation and transmission, design and construction of works structure, consideration of plant and equipment, building and starting the works, reconstruction of existing works; whilst general administration is described under such headings as staff organisation, routine organisation, correspondence, publicity and sales, estimates, output considerations, official orders, and working administration under works regulations, labour, drawing specification and patterns, materials, production efficiency and dispatch, and other various sub-headings or divisions. Section IV, Works Accounts, is ably treated with the following main dissections or classifications: functions of works accounts, works expenditure account, standing orders, stock accounts, cost allocation accounts, shop charges, process product, manufacturer's stock product, stocktaking, loose plant valuation, building and fixed plant valuation, works accounts abstracts, and administrative statistics.

Our old friend, or enemy, depreciation, deserves and receives a considerable amount of observation and discussion with some useful tables, in the course of which the writer states that each factory stands alone as to what are proper and adequate depreciation rates to apply. As a matter of valuation, considerable discrimination can be used as to the depreciation rates applicable to particular items, having regard to all the facts of the case. From the financial accounting point of view there is, however, no satisfactory alternative to the use of an average rate graded to an extent according to the classes of plant involved. The plant groupings already given recognise these limitations, and are arranged to minimise the misleading effect of average rates. Even if the depreciation rates were further graded to suit each class of plant included in these groups they would still fail to discriminate between the wear and tear of the different items in each class due to different conditions and makes, and the varying endurance of different types and makes. There is, therefore, little encouragement to consider the increased accounting work necessary to carry out such an idea.

Altogether the preparation of the work, which is of very great value, has been well carried out. There are many matters in the course of the treatise upon which the writer would have wished to comment in detail, but he must submit to space limitations.

The Elementary Principles of Wireless Telegraphy. By R. D. Bangay. London: Marconi Press. Price 1/- net.

This book is intended primarily to appeal to "amateurs" who, having a little technical knowledge, wish to take up the study and practice of wireless telegraphy. Only the underlying principles of the subject are dealt with, and the treatment given to these and to the essential components of a wireless equipment and their *modus operandi* is

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excellent. The author deals exclusively with the Marconi system (though the name Marconi does not appear once in the index, and but very rarely in the text). A wireless equipment as a whole is not, however, described; failing a general explanation of the method of working of any wireless installation, followed by treatment of the existing apparatus and underlying principles of different systems of wireless, surely the lay-out and operation of a complete installation should be considered.

It is always a difficult problem in writing an elementary treatise of this kind to determine just how much general technical knowledge should be assumed to be possessed by the reader. The author's introductory pages include very terse and useful explanations of elementary electrical principles and apparatus, in which explanations use is made of a number of excellent mechanical analogies. Yet before we reach "The Principles of Wave Motion," thirty pages (nearly 20 per cent. of the total number) have been filled. What it is so difficult to decide is whether a reader who finds this introductory section necessary will find it sufficient. We believe that the beginner possessed of a certain amount of electrical knowledge will find the author's introduction helpful in recalling and fixing clearly elementary knowledge with which he is already to some extent familiar.

The principles of wave motion and the properties, measurement and production of different types of waves are very well explained between pages 30 and 55. Throughout the work the author's mechanical analogies are apt and accurate. His grammatical style is very "pithy," and demands that the full import of each sentence be weighed carefully by the reader; this is no disadvantage, since there is no ambiguity or obscurity, but simply concentration of information. Oscillatory circuits, problems of energy and power therein, open and closed oscillatory circuits and methods of varying the wave lengths of aerials and closed oscillatory circuits are next dealt with. By this time we are half way through the book, and the question arises whether the beginner is likely to appreciate in a first reading the trend of the information placed before him. Would it not have been better first to outline the fundamental equipment and operation of a complete station, so that the reader might more easily appreciate the exact place of each component and problem in the scheme of things?

The purpose and construction of induction coils is next explained, and important sections are devoted to factors limiting the power in oscillatory circuits, the auto-jigger, reaction of secondary on primary, resultant wave length and calculation of coupling. The construction and use of wave meters and adjustable condensers are explained, and the author passes on to receiving circuits and detectors. Crystal detectors, carborundum and magnetic detectors are dealt with in detail. Surely electrolytic detectors are worth brief mention in a treatise on "essentials?" Types and size of aerial receive treatment in the final pages of the book, which is excellent value and certainly to be recommended to amateurs, Territorials, Boy Scouts, and others wishing for a sound treatment of the elements of wireless telegraphy. In later editions we should like to see a contents sheet, a specific description of a wireless installation as a whole, and some mention of the characteristic features and relative merits of different systems of radio-telegraphy.

Electrical Engineering. A First Year Course. By Frank Shaw, B.Sc. London: Routledge & Sons. Price 2/- net.

This is a small manual intended for the use of first year technical students who have already taken a preliminary course of mathematics, physics and chemistry. The elements of electricity and magnetism are treated very briefly in the first two chapters; a fairly full account of electromagnetics is then given, followed by half a dozen chapters on the dynamo and motor. The treatment is generally clear, and in spite of some weak diagrams the author has succeeded in giving a sound introduction to the study of electrical machines. There are also good chapters on electric lighting and heating and electrical measuring instruments.

The book suffers chiefly from the poorness of the illustrations. Most of the diagrams are clear enough, but with more discretion as to the relative sizes of the pictures the book might have been greatly improved. Some quite unimportant diagrams occupy a full page, while far more deserving blocks have been given but a few square inches. Some heavier type in place of the italic paragraph-headings would also improve the book. Altogether, and apart from these defects, Mr. Shaw has produced a very useful little book for first year students, and, what is of considerable importance to such students, it is published at a very moderate price.

P.H.S.K.

BUSINESS NOTES.

Incorrodible Steel Tubes.—The British Mannesmann Tube Co., Ltd., have just completed a plant for ferro-zincing and ironising tubes, under licence from Mr. Sherard Cowper-Coles. It is stated that the purer iron is, the less liable it is to pitting and corrosion, chemically pure iron being practically rustless. "Ferro-zincing," or "ironising," turns these facts to account by coating the steel surface with almost pure iron, the only impurity of any significance being hydrogen. The presence of hydrogen is an advantage, as it makes the iron slightly more electropositive to the underlying steel than it would otherwise be, so that it forms a better protective coating. Another advantage of the coating of electrolytic iron is that the coating is homogeneous, is not under unequal strain caused by mechanical operations such as drawing or hammering, and has not been subjected to any heat or mechanical treatment which of necessity causes impurities to be absorbed by the metal so treated.

It is found in practice for many purposes advantageous to coat the electrolytic iron surface with zinc, as a zinc coating with an intermediate layer of pure iron-hydrogen alloy gives greatly increased life to an ordinary steel tube or plate.

Catalogues and Lists. — Messrs. Credenda Conduits Co., Ltd., Chester Street, Birmingham.—Pamphlet F 18 illustrating, with prices, a number of Credenda electric fires, embodying their patent hot-bar system of heaters, which was described and illustrated in our issue of August 28th last. Electric wall heaters, grills, kettles, irons, lamp radiators, &c., are also dealt with.

Messrs. F. W. Potter & Co., Phipp Street, Great Eastern Street, London, E.C.—Illustrated leaflet giving particulars and prices of asbestos-woven wire-resistance nets of British manufacture.

Messrs. E. A. Reed & Co., Ltd., 14, Victoria Street, Westminster, London, S.W.—Twenty-page illustrated catalogue (new edition) of coal, ash, &c., elevating and conveying machinery of different types, mining and contractors' plant, steel and iron constructional work, steel chimneys, &c.

Messrs Elliott Bros., Central Buildings, Westminster, London, S.W.—Illustrated pocket pamphlet giving prices and particulars of Elliott micrometers and speed indicators made at their Lewisham works.

The Electrical Apparatus Co., Ltd., Vauxhall Road, South Lambeth Road, S.W.—Leaflet H 17A, covering shunt field regulators for ·15 to 100 amperes and 1·2 to 3,500 ohms. For each range of current and resistance two or three prices are given for varying number of steps. In all cases prices are given for front and back-of-board types, with and without C.I. cover for front, with extra price for enamelled slate bases and interlock for motor regulators. Dimensions, shipping specification and information regarding full load and shunt field current are given, the latter based on standard machines.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, London, W.C.—Volume 2 (second edition) of Messrs. Veritys' catalogue of electric supplies has recently been issued. It is as in the case of the first edition most convenient in size and its general appearance—well bound and quite unobtrusive—is all that can be desired, indeed it might be mistaken for the most harmless of text-books, instead of a business-getting catalogue. It consists of close upon 500 pages of art paper, and the things with which it deals form a multitude that no man can number in a hurry, so that we can do no more than indicate the general nature of the contents. If we say that it begins with fuseboards and ends with cooking appa-

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ratus that is because we must begin somewhere and wish to break it gently. Between those two ends there is a vast host of such electrical supplies as to justify the compilers in claiming that "it is crammed full of real-selling material." Since we wrote of "Verity in Three Volumes," now some years ago, there have been developments in small electrical work which of necessity are reflected in a catalogue of this kind, and some of the advances are to be found in the new sections covering theatre and cinematograph apparatus, portable electricity, &c. Glancing through the volume in a general sort of way we observe hundreds of illustrations, and thousands of prices, as well as code-words and brief descriptive notes, relating to Aston switches and switch accessories, all kinds of lampholders, cut-outs and connectors, shade-tilting arrangements, wires and cables, conduits and fittings, turndown lamps and wireman's tools and sundries, Conradty carbons, Holophane and other shades, bells and telephones, telegraph material and fire alarms, medical coils, electric signs and illumination devices, pocket lamps and batteries, lighting sets, various makes of accumulators, motor-car requisites, and electric heating and cooking apparatus. The book to which we refer is known as the "Sundries" section of "Veritys' Electric Supplies" (Vol. 2, new edition)—contractors and others interested will bear that in mind.

Messrs. Parmiter, Hope & Sugden, Ltd., Hulme Electrical Works, Manchester.—New price list (12 pages), containing description and illustrations of Hope's patent Fluvent fuse system, and giving recent tests of same certified by Mr. S. L. Pearce, city electrical engineer of Manchester.

Trade Announcements. — Messrs. Haylock and Haslett (formerly Ralph H. Haylock & Son), are trading as wholesale electrical merchants, at 63, Queen Victoria Street, E.C.

Messrs. Simplex Conduits, Ltd., announce that Mr. J. H. Baldwin, of 88, Wallasey Avenue, Belfast, is now acting as their Irish representative.

New offices and showroom premises at 5, Church Street, Enfield, N., have been opened by the Electricity Supply Co.

Book Notices.—*Made in England* is the title of a new penny monthly publication. It contains a large amount of interesting matter specially prepared to be of value to the British manufacturer, buyer, inventor and capitalist in connection with the present opportunity for capturing German export trade. Mr. L. G. Chiozza Money, M.P., contributes an article on the well-worn subject "British Consuls and British Trade," and other articles treat of the financial side of the war on German trade, motor-car trade, tungsten for steel and lamp manufacture, and so on.

The Mechanical World Pocket Diary and Year-Book for 1915 (Manchester: Emmott & Co., Ltd., price 6d. net), now issued for the twenty-eighth year, contains much new matter; structural iron and steel work is dealt with in a new section, and other features are articles on limit gauges and flat plates. Other parts have been revised and extended.

Questions and Solutions in Telegraphy and Telephony. By H. P. Few. London: S. Rentell & Co. Price 2s. 6d. net.—This is the fourth edition of a work which must be extremely useful to candidates for the examinations of the City and Guilds of London Institute in the subjects named, containing the questions set from 1904 to 1914 inclusive, with solutions by the author. Some of the questions set at the Departmental written examinations for overseers and assistant superintendents are also dealt with, and a number of the oral questions are included. Numerous diagrams are given, and numerical examples are fully worked out. An index facilitates reference to any particular subject. The frequent reprints and new editions of the book clearly indicate its popularity.

Electric Power Transmission by Aluminium Conductors.—This brochure, issued by the British Aluminium Co., Ltd., has been brought up to date, and the most recent regulations in force in various countries have been included, while a table of safe currents for overhead aluminium conductors, on the basis of temperature rises of 50 and 100° F., and new matter dealing with line regulation, the erection of aluminium conductors, and scrap value, have been added. Remarkable progress has been made in the use of aluminium for power transmission; on the Big Creek line, for example, which delivers energy at 150,000 volts some 241 miles from its source, 2,678 tons of aluminium strand was employed. The information given is so practical and useful, that we should consider the brochure indispensable to any engineer engaged upon the design and erection of important overhead lines.

"Laboratory Course in Electrochemistry." By O. P. Watts. London: Hill Publishing Co., Ltd. Price 4s. 2d. net.

"Principles and Practice of Electrical Engineering." By A. Gray. London: Hill Publishing Co. Price 12s. 6d. net.

"Electric Bells, Alarms, and Signalling Systems." By H. G. White. London: S. Rentell & Co., Ltd. Price 1s. 6d. net.

"Questions and Solutions in Telegraphy and Telephony." By H. P. Few. London: S. Rentell & Co., Ltd. Price 2s. 6d. net.

"Electric Mine Signalling Installations." By G. W. Lummis Paterson. London: Constable & Co., Ltd. Price 4s. 6d. net.

"Drawing for Electrical Engineers." By G. W. Worrall. London: G. Routledge & Sons, Ltd. Price 2s. net.

"Dynamo and Electric-Motor Building." By A. H. Avery. London: Cassell & Co., Ltd. Price 1s. net.

"A Manual of the High-speed Steam Engine." By H. Keay Pratt. London: Constable & Co. Price 5s. net.

Bankruptcy Proceedings.—H. B. Graham, consulting engineer, Craigs Court House, Charing Cross, S.W.—A first dividend of 9d. in the £ is payable any day (except Saturday) at Bankruptcy Buildings, Carey Street, W.C.

Liquidations.—Electro Steel Founders, Ltd.—A petition for winding up this company has been presented by Mr. A. E Owen, engineer, The Lawn, Streetly, Sutton Coldfield, a contributory, and it is to be heard on December 1st, in London.

Gyroscopic Motor Syndicate, Ltd.—A meeting of creditors will be held on December 18th, at 4, Mount Street Square, Cardiff, to hear an account of the winding up from the liquidator, Mr. R. C. Brown.

Pioneer Pump Patents, Ltd.—A meeting of creditors will be held on December 19th, at Clifton Street Works, Notting Hill, London, to hear an account of the winding up from the liquidator, Mr. G. H. Smart.

Fire.—A portion of the works of Bi-Metals, Ltd., and Messrs Neville Williams & Co, 57, Lant Street, Borough, London, S.E., was destroyed by fire on Friday last. Practically none of the finished stock was damaged, so that there will be no delay in the execution of orders.

LIGHTING and POWER NOTES.

Altrincham.—Application has been made to the B. of T. for the transfer to the Altrincham and District Electric Supply Co., Ltd., of the Altrincham and Bowdon and Ashton-on-Mersey E.L. orders.

Argentina. — The Commissioner of the La Plata Municipality has been authorised to come to an arrangement with the local electric light and gas companies in connection with the tariff for private service.

The Government is dealing with the question of reduction of tariffs in Tucumen, which has arisen between the consumers and supply company.—*Review of the River Plate.*

Ashford.—The 1911 E.L. order has been revoked.

Atherton.—The Howe Bridge Spinning Co., Ltd., has made application to the Council for energy for driving three 100-120-H.P. motors, the supply being three-phase, and the Council has decided to take steps to install three transformers and to lay the necessary cable to meet the demand.

Australia.—The Melbourne City Council has decided to spend on its electricity undertaking £145,000 during the next three years, £40,000 in 1915, £69,000 in 1916, and £35,000 in 1917. The extension proposed for 1916 includes a 5,000-KW. three-phase turbo-alternator, with additional boilers. This plant is considered necessary to meet the increased demands for electricity, and £20,000 is provided for works outside the power house, including mains.—*Tenders.*

According to the *Commonwealth Engineer*, the City Council some years ago erected a refuse destructor adjoining the electricity works in Spencer Street, against the advice of its engineer. Now additions are required to both plants, and the only way out of the difficulty is to purchase adjoining property.

Barnes.—Private Bill.—The U.D.C. has informed the I.M.E.A. that it has in contemplation the question of promoting a Private Bill which would include the electric lighting clauses proposed to be included in the Association's Private Bill.

Blyth.—Electric Pumping.—The steam pumps in connection with the large graving docks of the Blyth Shipbuilding and Dry Docks Co. are shortly to be replaced by an electric pumping installation. This new pumping plant will consist of two Gwynne pumps, capable of pumping 24,000 tons of water in two hours, driven by two 260-H.P. Bruce Peebles motors, running at 330 R.P.M., and taking current from the mains of the Newcastle-on-Tyne Electric Supply Co.

Chile.—According to the *Review of the River Plate*, the electricity company at Vina del Mar has decided to stop the public lighting service unless it is paid what it is owed.

Consett.—Street Lighting.—The U.D.C. has been informed that the Cleveland and Durham Electric Lighting Co. expected to complete the whole of the lighting in the course of a few days.

Continental Notes.—Austro-Hungary. — According to the *Morning Post*, Vienna, Buda-Pest, and other large cities and towns, are beginning to reduce the public lighting since the productive capacity of the electricity and gas works has been seriously affected owing to the shortage of coal and oil supply.

Ealing.—No charge is to be made under the contracts for outside lighting of shops, &c., during the period in which the police regulations for reduced lighting remain in force, provided each consumer undertakes to continue his contract from the time at which it would, in the ordinary course, expire, for a period equal to the duration of the first period referred to.

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Harrogate.—Proposed Extended Supply.—The Corporation is proposing to seek a general order to supply electricity in surrounding districts. At present the Corporation has power to supply Starbeck, three miles out, and it is seeking powers to supply Knaresborough, Spofforth, Ripley, Birstwith, Hampsthwaite, Haverah Park, Rigton, Kirkby Overblow, Dunkeswick, and Weeton. The area encroaches on other Unions, and some comment has been aroused owing to the sparsely populated character of the district. It is said that many of the villages welcome the proposal. The application for a prov. order is to be made before December 21st next.

Hendon.—Workhouse Lighting.—The B. of G. has decided to have electric light installed in the non-infectious wards, and has resolved to engage an expert, at a fee of 20 guineas, to report as to the question of the supply of electricity to the institution. The Sub-Committee appointed reported that the cost of lighting was slightly in favour of electricity, but taking into consideration the question of decoration and maintenance, together with the health of the inmates, the advantage of electric light was substantial.

Huddersfield.—Annual Report.—The statement of the past year's working of the electricity department shows that the consumers increased by 626, making a total of 5,814, and motors reached a total of 8,396 H P. The war is given as a reason why the new 5,000-kw. turbo-generator ordered at the beginning of the year, and now being erected, will be delayed beyond the specified time for completion, and the same difficulty is being experienced in regard to the delivery of converters at the tramway power station. Seven and three-quarter miles of cable have been laid in the roads, bringing the total length of mains to 162¼ miles. The public lighting in the Longwood ward has been converted from gas to electricity, and the adoption of the same system has effected lighting improvements at Longwood Bridge and Lockwood.

India.—Calcutta Public Lighting.—The Special Committee of the Corporation recently considered comparative estimates of cost of electric and high-pressure gas lighting for Chowringhee Road. It was proposed to use 66 gas lamps 150 ft. apart, or 83 electric lamps 118 ft. apart; the former were of 1,000 and the latter of 900 c.p. The chairman said that in every way the estimates worked out in favour of electricity; the cost of maintenance was Rs. 270 per lamp per annum for gas, and Rs. 209 per lamp per annum for electricity, and the total cost of electricity per annum would be Rs. 17,347, against which they would get a Government grant of about Rs. 4,500. It was resolved to recommend the offer of the Calcutta E.S. Corporation to install 83 lamps, and light and maintain them for Rs. 209 each per annum for 3,914 hours, or for Rs. 161 per lamp if extinguished at 1 a.m., the period of the contract to be five years.

The Madras Government has given the Madras Electric Supply Corporation permission to introduce the A.C. system of supply in addition to the existing three-wire D C. system.

The Governor in Council is urging all lift owners in the Bombay Presidency to have them insured and inspected. Since the introduction of electric power numerous electric lifts have been installed in hotels, offices, shop and houses, and one or two serious accidents have occurred.

Japan.—Two transformers, having a normal continuous rating of 360,000 volts, and 500 000 volts for short periods, were recently built by the Westinghouse Co., East Pittsburg, for the Inawashiro Hydroelectric Power Co., one being installed in the generating station on the Nippashi River at the outlet of Lake Inawashiro, and the other in the receiving sub-station at Tokio, about 145 miles away. They will be used for testing the transmission lines and the apparatus in the stations. The machines measure 19 ft. from the base to the top of the terminals, and the tanks containing the transformers proper are cylinders 9 ft. high and 9 ft. in diameter. One high-tension terminal of each transformer is grounded to the core and the case. By connecting the cases of the two in series, it is possible to develop a potential of 1,000,000 volts between the two high-tension terminals.—*Indian Textile Journal.*

The electric lighting of Tokio is at present being conducted under most complicated conditions, and in view of the competition among the municipal, the Tokio, and the Nippon electric lighting concerns, the Japanese Department of Communications is, as a supervising body, keeping a close watch on every movement of the different competitors. In this connection, the Department is reported to have decided to commence a formal investigation of the present phase of competition, and also of the opinions of consumers with regard to the position.

Leeds.—Half-Year's Working.—The returns of the Corporation electricity department for the half-year ended September 30th show that 18,626,358 units were sold, as compared with 12,858,263 in the same period of 1913; the former figure includes some 2 million units for private lighting, 10 million for power and heating, 255,000 for public lighting, and 8¼ million units for traction. Private lighting and power sales are both higher than in the previous year, despite the war, and traction supply increased by some 6 million units, due to the transfer of generation from the Crown Point (tramway station) to the Whitehall Road station. The lighting consumers numbered 10,226, as compared with 9,612, and the H P. of motors connected was 29,052, as compared with 26,842. The larger proportion of low-priced traction units reduced the average price from 1·02d. to ·83d. per unit. The strike in the early part of the year, and the necessity of using reserve plant, owing to the small margin available, were not favourable to economy in working, but working expenses figured at ·39d., as against ·43d. The gross profit for the six months was £33,553, as against £31,756 in 1913, and the net result a deficit of £11,686, as against a deficit of £6,417—these figures being no criterion of the whole year's working, as the winter output is much greater than the summer output referred to above.

The Corporation electricity department last week took over the undertaking of the Roundhay and District Electric Lighting Co., Ltd., which has, since 1901, supplied current to the Roundhay district. On the recent extension of the city boundaries, when Roundhay was included, the company retained the right to supply until such time as the Corporation should purchase its undertaking. From the consumers' point of view, the district will benefit, as the Corporation prices for current are 50 per cent. lower than those charged by the company.

Litherland.—Prov. Order.—The U.D.C. has decided to apply to the B. of G. for a prov. order for electric supply.

Malling (Kent).—Workhouse Lighting.—The B. of G. has decided to obtain estimates for lighting the workhouse by electricity and utilising it for cooking, current to be generated on the premises.

Manchester.—According to a Scottish correspondent, a deputation from Manchester has visited Edinburgh to inspect the arrangements at McDonald Road station for utilising sewage water for condensing purposes. It is proposed to erect the new Manchester power station adjacent to a sewage works, which deals with 36 million gallons of sewage daily, which could be screened and utilised for condensing purposes.

Nuneaton.—The T.C. has decided to contribute towards the cost of the promotion of the Bill of the I.M.E.A. Provided current is already available in the premises, no charge is to be made for electricity supplied to houses exclusively occupied by Belgian refugees.

Rawtenstall.—Proposed Loan.—A L.G.B. inquiry was held on Tuesday last into the application of the T.C. for sanction to borrow £6,500 for the electricity undertaking.

Rochdale.—Street Lighting.—The B. of G. has decided to extend the lighting by electricity of Birch Hill Lane towards Shore boundary upon terms which it is expected will be approved by the Wardle U.D.C.

Slaithwaite.—E.L. Scheme.—The U.D.C. has instructed Mr. J. Schofield, of Bradford, to prepare a scheme for generating electricity for lighting, with specifications, quantities, and estimates for a plant to produce 50,000 units per annum.

South Shields.—Despite the effects of the war, and the fact that a hundred arc lamps are out of lighting, and that all public houses are closing at 9 p.m., the units generated at the Corporation electricity works from August 6th to October 29th last reached 1,204,765, as compared with 1,196,011 in the previous year, an increase of ·7 per cent. In the period from March 31st to October 29th, the units generated amounted to 3,052,590, an increase of 5·5 per cent. over the 1913 figures.

Sunderland.—The Corporation has agreed that power consumers now supplied upon a kilowatt rental, plus a unit charge, be supplied in future with electricity for office and similar heating and cooking apparatus at the same unit rate as the existing supply, plus the coal charge, and that no kilowatt rental be made in respect for such apparatus.

Tavistock.—Opening Ceremony.—On Wednesday, last week, the electricity works were formally opened. The contractors for the plant, &c., were Messrs. W. G. Heath & Co., of Plymouth, who have supplied 30 miles of overhead and four miles of underground cable, street pillars, poles, fittings, &c., for 160 street lamps and a generating plant, consisting of a 75-H.P. suction gas engine and dynamo, with battery, booster, balancer, &c., and an auxiliary water turbine plant.

Torpoint.—The U.D.C. has decided to discuss with the E L. Co. the question of entering into an agreement with regard to private lighting.

Warrington.—The Corporation is applying for powers to supply electricity to Stockton Heath.

Wigan.—At the last meeting of the Ince D.C. some discussion took place with reference to explosions in electric cable manholes, and it was agreed that the clerk of the D.C. write the T.C. of Wigan calling attention to the danger involved, and pointing out that responsibility for any accident which might occur would rest with the Corporation.

Worsley.—Street Lighting.—The U.D.C. has decided to ask the Tramways Co. to fix four 100-c.p. lamps on poles at the junction of Manchester Road and Walkden Road.

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TRAMWAY and RAILWAY NOTES.

Australia.—The lease of the Melbourne Tramway and Omnibus Co. expires on July 1st, 1916, on which date certain of the municipalities through which the tramways run take over the system.—*Commonwealth Engineer.*

Bradford.—Halfpenny Fares.—The Chamber of Trade Council has discussed at considerable length the subject of halfpenny tramway fares. Mr. John Preston submitted statistics from the tramway authorities of Leeds, Sheffield, Hull, Glasgow and Aberdeen, showing how generally successful the halfpenny fares had been found in those places, and gave detailed comparisons showing that, in regard to Bradford, people who lived in outdistricts several miles away, and used the railways, travelled to town at materially cheaper rates than those who lived within a mile of the centre of the city and used the trams. Eventually a resolution was carried urging the Tramways Committee to consider the advisability of giving a six months' trial to the adoption of halfpenny fares on all sections of the local tramways.

Canada.—The Board of Control recently agreed to an application to the Dominion Railway Board for an order compelling all railways entering the city to electrify their systems to a point not less than two miles beyond the Toronto city limits. Eleven out of thirteen districts north of Toronto, have voted in favour of hydro-radial lines under the scheme of the Hydro-Electric Commission, and subject to the Dominion Government granting a mileage subsidy.—*Can. Elect. News.*

Glasgow.—New Type Car.—The Corporation is experimenting with a new type of car in which the special features are the introduction of a capstan wheel and gearing in place of the ordinary brake wheel, to give more room on the platform; a front exit on the platform for the convenience of downstairs passengers; and the provision of a pivoted seat for individual passengers on the upper deck, so that the seats can be swung round to suit the direction of travelling. The pairs of seats are not in line so as to allow more shoulder room and a wider central gangway.

Ilford.—The B. of T. has informed the Ilford tramways manager that it is proposed to make regulations with regard to trolleys attaching to vehicles using a tramway.

Japan.—According to the *Railway News* the work of making the existing double-track line from Tokio to Yokohama into a four-track line has been practically finished. The old track will continue as a steam line, while the new track will be used for electric services. Electric cars will run from the new Tokio central station; the various intermediate stations have been rebuilt, and the work has taken some five years to carry out.

Lepton.—Proposed Tramway Extension.—The U.D.C. has decided to meet a deputation from the Grange Moor Co-operative Society with respect to the extension of the Huddersfield tramway system to the district.

London.—L.C.C.—The Highways Committee recommends that arrangements be made to increase the existing car services, and that an additional supply of power up to 1,500 kw. be obtained from the London Electric Supply Corporation, at £3 per kw. a year plus 4d. a unit. The price previously paid the company was £3 per kw. plus 33d. a unit, the increase of 05d. per unit being due to the increased cost of fuel. The increased power will be sufficient to run 50 or 60 additional cars, and will be provided at the Lewisham sub-station. The cost is estimated at £6,750 for five months.

Electric Delivery Vans.—As indicating the progress that the electric delivery vehicle is making in the London district, it is interesting to learn that Messrs. Harrods, Ltd., in addition to a number of three-wheel machines, have now in service or on order no less than 28 Elison electrics.

Richmond (Yorks.).—The Light Railway Commissioners have granted an order authorising the construction of a light railway from Richmond-on-Tees to Reeth.

Stirling.—The first petrol-driven tramway car in Scotland, on the Stirling and Bridge of Allan route, has proved an unqualified success; the passengers carried on the section where the new car has been in constant use have increased by no fewer than 24,300. It has been decided, after the encouragement shown to the petrol car, to have the whole tramway system electrified. The Corporation of Stirling will probably take the tramway system over after the war has ceased, and meantime the Tramway Co. has obtained an extension of the licence permitting it to experiment with the petrol tramcar for another year.

TELEGRAPH and TELEPHONE NOTES.

An Automobile Laboratory.—For some time past the G.P.O. authorities have been making use of hired motor vehicles fitted up with the necessary apparatus for testing the main telegraph cables throughout the country. As a result of the experience gained, they have now commenced to purchase a number of motor vehicles for this work. One of the first to be completed is a 15-18-h.p. Buick, which has been fitted with a special van body by Messrs. Hora, of Peckham. The body, which forms a travelling office and laboratory, is fitted with all the necessary instruments for cable-testing purposes, the outfit including a dynamo and a battery of accumulators.

Alien's Wireless Installation.—On Tuesday a court-martial was held at Woolwich on Harold Fochtenberger, alias Harold Falconer, described as a wireless engineer, who was charged with having in his possession wireless telegraph apparatus at Thorpe Bay, Southend, and Avonmore Road, South Kensington. The accused pleaded not guilty to both charges. Detective-inspector Beavis stated that on October 28th accused admitted to him that the wireless installation at Thorpe Bay belonged to him, and that he had a complete and powerful installation stored at Messrs. Whiteley's repository. Frank William Davey, assistant engineer at the G.P.O., said the apparatus comprised a complete wireless installation, which would be capable under ideal conditions of communicating over a distance of 150 miles. The prisoner stated that he was not aware that the possession of wireless apparatus was forbidden; he thought a licence was only necessary for apparatus in working order. The trial was concluded.

India.—The new wireless station at Madras has been completed and opened.—*Indian Engineering.*

Secret Wireless Stations.—A secret wireless telegraph station is reported to have been discovered in Valparaiso. Two private stations in the capital have been discovered and dismantled by the police.—*Review of the River Plate.*

Commander Lupcke and the wireless operator Voltz, of the German warship *Preussen*, who are interned at Sabang Bay, Batavia, have been arrested by the Naval authorities. The communication between the antenna and the wireless rooms had been broken, but it was found that a wire had been passed along the mizzen mast from the antenna to a receiver under the pillow of the wireless operator. The authorities have ordered Lupcke and Voltz to be tried for violation of Dutch neutrality.

It is reported that the United States Government has sent secret service agents to inspect a wireless station which was accidentally discovered by some hunters in the Maine woods. The station is supposed to have been operated in German interests.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—December 28th. Victorian Railways. Three 50-kw. static transformers. Contract 27,737. Contractors' Room, Spencer Street.

December 9th. 1,200 yd. 0·3 sq., 2,400 yd. 0·25 sq., 1,600 yd. 0·15 sq., 660 yd. 7/16 S.W.G. single conductor lead-covered cable, 880 yd. 7/16 S.W.G. concentric lead covered cable, for City Council. See "Official Notices" to-day.

Brisbane.—December 21st. City Council. Motor-generators and switchgear suitable for electric vehicle battery charging. Specifications, 10s. 6d., from City Electrical Engineer.

January 6th. Copper wire and accessories, paper-insulated lead-covered cable, for P.M.G. See "Official Notices" to-day.

Perth.—December 16th. Telegraph and telephone instruments for P.M.G. See "Official Notices" November 13th.

Ashton-under-Lyne.—November 25th. Engine slack. Borough Electrical Engineer, Wellington Road.

Atherton.—The U.D.C. has decided to invite tenders for three transformers, and to request Messrs. Callender's Cable Co., Ltd., to tender for 300 yards of cable.

Barnet.—December 7th. B. of G. Electrical power and lighting plant, electric lift, &c., for the Guardians of Barnet Union. Particulars and forms of tender from Messrs. Williams and Cox, architects, 34, Henrietta Street, Covent Garden, W.C.

London.—L.C.C. December 8th. (*a*) H.T. and L.T. switchgear, (*b*) gravity bucket ash conveyor in connection with tramways. See "Official Notices" November 13th.

Bethnal Green.—December 2nd. H.T. and L.T. cables and roadwork, static transformers, sub-station switchgear, for the B.C. See "Official Notices" to-day.

Manchester.—December 16th. Corporation. Ten 50,000-lb. water-tube boilers complete; two 15,000-kw. turbo-alternators complete. See "Official Notices" November 13th.

December 1st. The Tramways Committee invites tenders for tramcar trucks. Mr. J. M. McElroy, General Manager.

Newcastle-on-Tyne.—November 23rd. Incandescent lamps and arc lamp carbons for a year, for the Tyne Improvement Commissioners. Mr. J. McDonald Manson, General Manager and Secretary, Bewick Street.

(*Continued on page* 696.)

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THE GOVERNMENT ELECTRIC POWER STATION OF BANGKOK.

By FRANCIS B. SHAW, A.M.Inst.C.E., A.M.I.E.E.,
Electrical Engineer to the Government of Siam.

(*Concluded from page* 663).

Distribution.—All the high-tension distribution, except for a few short lengths of cable, is by overhead lines, the voltage being 3,500 transformed to 110 volts for lighting and small motors. The use of the overhead system is due to the high initial cost of a cable system; the rapidly changing nature of the district, frequently requiring a supply in an unexpected quarter; and the frequent demand for large temporary installations, *e.g.*, for illuminations, &c., which require large transformers to be put down for a few days only.

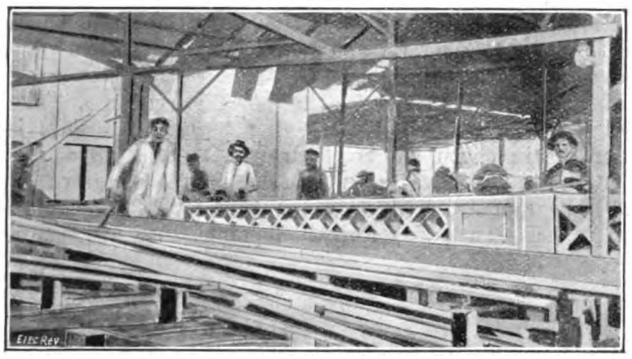

Fig. 21.—Casting Ferro concrete Poles.

Moreover, the supply is often carried along roads which may, from time to time, be altered—the replanting of trees along them being a frequent source of trouble to our present L.T. cables; many canals are crossed by bridges of a temporary nature, which are slowly being replaced by more permanent ferro-concrete structures, and at certain periods of the year many roads are partially inundated by the river being in flood.

It was decided to depart from the previous practice of using teak posts for the overhead lines, and to use ferro-concrete poles. These have all been constructed locally, in the manner described later.

Great care has been taken to make the lines as permanent and as free from any possibility of interruption as possible. All main feeders are run in duplicate, each phase being composed of two sets of three lines. No. 1 feeder, which supplies the waterworks, is composed of six lines, each of 35-mm². hard-drawn copper. At all crossings of roads double insulators have been used, and at the railway crossing double suspension has been employed. Lightning arresters have been installed at the sub-stations and some of the exposed transformer positions. At the power station, in addition to the multigap lightning arresters, Gola arresters have been fitted. At sub-stations multigap arresters are used, and in a few cases horn type arresters have been installed.

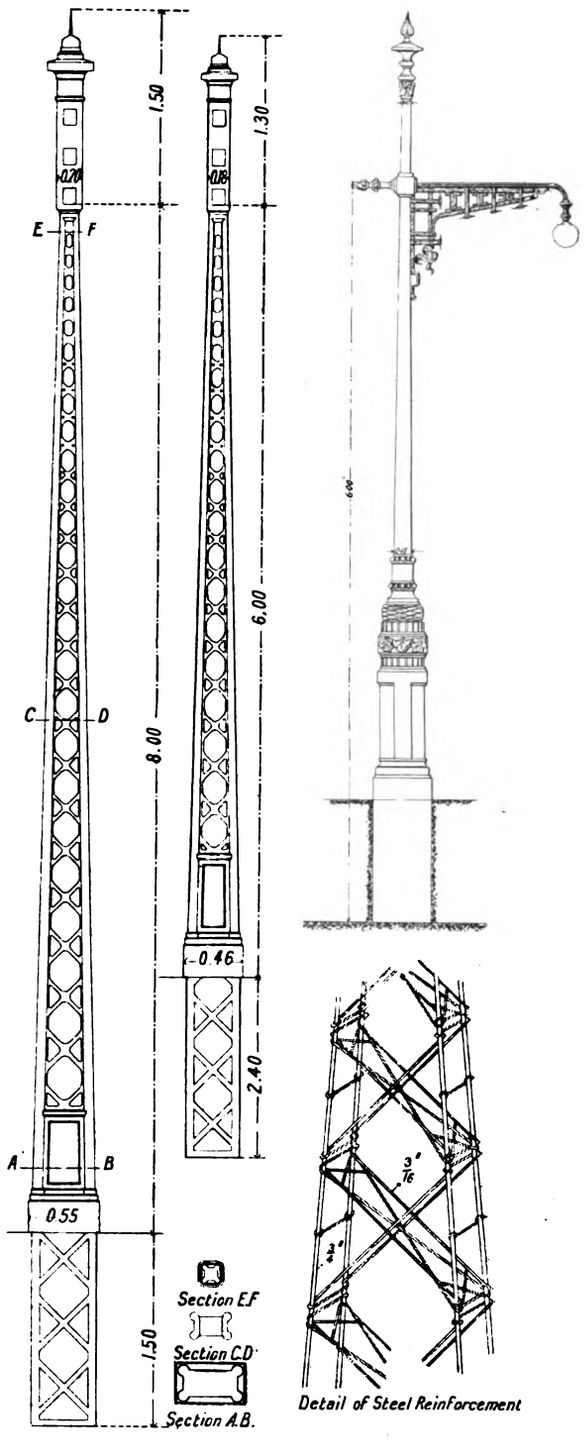

Fig. 22.—Ferro-concrete Lattice Poles and Tubular Lamp-post.

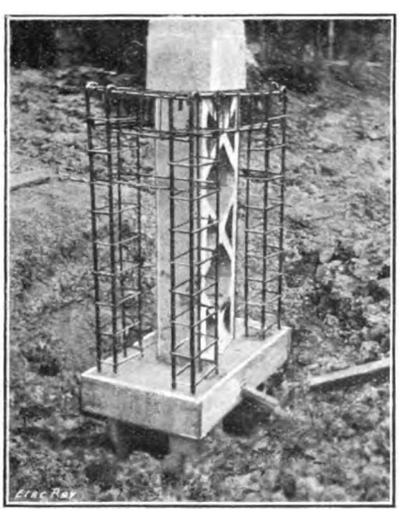

Fig. 23.

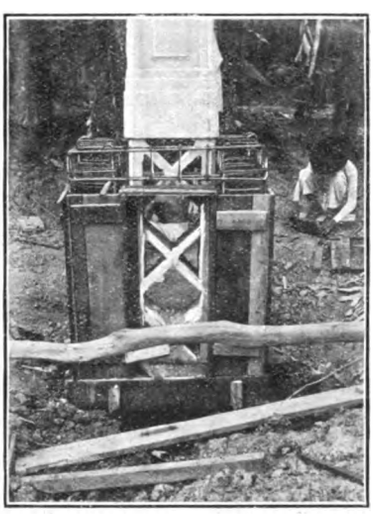

Fig. 24.

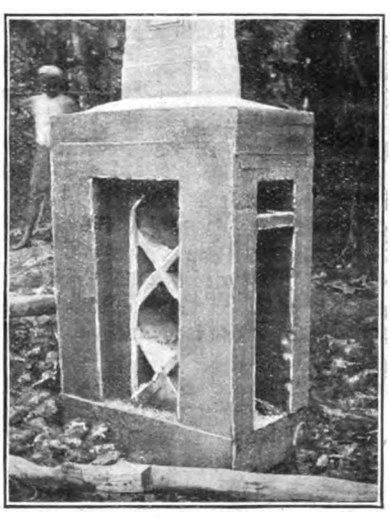

Fig. 25.

Construction of Special Base for Ferro-concrete Pole.

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No. 2 feeder supplies several of the Royal palaces, and consists of six lines, each of 50-mm². hard-drawn copper. The standard spacing for all the lines is taken as an equilateral triangle of 400-mm. sides, and the tension is 6 to 7 kilogrammes per mm². No. 3 feeder will also be principally for lighting and similar in all respects to No. 2.

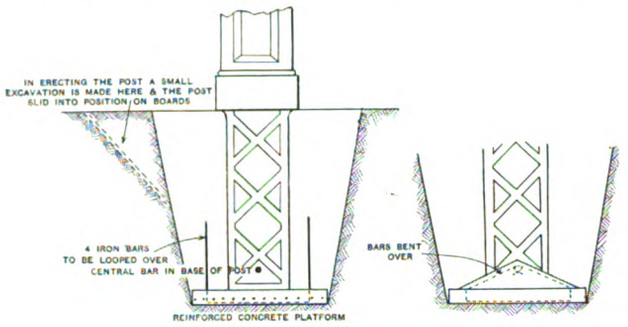
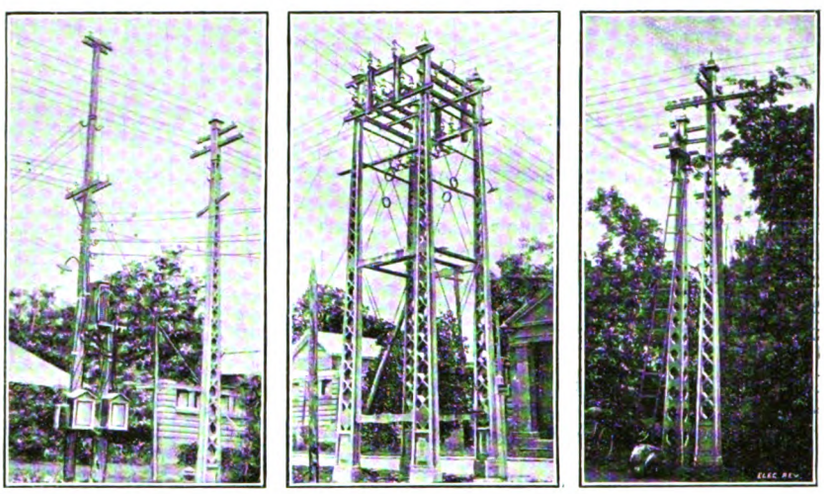


Fig. 26.—Foundation for Pole.

Sub-stations.—There will be seven principal sub-stations, the high and low-tension boards for which have been constructed by the British Thomson-Houston Co., Ltd. In certain of the sub-stations arrangements are provided for connecting up Nos. 1, 2 and 3 feeders in order that in case of damage or accident to any one feeder, important points may be fed from another direction. No automatic selective switchgear is employed, but telephonic communication with the power station from these sub-stations is provided by the department's private lines.

Street Lighting.—The ordinary street lighting is effected by means of 50-c.p. lamps on brackets, for which provision has been made on all the ferro-concrete poles. On certain of the main roads 1,000-c.p. lamps are used. The whole of the street-lighting system is controlled from a small switchboard situated in the power station. From this switchboard pilot lines are run to the various sections, and these control automatic switches. A lamp on the switchboard indicates immediately when the street lighting is in operation, and another lamp indicates if any fault arises. With this system it is unnecessary to run special high-tension lines solely for street lighting purposes, as was the former custom here.



Old and New Poles. Four-pole Turnout. Two Types of Pole.

Fig. 27.

Reinforced Concrete Poles.

For the past eight years the Siamese Government have been using reinforced concrete poles of various types both for street and park lighting and also for transmission lines. Previous to this teak poles and certain other woods more or less unattacked by the white ant were used.

The average life of a teak pole is about 15 years, and that of the other woods used from five to seven years. Of late it has grown more and more difficult to obtain suitable teak poles, and the price of teak has risen considerably. On this account reinforced concrete poles were adopted for the transmission lines of the new Government electric power station.

It was found that reinforced concrete poles could be made locally at nearly the same price as teak poles, the latter of, say, 11 metres, costing £2 15s., and reinforced concrete poles, £3. Furthermore, the value of a teak log increases very rapidly with increase in length, straightness, and freedom from flaws. Thus no very fixed basis of comparison of price is possible.

The concrete pole of the lattice-work pattern adopted by us is only about 10 per cent. heavier than a teak pole of the same length, and this extra weight is more than counterbalanced by the fact that the centre of gravity is at slightly less than one-third of the length from the butt.

This fact makes the erection of the pole a far more simple matter than erecting a teak pole, which is usually of nearly uniform weight throughout. Again, the base of the concrete pole is constructed to give a large bearing surface and area to resist movement and sinkage in soft ground.

The wooden pole has usually a pointed or rounded end, and requires elaborate cross-tree timbering to prevent movement or sinkage. Another point not usually taken into account is the elasticity of the reinforced concrete pole. With a teak-wood pole line, if by reason of a tree falling on the line, or a fire, all the lines between two poles are broken, the wooden poles usually give in the ground, and require very careful straightening. With concrete poles this is not the case, as they are sufficiently elastic for the strain to be distributed along several poles on either side without any movement of the pole bases.

Three types of ferro-concrete poles are in use. The ordinary type of pole for carrying high-tension lines is 11 metres in length, and is constructed to take three cross arms and to withstand a pull at the middle cross arm of 200 kilogrammes, with a factor of safety of four. In certain cases, such as termination points, turnouts, special crossings as those at "klongs" (canals), roads, &c., a special pole to withstand a pull of 2,000 kg. is employed. In some cases, such as at turnouts, four ordinary type poles are placed to form a tower on which the transposition of lines can be easily effected. The third type of pole is 6·50 m. in length, and will stand a pull of 200 kg. This is used only for low-tension lines.

Tests on the 11-metre poles gave a deflection of 10 cm. at the top of the pole within the elastic limit, and 19 cm. before any serious cracks appeared on the pole. This, of course, was with a horizontal pull, which, for the deflection of 19 cm., was approximately 500 kg.

Construction of the Lattice Type of Pole.—The armature is composed of the ordinary round iron bars grouped at the corners. From three to five ⅝-in. bars are bound together, and reduced gradually to two bars at the neck of the pole at each corner. The cross bracings are bent on formers or templates and strung on the pole. Soft iron binding wire is used to keep them in position (see fig. 22).

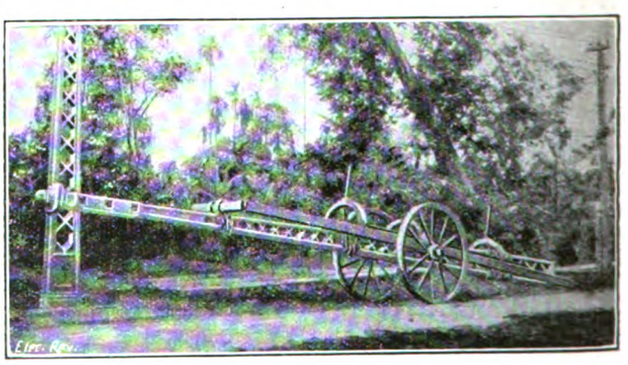


Fig. 28.—Pole Car.

Four teak wood moulds were made, in order that there should be a continuous output of four 11-metre poles a day.

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After the ironwork has been completely built up it is placed in the wood mould. The spaces in the poles are made by teak blocks built up in five pieces, tapered so as to receive a tapered wedge in the middle. After the concrete has been run in and allowed to set for 24 hours, the central

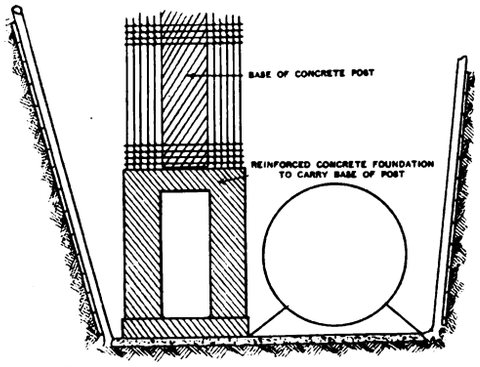
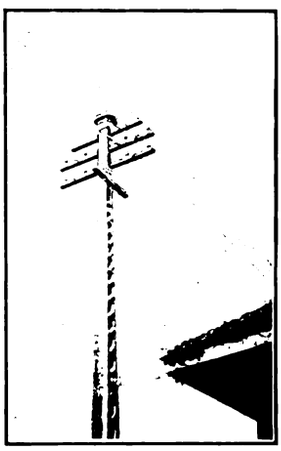


Fig. 29.—Detail of Special Base.

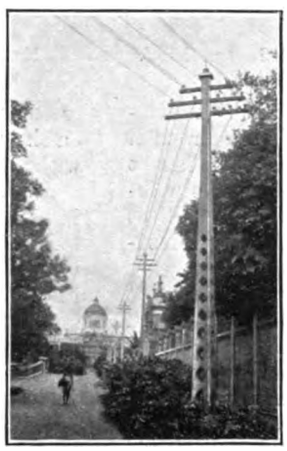
wedge of each hole is pulled out, thus releasing the other tapered pieces of teak. These wedges, as well as the sides of the mould, are kept well greased.

The pole is cast horizontally, and after 24 hours the mould may be entirely removed (see fig. 21, page 691). Already 800 such poles have been made from four moulds.

The cross-section of the pole (fig. 22) shows that the iron is placed so as to give the greatest strength in the direction of the line. The condition of severest strain likely to occur on any of our lines is that due to all the lines between two poles being broken. On certain lines there are as many as 12 conductors—six of 50 mm.^{2} cross-section and six of 35 mm.^{2}. All lines are tensioned up to 7½ kg. per mm.^{2} by dynamometer. Thus in the case of all lines being broken there would be a pull of 3,750 kg. to be distributed along the line.



Service Line.



Angle Pole.

Cable Junction.

Fig. 30.

Siam is fortunately out of the typhoon area, and there is no possibility of ice or sleet forming on the lines; thus there is no serious side pressure to be allowed for. Further, at the frequent road crossings double suspension and either two poles or an extra strong pole is used.

Serious trouble from lightning has been experienced in the past when teak poles were used. For this reason each concrete pole is provided with an iron spike conductor connected metallically through the armature to earth. No earth line, either over or under the conductors, is used, and with these lines no trouble from lightning has been experienced.

The soft clayey nature of the ground throughout Bangkok, and the fact that it is at an average of only 6 in. above sea level, make the question of foundations for these poles carrying the abnormally heavy lines that they do a special problem. The first few poles were put up on a simple plate of concrete, and part of the base was filled in with concrete and broken brick. This was, however, found to be too costly, and to have too little stability, the whole structure having a tendency to sink.

The following plan has proved comparatively inexpensive, and has completely solved the difficulty. Two ¾-in. bars are embedded in the foundation-plate of concrete, which is approximately 3 ft. 6 in. long by 2 ft. 6 in. wide by 5 in. thick, and reinforced with a network of small ⅜ in. iron bars. The last lattice-work section of the pole is cast solid, and a short 1 in. bar threaded through, leaving 4 in. projecting on either side of the pole (see detail, fig. 26).

The pole is slid into position on this platform on boards placed on the side of the pit, and is held in a vertical position by four ropes. The four projecting bars are bent over the 1 in. bar, and concrete is filled in just to cover them, as shown. The concrete is allowed to set for two or three days before the earth is filled in.

In one particular instance the erection of these poles was complicated by the fact that a large underground culvert 5 ft. in diameter was being constructed at the side of the road and almost in the line where it was necessary to erect one of our most important lines. The top of the culvert almost coincided with the depth at which the base of the pole had to be, and it was first proposed to strengthen the culvert at these points and to form a platform base on the culvert. But as this culvert had already given considerable trouble and was under a different department, it was impossible to obtain permission for this. Consequently the line had to be shifted to a point just clear of the culvert, and foundations were made at the same depth as that for the culvert; from this four pillars, 6 in. × 6 in., were brought up to the desired height, and the platform for the base of the post was constructed on them, as in fig. 29. The armouring was carried continuously through these pillars to the ground level, and the four pillars at this point were made to embrace the base of the post. This is clearly shown in figs. 23-25.

A somewhat similar construction had to be adopted when the line crossed a high railway embankment, and where the ground was very low and swampy on either side of the railway, the pole on either side of the line being gradually raised on these special bases for some four or five spans on either side.

For end sections, termination points, corners and turnouts, a specially strong concrete pole has been made at only a slighly increased cost; it is a square hollow lattice type of pole and is designed to stand a pull at the top of 2,500 kg. (fig. 30).

The foundations for these are usually designed to meet each special case, the shape and position of the plate as well as the underground staging being laid out to suit the resultant pressure on the pole so far as possible; stay wires

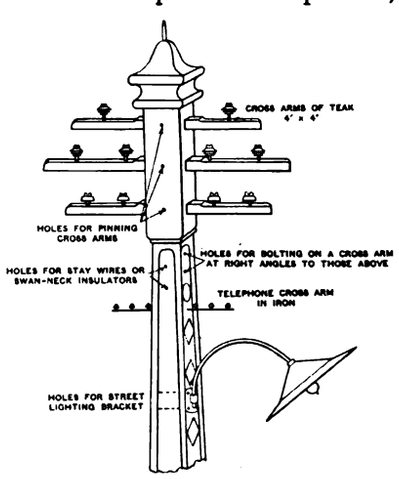


Fig. 31.—Detail of Pole Head.

are not used, as it is found that heavy concrete blocks as anchors, &c., bring the cost nearly to that of putting in a strong pole, and, of course, in many cases stay wires cannot be used, as they would interefere with road traffic or private property.

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The cross-arms are of teak, 4 in. × 4 in., soaked in Spencer preservative compound. Exception has been taken by some to putting these cross-arms through holes in the concrete poles, as they consider that the teak may rot at these points, and the trouble be unknown until too late. This has not been found to be the case. The cross-arms are easily removed by punching out the ½-in. iron pin (fig. 31).

Mr. P. P. Wheelwright, Chairman, Manchester Section I.E.E.

In the casting of the poles holes have been left to template for tramway cross-arms, swan-neck insulators for small branch lines, brackets for our own telephone lines, and street lighting brackets. The native wiremen work mostly without ladders on these poles, as the lattice work gives excellent foothold. The work of slinging up the lines, fitting insulators, &c., is thus carried out very rapidly.

Transport.—Two types of pole car were made. The first was a four-wheeled car with two bridges and a high arched back axle. From each of the bridges two differential pulley blocks were suspended. The car being backed over the poles as they lay on the ground, slings were passed under the poles and hooked to the pulley blocks and the poles raised to the required height. In practice it was found

Mr. James Lowson, Chairman, Scottish Section I.E.E.

that this four-wheeled car was too long and cumbersome for towing by motor lorry, and when loaded with two poles was too much for some of the bridges.

The other type of pole-car constructed at the same time had only a single pair of iron wheels, 5 ft. in diameter, and a chassis partly of iron and partly of wood, with two bridges. At the centre of each bridge was a long screw terminating in a hook, with a suitable winding lever. This pole car is comparatively light, and is arranged for towing by motor lorry (fig. 28). At the time of writing about 400 poles have been transported without any difficulty to distances up to 3 miles at the average rate of about 10 poles a day. The structure has to be strong, as this work being completely in the hands of natives, the poles were usually transported at an average speed of 15 miles an hour, and this with rough roads and awkward bridges over the frequent canals.

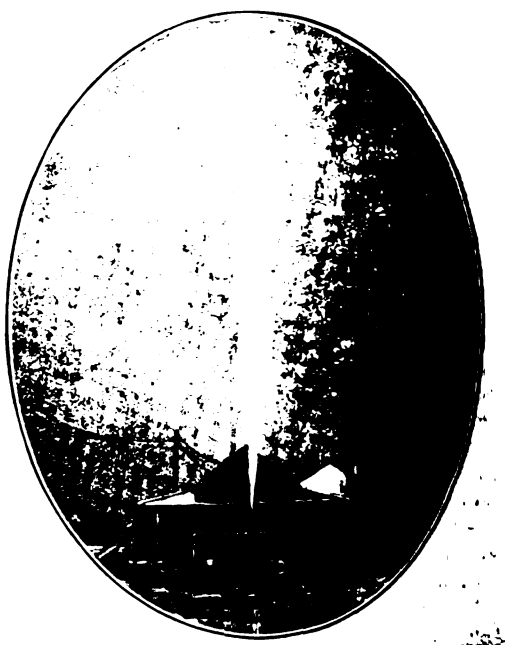
In certain instances where it was impossible to build a

Mr. P. V. Hunter, Chairman, Newcastle Section I.E.E.

transformer house, transformers up to 25 kw. are mounted on the poles, being usually suspended between two poles with channel iron supports.

Street Lighting Posts.—Three or four different types are in use. The drawing, fig. 22, shows one of the smaller types for 100 to 200-c.p. lamps, the largest size being used on the main streets for 1,000-c.p. lamps. Since these are all used in connection with underground cables, they have no great strain to withstand, and are, therefore, cast in two pieces, the top part being a plug fitting into a socket in the base.

It was at first thought desirable to cast these posts ver-



An Australian Water-Power Plant (see p. 696).

tically, in order that the hydrostatic pressure should cause the concrete to set under pressure, and therefore to reduce the height of the filling platform they were made in two parts. The system has answered perfectly, and no weakness whatever has shown at the joint—in fact, it cannot be detected.

The pole is cast hollow with a liner of very thin sheet zinc, which is left in position after casting. The reinforcement is of round iron bars kept in position by a spiral winding. The base is provided with an underground cable entrance and above ground a large door in one side, the

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door being of concrete and held in by dogs and a padlock fitting. Pieces of wood are cast in position inside for fixing switches, cable boxes, &c.

In conclusion, I would say that these concrete poles have to withstand a sun radiation temperature of 140° F. during the six months' dry season, and this is followed by six months' wet season. The poles that have been in use for eight years have shown no signs of deteriorating, and retain their clean colour and appearance.

THE I.E.E. LOCAL SECTIONS.

The proceedings of the Local Sections of the Institution of Electrical Engineers during the session which has just been opened must inevitably be to some extent under the clouds of war. Annual dinners are not to be held, though the President and others from headquarters will make an official visitation of each Section on suitable nights yet to be arranged. The youngest member of the family—the Western Section (Mr. David E. Roberts, chairman)—which has found it difficult enough to secure good meetings in normal sessions, does not expect to gather together at all, with its numbers depleted by war absentees. As our pages last week and this show, several of the chairmen have already delivered their opening addresses to their respective Sections—Mr. P. P. Wheelwright at Manchester, Mr. James Lowson at Glasgow, Dr. A. H. Railing at Birmingham, Mr. P. V. Hunter at Newcastle-on-Tyne, and Mr. Thomas Roles (Yorkshire Section).

Mr. P. P. Wheelwright (Manchester).

Mr. P. P. Wheelwright, who is the chairman of the Manchester Local Section of the I.E.E., and whose opening address appeared in abstract in our last issue, has been on the Committee of that Section for the last three years, during two of which he has occupied the vice-chair. For the greater part of his electrical career his interests have held him to Blackburn, where his pupilage was served under the late Mr. A. S. Giles. Prior to this, Mr. Wheelwright was apprenticed to the Phœnix Electrical and Mechanical Engineering Works at Derby, where he went through the shops, designing and drawing offices, and all the departments of a firm manufacturing engines, generators, and electrical apparatus. After the completion of his period with Mr. Giles, he went for a short time as shift engineer at the Blackpool and Fleetwood Tramroad generating station. From there he returned to Blackburn as a shift engineer, and after five years in that capacity he was appointed assistant mains superintendent; two years later he became mains superintendent, and subsequently chief assistant and deputy engineer. In 1904 he did what, we believe, few other supply engineers have done in this country—became "chief" in the works where many years before he had begun his electricity supply training. As chief electrical engineer and manager, he has since carried out all the extension work, &c., in connection with the Blackburn undertaking, including the addition of some 5,000 KW. of alternating-current plant, and the starting up of a three-phase distribution system at 6,600 volts, with sub-stations necessary for mill-driving, &c. At the present time the Corporation is proceeding, under Mr. Wheelwright's advice and supervision, with the building of a new generating station situated outside the town, such a station having become essential owing to the very rapid increase in the work of the department during the last five years.

Mr. James Lowson, V.D. (Scottish Section).

Mr. James Lowson, V.D., chairman for the current session of the Scottish Local Section of the Institution of Electrical Engineers, was born at Carnoustie, Forfarshire, and educated at the Dundee High School and the Royal Technical College, Glasgow. In 1895 he went into partnership with the late Councillor W. C. Martin, practising as W. C. Martin & Co., of Glasgow and London. The firm have specialised in steamship work and have gained a reputation which is practically world-wide. They have supplied and erected the complete electrical equipment of many of the largest steamships at present afloat, including the *Mauritania*, *Aquitania*, *Transylvania*, *Tuscania*, several well-known Dutch steamers, *Gelria* and *Turbantia*, the Austrian ship *Kaiser Franz Joseph I*, &c. The firm also carried out an important installation of dock lighting for the Clyde Trust. Mr. Lowson is a member of the Institution of Electrical Engineers; the Institution of Engineers and Shipbuilders in Scotland; the Electrical Contractors' Association; the Merchants' House, Glasgow; the Incorporation of Hammermen, Glasgow; Glasgow Chamber of Commerce, &c. He was for 25 years a member of the 1st Lanark Rifles (now 5th Scottish Rifles), retiring with the rank of Hon. Major. He was presented with the Volunteer decoration in 1910. Mr. Lowson's son, Mr. Norman C. Lowson, B.Sc., has joined the Special Reserve of the Royal Engineers, and is now in the Signal unit serving his country in France.

Mr. P. V. Hunter (Newcastle Section).

Mr. P. V. Hunter, the chairman of the Newcastle Section, has been for the past five years chief of the electrical department of Messrs. Merz & McLellan. He entered Faraday House in 1900, and after a successful period as a student there, he went to Messrs. Willans & Robinson, Ltd., for mechanical training, and subsequently began his electric supply experience in connection with the Yarmouth municipal undertaking. In 1903 he joined the staff of Messrs. Robert Hammond & Son, and later became assistant clerk of works during the construction of the Mansfield Corporation Electricity Works; he occupied a similar position with the Hackney Borough Council when it was extending its supply network. He first joined Messrs. Merz & McLellan in 1904, and about five years later took up the position that he now occupies with them. Since that date many large and important electrical engineering matters have passed through the firm's hands, including extensions at Carville power station, the building of Dunston power station, the laying of a complete system (200 to 300 miles) of 20,000-volt underground cables and overhead lines in Northumberland and Durham, the equipment of a number of waste heat and gas power stations, the electrification of the Melbourne suburban railways, and the Central Argentine and Buenos Ayres Western Railways, the installation of a 15,000-KW. turbo-alternator at Lot's Road, and the installation of the 25,000-KW. turbo-alternator for Chicago. Mr. Hunter is the inventor of the split conductor protective system, and of the "Repellant Arc" high power switch

Mr. Thomas Roles (Yorkshire Section).

Mr. Thomas Roles, who is chairman of the Yorkshire Local Section, entered the Institution as an associate member in 1901. Since 1912 he has been a member of the Local Committee. Some references to his career appeared in the Electrical Review for June 19th, 1914. He is, of course, city electrical engineer and manager of Bradford.

AN AUSTRALIAN WATER POWER PLANT.

We are well accustomed to the utilisation of water-power in large hydro-electric installations in the United States, Scandinavia, Canada, and elsewhere, but the station which we illustrate on page 694 is probably unique, as showing a reversal of the ordinary procedure. It is to be found at Thayo-mindah, Queensland, Australia, and was erected in 1895 under the authority of the Balloo Shire Council, in order to provide electric lighting in the vicinity. By the courtesy of Mr. G. A. Lewis, the engineer to the installation, we are able to give a few particulars of it.

A most interesting point is that the water-power is derived from an artesian bore well, which has a certified pressure when shut down of 270 lb. per sq. in., and a working pressure of 190 lb. per sq. in. when the jet is playing on a Leffel water wheel. In the illustration the power of the jet is shown by the column of water which is being allowed to escape. This source of power is being utilised to drive two dynamos, each of 10-KW. capacity, which supply current to a D.C. two-wire system comprising 80 50-C.P. metal-filament lamps, the number of consumers being 25, and the voltage at consumers' terminals 200 volts. There is no electricity supply for power purposes, and there is no gas in the neighbourhood, so that the price which is charged for lighting, namely, 1s. per week for each light, may be reckoned, under the circumstances, as a very reasonable and simple tariff.

On the Pounce.—The following extracts are taken from an outburst entitled: "While Europe Fights, America Prospers." By Herbert Kaufman, in a Chicago paper:—

It's here! Your chance has come. Half the world had to be blown off the map to produce the opportunity. More billions of pounds, francs and marks' worth of assets than the total created wealth of the world five hundred years ago had to be smashed to smithereens . . . to arrange matters for your benefit, but at all events you are one of the residuary legatees of the still vast, valid estate.

Now make good—you're nailed. We've always suspected you, but you were so confoundedly plausible with your excuses—so clever with your explanations of how you just missed it, that we gave you the benefit of the doubt and—another try. But you won't "get by" again, unless you produce the goods. . . . This is not an urge to capitalise our neighbours' woes. On the contrary, it is a suggestion to get busy and lighten them. The more we help ourselves, the quicker we analyse the situation and sensibly set about relieving the world-strain, the sooner we repair the universal tears and snags and patch up the broken machinery—the better off everybody will be. . . . . Shed a tear in the name of decency and humanity over the appalling tragedy, but in the name of good citizenship and good sense, simultaneously help devastated lands and your own country by spreading cheer among the blinded doubters whose pessimism is retarding a necessary and immediate boom.

By every law of logic and profit there shouldn't be a still wheel or a clean smoke stack on the whole Continent. By raising our production to its maximum limits, we can not only create enormous fortunes for ourselves, but at the same time so reduce costs that we can also lighten the misfortunes of our kinsmen yonder. History won't repeat the present performance in your lifetime. It's your best axe and biggest chance.

The spectacle of Mr. Kaufman pausing one second to shed a tear before he hurls himself upon the vested interests and established goodwill of the contending parties and prepares to create enormous fortunes "for ourselves" (*i.e.*, U.S.), if adequately portrayed would be worthy to rank with that immortal masterpiece, "George Washington Trying to Tell a Lie." Do our American cousins really relish these effusions? Or do they not rather feel uncomfortable when they see one of their compatriots (of German origin, too) prancing on his hind legs and whirling his arms in print in this undignified fashion?

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CONTRACTS OPEN and CLOSED.

(*Continued from page* 690.)

Spain.—Tenders have just been invited for the concession for the electric lighting of the town of Guadacanal (province of Seville) during a period of ten years; for the concession for the town of Palenzuela (province of Palencia) for six years; and for the town of Engera (province of Valencia) for four years.

November 27th. Tenders are being invited by the municipal authorities of Molina (province of Guadalajara) for the concession for the electric lighting of the town during a period of ten years.

November 28th. Tenders are being invited by the municipal authorities of Igualada (province of Barcelona) for the concession for the electric lighting of the town during a period of 10 years.

December 1st. The municipal authorities of Albuera (province of Badajoz) are inviting tenders until December 1st, for the concession for the electric lighting of the town during a period of six years.

Stockton-on-Tees. — November 20th. Corporation. Paper-insulated, lead-covered and armoured cables. See "Official Notices" November 13th.

South Africa.—December 17th. Five electric bed lifts for the Alexandra Hospital. Tenders to the Chairman of Tender Board, Provincial Auditor's Office, Cape Town. A specification and blue prints can be seen at the Board of Trade (C.I. Dept.) in London.

Wakefield.—December 4th. Yorkshire (W.R.) Electric Tramways Co., Ltd. Twelve months' supply of electric lamps, fittings, insulating materials, &c. Schedules can be obtained from the Central Offices, Belle Isle.

Walsall.—December 8th. Corporation. Six 250-KW. and one 500-KW. rotary converter equipments. See "Official Notices" to-day.

Wigan.—November 23rd. Uniform clothing for tramway men. Mr. Frank Buckley, General Manager.

Winchester. — December 17th. Corporation. One 500-KW., D.C. turbo-generator, with condensing plant, pipework, &c. See "Official Notices" to-day.

CLOSED.

Australia.—The following tenders have been accepted :—

P.M.G.'s Department, Victoria.—
Six miles paper-insulated cable, £144.—Callender's Cable and Construction Co., Ltd.

P.M.G.'s Department, South Australia.—
25 tons G.I. wire, £10 17s. 6d. per ton; 8 tons tie wire, £15 5s. per ton.—Rabone, Felz & Co.

Victorian Railways Department.—
Bessemer steel tram rails, £8 8s. 2d. per ton.—Elders Metal and Mercantile Pty., Ltd.
Vulcanised rubber E.L. wire, £14 8s. per mile.—B.I. & Helsby Cables, Ltd.

Sydney Municipal Council.—
Three 2,000-K.V.A. 33,000-5,000-volt transformers, £1,699 each.—Australian G.E. Co.
300 Nitro lamps, £2,197 10s.; 100 750-watt Nitro lamps, £732 10s.—Aust. G.E. Co.
—*Tenders.*

Dorset.—The Electrical Apparatus Co., Ltd., has received the renewal of the contract for meters for 12 months to the County of Dorset Supply Co.

London.—The following tenders have been received by the London Education Committee for installing electric lighting at three schools :—

	The "Victoria," Hammersmith.	Woolmore Street, Poplar.	Senior Street, Paddington.
Defries & Goldman (accepted)	£470	£210	£375
T. W. Vaughan & Co. (1914), Ltd.	318	260	409
Lawrence & Redman	325	254	—
Foote & Milne, Ltd...	314	263	500
J. & F. May	339	282	—
H. J. Cash & Co.	339	277	402
Kent & Co.	349	277	—
Tyler Apparatus Co., Ltd. ..	355	291	—
Smeeton & Page	370	287	—
Alpha Mfg. Co., Ltd.	381	250	—
G. Weston & Sons, Ltd.	395	320	444
Electra, Ltd.	405	349	—
Napier Kimber, Ltd.	—	274	—
Marryat & Place	—	402	—
A. Hawkins & Sons	—	—	419
R. H. & J. Pearson	—	—	479
Arthur Newman	—	—	484
S. G. Cozens	—	—	5.6

L.C.C.—The Highways Committee recommends that the reserve supply of coal for the Greenwich generating station be increased by 10,000 tons, and that the offer of Messrs. W. Cory & Sons, Ltd. (the present contractors), be accepted to supply the additional 10,000 tons of coal at the contract price, with an extra 1s. a ton to cover war risks. The company agrees to unload and stack the coal at the Purfleet wharf for a period of 12 months, and to reload the coal into barges and deliver to the Greenwich generating station as required by the Council at an additional sum of 4s. per ton. It is proposed that the Council shall have the option during the next 12 months of extending the arrangement for a further period of six years at such terms as may be agreed.

BERMONDSEY.—The Electricity Committee of the Borough Council has accepted the tender of the Bell's United Asbestos Co., Ltd., to supply 1,050 solid seamless asbestos gaskets, at 6s. 6d. per lb.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named :—

OFFICE OF WORKS.

Rewiring, 11 and 12, Downing Street.—H. J. Cash & Co.

POST OFFICE.

Protective apparatus.—Siemens Bros. & Co., Ltd.
Telegraphic apparatus.—Creed Bille & Co., Ltd.; Gell Telegraphic Syndicate, Ltd.
Telephonic apparatus.—B. I. & Helsby Cables, Ltd.; British L. M. Ericsson Manufacturing Co.; General Electric Co., Ltd.; London Electric Wire Co. & Smiths, Ltd.; Phœnix Telegraph and Electric Wire; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Telephone cable.—Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; London Electric Wire Co. & Smiths, Ltd; C. Macintosh & Co., Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Insulators.—Bullers, Ltd.; Doulton & Co., Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.
Copper wire.—London Electric Wire Co. & Smiths, Ltd.
Galvanised iron.—Rylands Bros., Ltd.; F. Smith & Co.; Wire Manufacturers, Ltd.
Laying line of stoneware ducts, steel tubes and cast-iron pipes, Birmingham-Sheffield.—Section I: T. Lowe & Sons.
Laying line of stoneware ducts, Birmingham-Sheffield.—Section III: T. Lowe & Sons.
Laying line of cast-iron pipes, Chichester.—O. C. Summers.
Laying lines of stoneware ducts and cast-iron pipes, Eastbourne.—W. L. Wallis & Co.; London—Sevenoaks, Section III.—J. Mowlem & Co.; Luton—St. Albans.—G. Powdrell; Thornaby—Stockton.—W. Irwin & Co., Ltd.
Manufacturing, supplying, drawing-in and jointing lead-covered cables. — Birmingham — Sheffield, Johnson & Phillips; Chelmsford—Colchester, Siemens Bros. & Co., Ltd.; Edinburgh—Forth Bridge, Siemens Bros. & Co., Ltd.; Glasgow—Kilmarnock, Siemens Bros. & Co., Ltd.; Liverpool—Ormskirk, B.I. & Helsby Cables, Ltd.; London—Sevenoaks, W. T. Henley's Telegraph Works Co., Ltd.; Luton—St. Albans—W. T. Henley's Telegraph Works Co., Ltd.; Oldham—Halifax, Western Electric Co., Ltd.; Ormskirk—Southport, B.I. & Helsby Cables, Ltd.
Supplying and installing electric lift, Belfast P.O.—J. McLean and Sons.
Telephone Exchange equipment, Darlaston P.O.—Western Electric Co., Ltd.
Telephone Exchange equipment, Merthyr Tydvil.—Western Electric Co.
Telephone Exchange equipment, Ryde P.O.—Peel-Conner Telephone Works, Ltd.
Telephone Exchange equipment extension, Sale.—Peel-Conner Telephone Works, Ltd.
Wiring for electric light, &c.—Birmingham P.O. Factory; Grindlay, Ross & Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Insulators W.P.—Bullers, Ltd.
Telegraph material.—Bullers, Ltd.
Telephones.—British L.M. Ericsson Manufacturing Co., Ltd.
Bronze wire.—Shropshire Iron Co., Ltd.
Copper wire.—Shropshire Iron Co., Ltd.
Galvanized iron wire.—Rylands Bros., Ltd.

INDIA OFFICE STORE DEPARTMENT.

Accumulators.—J. Stone & Co., Ltd.
Apparatus.—Elliott Bros.
Cable.—Peel-Conner Telephone Works; Siemens Bros. & Co., Ltd.
Ebonite.—India-Rubber, G.P. & Telegraph Works Co., Ltd.
Spare parts of electric plant.—Siemens Bros. Dynamo Works.
Switchboard.—Peel-Conner Telephone Works.
Switchgear.—Eckstein, Heap & Co.
Turbines.—Lancashire Dynamo Co.

Loftus.—The U.D.C. has accepted the tender of Messrs. Cox-Walkers, of Darlington, for the electric installation at the Council Chamber.

Ruthin and Marlboro'.—The tenders of the Premier Accumulator Co., Ltd., have been accepted for the supply of batteries for both of these electricity works.

Taunton.—The T.C. has accepted the tender of Messrs. Cory Bros., Ltd., for from 2,000 to 3,000 tons of coal (Russell's new black vein washed beans), for the electricity works, at 17s. 3d. per ton.

Tunbridge Wells.—The Lighting Committee recommends the tender of the Western Electric Co., Ltd., for cables for a period of three years, for acceptance.

Woolwich. — The B.C. Electricity Committee has accepted the following tenders :—

Two lift pumps, £127.—Messrs. Gwynnes.
Two feed water tanks, £46.—Harvey & Co.
Rolled-steel joists for the 3,000 KW. set, £21 15s.—Measures Bros.
One meter and two feeder panels, £266.—Ferguson, Pailin & Co.

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FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, November 20th. At 8 p.m. At Storey's Gate, S.W. Paper on "The Effect of Vacuum on Steam Turbines," by Mr. G. G. Stoney, F.R.S.; Thomas Hawksley lecture on Pumping and other Machinery for Waterworks and Drainage.

North-East Coast Institution of Engineers and Shipbuilders.—Saturday, November 21st. At 7.15 p.m. At Bolbec Hall, Westgate Road, Newcastle-on-Tyne. Paper on "Lighthouses and Lightships," by Mr. C. Suckan.

Faraday Society. Monday, November 23rd. At 8 p.m. At Rooms of Chemical Society, Burlington House, Piccadilly, W. President's address by Sir R. Hadfield, F.R.S.

Royal Society of Arts.—Wednesday, November 25th. At 8 p.m. At John Street, Adelphi. Paper on "The Supply of Chemicals to Great Britain and her Dependencies," by Sir W. A. Tilden F.R.S.

Greenock Electrical Society.—Thursday, November 26th. At 7.45 p.m. At Masonic Rooms, 21, West Stewart Street. Papers on "The Oscillograph," and "The Gyroscope and Gyroscopic Control," by J. A. Kinnaird.

Institution of Electrical Engineers. Thursday, November 26th. At 8 p.m. At Victoria Embankment, W.C. Paper on "Power Plant Testing," by Mr. W. M. Selvey.

(Birmingham Local Section).—Wednesday, November 25th. At 7.30 p.m. At the University, Edmund Street. Paper on "Power Plant Testing," by Mr. W. M. Selvey.

Physical Society. Friday, November 27th. At 5 p.m. At Imperial College of Science, South Kensington, S.W. Papers on "Notes on the Conduction of Electricity at Point Contacts," by Mr. A. F. Hallimond, and "Thermal Conductivity of Badly Conducting Solids," by Mr. T. Barratt.

Junior Institution of Engineers.—Friday, November 27th At 8 p.m. At 39 Victoria Street, S.W. Paper on "A Model Drawing Office System," by Mr. C. E. Ford.

Association of Mining Electrical Engineers (Lancashire, Cheshire and North Staffordshire Branch). Saturday, November 28th. At 3.30 p.m. At Wigan Mining and Technical School. Joint meeting with the Colliery Managers' Association (Lancashire Branch).

Association of Supervising Electricians.—Saturday, November 28th. At 6.30 p.m. At London Tavern. Inaugural Dinner.

NOTES.

Institution and Lecture Notes.—Greenock Electrical Society.—The syllabus of the above Society for the Session 1914-15 includes:—

1914.—November 26th.—"The Oscillograph," "The Gyroscope and Gyroscopic Control," by J. Aitken Kinnaird.
December 5th.—Visit to Coplawhill Car Works and sub-station of the Glasgow Tramways.
" 10th.—"The Electrical Equipment of a Liner," by J. E. Allan.
" 24th.—Social Meeting.
1915.—January 7th.—"Developments in the Electrical Industry," by D. McDougall.
" 14th.—Visit to Babcock & Wilcox's Works, Renfrew.
" 21st.—"Electricity in a Shipbuilding Yard," by D. Angus.
February 4th.—"Illumination," by F. B. Humphriss.
" 18th.—Visit to Royal Technical College, Glasgow.
" 18th.—"Diesel Engine Testing and Running," by J. Richardson.
March 4th.—"The Operation of a Large Electric Supply System," by G. Macdonald.
" 18th.—Visit to Mavor & Coulson's Works, Glasgow.
" 18th.—"Suction Gas Plant," by E. P. Duckworth. General Meeting.
April 2nd.—Social Meeting.

Royal Society of Arts.—The opening meeting of the Session was held on Wednesday evening, when an address was delivered by Colonel Sir Thomas H. Holdich, R.E.

Among the papers to be read before Christmas are:—

Wednesday evenings, at 8 o'clock:—
November 25th.—Sir W. A. Tilden, D.Sc., F.R.S., F.C.S., "The Supply of Chemicals to Britain and her Dependencies."
December 2nd.—W. R. Ormandy, D.Sc., F.C.S., "Britain and Germany in Relation to the Chemical Trade."

The following papers are to be read after Christmas:—

Thomas Worthington, "The Work of the Commercial Intelligence Branch of the Board of Trade."
T. Thorne Baker, "The Industrial Uses of Radium."
G. W. Hulme, "Patent Law."
W. T. Thornton, "The Industrial Uses of Coal Gas."
J. A. Hunter, "The Textile Industries of Germany and of Great Britain."
Dr. F. Mollwo Perkin, "Oils, their Production and Manufacture." Three lectures, January 18th, 25th, February 1st.
M. H. Baillie Scott, "House Building—Past and Present." Three lectures, March 15th, 22nd, 29th.
Prof. Vivian B. Lewes, "Motor Fuel." Three Fothergill Lectures, February 15th, 22nd, March 1st.

Institution of Electrical Engineers.—According to the programme of the YORKSHIRE LOCAL SECTION for the Session just commencing, general meetings will be held at the Philosophical Hall, Leeds, on the following dates:—December 2nd, January 13th, February 10th, March 10th, April 14th. Annual General Meeting May 12th.

At the meeting on November 17th Mr. C. J. Beaver read his paper on "Cables" before the MANCHESTER LOCAL SECTION. The discussion was closed.

At the meeting of the BIRMINGHAM LOCAL SECTION on Wednesday last, the Chairman, Dr. A. H. Railing, delivered his inaugural address.

Royal Society.—The following awards have been made by the President and Council:—The Copley Medal to Sir Joseph Thomson, O.M., F.R.S., for his discoveries in physical science. The Rumford Medal to Lord Rayleigh, O.M., F.R.S., for his numerous researches in optics. The Hughes Medal to Prof. John S. Townsend, F.R.S., for his researches on electric behaviour of gases.

Physical Society of London.—The Council has decided not to hold an exhibition of apparatus during the present Session.

Junior Institution of Engineers.—At a recent meeting Mr. F. D. Evans, A.M.Inst.C.E., Executive Engineer, Public Works Department, Federated Malay States, discoursed on the topic "The Engineer and Malaria." He said that the most certain way of getting rid of mosquitoes was to do away with all water containing refuse in vessels, or properly to screen in or close such vessels, and thoroughly drain land. It was most necessary for engineers carefully to consider the probable effects of malaria on the labour force to be employed on any new work in a malarious country, and to employ what precautionary measures were practicable, as otherwise they might be faced with an appalling death and wastage rate when the work was in progress.

Royal Institution.—The Eighty-Ninth Christmas Course of Juvenile Lectures will be delivered this year by Prof. C. V. Boys, F.R.S., his title being "Science in the Home." The lectures will be experimentally illustrated, and the subjects are as follows:—"Mechanics in the Home," Tuesday, December 29th; "Chemistry in the Home," Thursday, December 31st; "Fluids in the Home," Saturday, January 2nd; "Heat in the Home," Tuesday, January 5th; "Electricity in the Home," Thursday, January 7th; "Light in the Home," Saturday, January 9th. The lecture hour is 3 o'clock.

Victorian Institute of Electrical Engineers.—The Institute has decided to admit as full members persons under 30 years of age, who are only eligible as associates. The maximum age of students has been fixed at 25, instead of 23.

Association of Supervising Electricians.—At a meeting on the 10th inst., a paper was read by Mr. H. C. E. Jacoby on "A.C. Commutators." The hon. sec. announced that the next paper, on "Wiring Systems," would be read on December 15th, and also drew attention to the inaugural dinner to be held on the 28th inst. By the courtesy of the Central London Railway Co., the members of the above Association paid a visit to the Paddington-Bakerloo Station to examine the working of the escalators, the whole of the apparatus being thoroughly explained by their inspector, Mr. Lindsay. Afterwards the company conveyed the members to Edgware Road Station to examine the Ozonair plant. The visit proved most interesting and instructive.

Birmingham and District Electric Club.—On Saturday last a paper on gas turbines was read by Mr. W. Fennell, who stated that a great amount of experimental work was being carried out.

Illuminating Engineering Society.—On Tuesday, December 1st, at the House of the Royal Society of Arts, John Street, Adelphi, W., a discussion on "Illuminating Engineering in War Time: Some Lessons to be Learned from the Present Lighting of London," will be opened by Mr. Leon Gaster.

Association of Mining Electrical Engineers.—At a meeting of the WEST OF SCOTLAND BRANCH last week, Mr. L. G. F. Routledge read a paper on "Power Factor and Its Improvement." A paper on "Rock Drills," by Mr. C. E. Hart, was also discussed.

Inside Out.—The Appeal Court has, this week, been called upon to consider a decision of a Metropolitan magistrate to the effect that the top-covered compartment of a tramcar is really the inside as much as the inside under the Acts. The Court has turned the decision of the said magistrate inside out, or upside down, by ruling that the outside is the outside none the less because the putting of a top-cover on the outside makes it an inside. This being so, it was perfectly right to summon a conductor who allowed overcrowding on the top-deck. Really, to more simple-minded creatures than magistrates, it does seem strange that it should have been necessary to trouble the Court of Appeal with the problem of whether and when a top-deck ceases to be a top-deck.

Hughes Induction Balance in Surgery.—In a note communicated to the Académie des Sciences, Mr. G. Lippmann draws attention to the utility of the Hughes induction balance for locating metal in military surgery. The balance consists of a battery and interrupter, in series with two primary coils, on which are wound secondary coils connected in series with a telephone; the leads are crossed, and the coils are exactly alike, so that normally their effects are exactly neutralised, and no sound is heard in the telephone. When, however, a metallic body is placed near one of the coils, the eddy currents induced in the metal react upon the coil and disturb the balance, so that a sound is heard in the telephone. When the metal is magnetic, as in the case of splinters of shell or German bullets, the effect is much increased. Thus the device can be used to indicate the presence, and to some extent the nature, of a metallic body, and its approximate position.

Fatality.—ROTHERHAM.—A Sheffield paper reports that a motor attendant named Hopkinson, 18, met with his death at the Rotherham Main Colliery. He was engaged in the wash-house at the coke ovens, when an electric wire fused and ignited a bucket of benzol. Hopkinson got hold of the bucket to pull it away from the switchboard, and his clothing caught fire. He was severely burnt, and was removed to the Rotherham Hospital, where he died.

For Sale.—The Shropshire, Worcestershire and Staffordshire Electric Power Co., Downing Street, Smethwick, invite offers for eight motors, suitable for 200 v. 50 amps. two-phase supply system, also three spare rotors. Particulars are given in our advertisement pages to-day.

Appointments Vacant.—Junior assistant electrical engineers (15s.), for Newcastle-on-Tyne Electric Supply Co.; fitter driver (35s.), for Sevenoaks and District Electricity Co.

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Definition of Consumer's Terminals.—A correspondent, who has had occasion to investigate the application of the Board of Trade Regulations to service lines, writes indignantly complaining that the Board is unable or unwilling to interpret its own rules. We understand that he sent a diagram of his installation, which we reproduce in outline, to the Board with the following questions:—

Is A the consumer's terminal box, or is it the Corporation's cut-out?

Is A for the protection of the undertaker's mains?

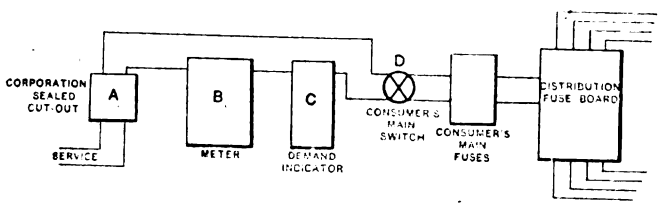
If A is the consumer's terminal box, is the demand indicator C in its correct position as required by the Board of Trade; the maximum demand indicator being the property of the Corporation, and used by them solely for their own purpose?

D. Would this switch be the point at which undertaker's service terminates? if not, where does undertaker's service terminate?

Consumer's main fuse.—Is this for the protection of consumer's house?

His own reading of the rules is that A is the Corporation's cut-out; that according to the rules C may only be placed on the undertaker's side of consumer's terminals, and that the position of this, therefore, governs the point of consumer's terminals, *i.e.*, switch D.

The Corporation's electrical engineer maintained that A was the consumer's terminal box, and that C was in its correct position, *i.e.*, in accordance with the Board of Trade's rules and regulations.



We may add that in addition to the Corporation cut-out shown, there is no other cut-out on the service, and the meter and indicator are the property of the Corporation.

The reply of the Board of Trade was a suggestion that our correspondent should consult his legal and technical advisers with regard to the questions raised.

Reference to the Board of Trade regulations has not enabled us to decide where the service terminates and the consumer's installation begins. Regulation No. 26 states that a sealed safety fuse must be inserted in each service line within a consumer's premises as close as possible to the point of entry; clearly, therefore, the meter and indicator cannot be fixed on the Corporation side of the cut-out A. Nevertheless, it is provided that such instruments must be between the mains of the undertakers and the consumer's terminals. We understand that the Corporation engineer absolutely prohibits a main fuse for a private house other than the main cut-out which the Corporation seals and controls. Is not this requirement *ultra vires*?

We should be glad if our supply station readers would give us an authoritative decision on the points raised.

National Relief Fund.—In aid of the Prince of Wales's Fund, Messrs. Raphael Tuck & Sons, Ltd., are about to issue a "National Christmas Card," which will be sold entirely for the benefit of the Fund. A picturesque group of "Defenders of the Empire," in colours, appears on the cover, and a view of a Dreadnought saluting Nelson's *Victory* inside. It is an artistic and appropriate production, and should prove a popular means of adding to the Fund.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Swinton and Pendlebury District Council has increased the salary of MR. BUSBRIDGE, electrical engineer, to £200, as from December 1st.

On the occasion of his marriage to Miss Edith May Gregory, of Barnstaple, MR. JOHN JAMES HERITAGE, of the Coventry Corporation electricity staff, has been presented by his colleagues with a silver tea-set.

Having received another appointment, MR. ARTHUR COVENEY, manager of the Erith U.D.C. tramways and chief engineer at the E.L. works, has resigned.

MR. F. RILEY, power station superintendent at the Rawtenstall electricity works, has been appointed resident engineer to the new Whalley Asylum, at a salary of £275 per annum. There were 470 applicants. Mr. Riley has been with the Rawtenstall Corporation five years, and was previously with the Stalybridge Joint Board, Ashton-under-Lyne Corporation, Blackburn Corporation, and Lancashire United Tramways in their power stations.

General.—MR. P. WALTER D'ALTON, M.Inst.C.E., M.I.Mech.E., M.I.E.E., than whom there are few more widely known and more highly esteemed in the electrical engineering world to-day, has left Messrs. Dick, Kerr & Co., Ltd., with the entire sympathies of the directors, and has opened offices at Cross Keys House, 56-58, Moorgate Street, London, E.C. (Telephone No. 1055 London Wall), where he will practise as a consulting and inspecting engineer. It has been our privilege to know Mr. d'Alton personally for very many years; indeed, his direct connection with electrical affairs dates back to as long ago as 1889, when he joined Mr. S. Z. de Ferranti, taking charge for him of the Deptford 10,000-volt undertaking. Earlier than that, however, he was actively engaged in engineering work of what in those days was as daring a kind in the marine sphere as Mr. Ferranti's proposals were in the electrical, for after being trained as a marine and mechanical engineer with Messrs. R & W. Hawthorne on Tyneside and under the late Sir William White, his engineering godfather and great friend, he spent several years in submarine work under Mr. Thorsten Nordenfelt from 1886 onwards. It may be remembered that the first of the Nordenfelts was built for the Greek Government, her capabilities being demonstrated in the Gulf of Salamis. The second and third boats were built for the Turkish Government, by which they were taken over after exhaustive experiments in the Golden Horn and the Sea of Marmora. Mr. d'Alton was wrecked in the last of the four Nordenfelt submarines, a boat of 300 tons displacement, and having main engines of 1,500 H.P., off the coast of Jutland, while on a voyage to Kronstadt, for delivery to the Russian Government which, after experiments and demonstrations at Spithead, in the Solent and in the English Channel, had bought her. It was in 1889 when Mr. Ferranti was in need of efficient assistance that circumstances brought Mr. d'Alton into touch with him, and if the truth were told the experience under water doubtless was not without its influence upon the mind of the high-tension pioneer of Deptford when operations calling for courage, initiative and persistency were under consideration. In 1892 Mr. d'Alton succeeded Mr. Ferranti as engineer-in-chief of the London Electric Supply Corporation, Ltd., and occupied that position until the year 1900. We were then engaged in the South African war, and for the greater part of that year Mr. d'Alton was at Aldershot in reserve with the 6th Battalion of the Royal Irish Rifles, with the rank of Major. He has at various times served with the Yeomanry, Volunteers, Territorials and Regulars, retiring, at the end of 1910, when Second-in-Command of the "London Irish," with the rank of Lieut.-Colonel. On the disembodiment of the (Louth Militia) 6th Royal Irish Rifles at the end of 1900, he became engineer-in-chief of the Central London Railway, and two years later he relinquished that office in order to join Messrs. Dick, Kerr & Co., Ltd., taking charge of the very important work connected with the electrification of the Lancashire and Yorkshire Railway. While thus engaged he was also chief mechanical engineer for the same firm, and in that capacity he had through his hands much noteworthy engineering work for abroad (Holland, Spain, Portugal, Egypt, &c.), and especially work of a pioneering character in South America. From the foregoing it will be apparent that Mr. d'Alton has had an exceptionally wide and varied experience, and in his new operations he will bring abilities of a very high order to bear upon civil, electrical and mechanical engineering work. He will make a special feature of representation work in connection with all departments of engineering in Russia, where British manufacturers are justified in expecting to be called upon to execute engineering works and requirements on a very large scale after the war is over. We are sure that Mr. d'Alton's host of friends will join with us in wishing him that measure of success which his genial nature, unvarying courtesy, tactfulness and unique experience as an engineer, and as a man of affairs, so fully deserve.

After an absence of 12 months, MR. C. HIGHAM has been re-elected a member of the Blackburn Town Council. On Mr. Higham's retirement MR. ALDERMAN A. NUTTALL, J.P., was appointed vice-chairman of the Electricity and Tramways Committee in his stead. The latter has now relinquished the post in order to allow Mr. Higham to take over his former position. ALDERMAN W. THOMPSON, chairman of the Electricity and Tramways Committee, has been appointed Mayor of the Borough.

The new chairman and deputy-chairman of the Leeds Corporation Tramways and Electricity Committee are ALDERMAN SMITHSON and ALDERMAN J. BROWN. The chairman and deputy-chairman of the Street Lighting Committee are COUNCILLOR WATSON and ALDERMAN THAXTON.

The new chairman and deputy-chairman of the Bradford Corporation Electricity Committee are MESSRS. J. HALEY and J. HOYLE. The chairman and deputy-chairman of the Tramways Committee are MESSRS. E. PRIESTLEY and S. NEUMANN.

The *Commonwealth Engineer* for October 1st contains the following news of the movements of Australian electrical men:—MR. S. B. COX, of the Sydney staff of the Australian General Electric Co., returned by the ss. *Niagara* last month from a seven months' holiday tour, covering Europe, the United Kingdom, and the United States of America. MR. EDWARD HIRST, managing director of the British General Electric Co., Ltd., returned to Sydney last month after a short visit to Europe. MR. NORMAN NEVILLE, who has been with the Union Electric Co. of Australia, Ltd., for the past three years, left for London, *via* America, by the ss. *Sonoma* on September 26th, for the purpose of arranging British sources of supply for the company's Australian business.

Alderman A. G. Ellaway has retired from the chairmanship of the Birmingham Electric Supply Committee, which he has held for several years. He is succeeded by ALDERMAN A. R. JEPHCOTT, who joined the Committee upon its formation 10 years ago.

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Mr. Geo. S Helme, A.M.I.E.E., who is at present representative in Scotland for the Electrical Co., Ltd., has resigned his appointment with that company as from the end of the present year.

Obituary.—Mr. Augustus Stroh.—We much regret to record the death of Mr. Augustus Stroh, which took place on November 2nd, at his residence at Haverstock Hill. The deceased gentleman was in his 87th year. An account of his career, together with a photograph taken by himself, appears in *Engineering* for Friday last. John Matthias Augustus Stroh was born at Frankfort-on-Main in May, 1828, where he served an apprenticeship in the clock and watch-making trade. His aptitude and skill in this class of work proved to be remarkable, and eventually gained for him the titular distinction (amongst his friends) of "the Prince of Mechanicians." In 1851 (the year of the Great Exhibition) he became a resident in England, becoming a naturalised British subject in 1869. Mr. Stroh was from the earliest times closely associated with the late Sir Charles Wheatstone, and it is not too much to say that the inventions which developed in the fertile brain of that distinguished physicist owed their partial development to the mechanical genius of Mr. Stroh. Of the ingenuity and skill of Mr. Stroh in devising what were practically entirely new mechanical devices and movements, is now known only to a few, but those who know can never forget the "prettiness" of some of the devices invented by him. The mechanism of the "A. B. C." instrument (although this form of apparatus has almost entirely now gone out of use), was alone a model of mechanical skill, whilst the "Wheatstone Automatic system," which, although first devised many years ago, still survives and flourishes, is an enduring monument of both Wheatstone's and Stroh's genius, Mr. Stroh being awarded a gold medal for the same at the Paris Exhibition of 1878. Amongst other inventions Mr. Stroh, in conjunction with Sir Chas. Wheatstone, introduced a new system of magneto-electric clocks, which, although no longer in use, were, in their design and principle, of very great ingenuity. In 1860 Mr. Stroh established in Tolmer's Square a factory for the manufacture of the Wheatstone and Stroh instruments and for developing his other inventions. These works were taken over by the General Post Office in 1880, when he retired from active commercial work. When the first phonograph was introduced into England by the late Sir W. H. Preece, Mr. Stroh produced an instrument of very perfect construction, the motor and moving parts being absolutely silent, and the speed perfectly uniform. Mr. Stroh designed and constructed a series of extremely beautiful instruments by which he repeated in air Prof. Bjerknes's experiments in liquids on the attraction and repulsion due to vibrations, which were described in the Electrical Review at the time. He was most successful as a photographer and produced beautiful work in portraiture and in landscape, in stereoscopic and colour photography. Mr. Stroh was a member of the Institution of Electrical Engineers (of which he was a member of Council for several years), of the Royal Institution, the Physical Society, and of the Société Internationale des Electriciens of Paris, and he was a juror for a number of International Exhibitions. One of his latest inventions, based no doubt on the phonograph, was the violin known to musicians as the "Stroh Violin," which was unlike, say, a "Strad," as could well be imagined. The body consisted of a cylindrical rod, with an ordinary neck and finger-board at one end, the tail piece and chin rest at the other, with the bridge and four strings as on a violin. The vibrations of the strings were conveyed by means of the bridge, which rested upon a rocking or bell-crank lever, to a diaphragm to which was attached a trumpet or resonator underneath the body, which latter was in no way employed for sound purposes. The diaphragm represented the vibrating belly of an ordinary violin, and when the strings were set in motion the rocking lever transmitted the vibrations to the diaphragm, which, in turn, set in motion the air contained in the resonator, and a great volume of sound resulted. The mechanism was simplicity itself, could never get out of order, and was practically indestructible, but the peculiarly metallic timbre of the instrument, so far as we are aware, could never be entirely eliminated.

Will.—The late Mr. Robert Kaye Gray, past president of the Institution of Electrical Engineers, and managing director of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., who passed away in April last, left £62,959 gross and £45,870 net personalty.

NEW COMPANIES REGISTERED.

Defries & Goldman, Ltd. (138,300).—This company was registered on November 13th, with a capital of £2,000 in £1 shares, to take over the business of electrical engineers and factors carried on at Albion House, New Oxford Street, W.C., as Defries & Goldman, and to adopt an agreement with H. Defries and H. L. Goldman. The subscribers are:—N. Goldman, 80, Bishopsgate, E.C., director, 50 shares; W. Richards, Albion House, New Oxford Street, W.C., financial agent 1 share. Private company. The number of directors is not to be less than two or more than ten; the first are H. Defries and H. L. Goldman (both permanent). Registered office, Albion House, New Oxford Street, W.

British Arc Welding Co. (Scotland), Ltd. (9,265).—This company was registered in Edinburgh on November 12th with a capital of £10,000 in £1 shares, to acquire a process for electrical welding to be given by The British Arc Welding Co., Ltd., and to carry on the business of ship repairers, shipwrights, contractors, etc. The subscribers (with one share each) are:—R. S. Kennedy, 41, Howitt Road, Belsize Park, London, N.W., engineer; J. Kennedy, 11, Fellows Road, South Hampstead, N.W. Private company. The number of directors is not to be less than two or more than six; the first are not named. Qualification, £200.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electric Hose & Rubber Co., Ltd.—Charge on the company's undertaking and property, present and future, including uncalled capital (if any), dated 3rd November, 1914, to secure all moneys due or to become due from the committee to London County and Westminster Bank, Ltd., 41, Lothbury, E.C., stamped to cover £1,500.

Chipping Norton Electric Supply Co., Ltd.—Notice is given that the debentures dated 20th October, securing £4,000, were not issued, and were cancelled by resolution of the directors dated 10th November, 1914, and the resolutions under which the same were authorised and created were rescinded.

Yorkshire Incandescent Electric Lamp Co., Ltd.—Issue on 24th November, 1914, of £3,000 debs., part of a series of which particulars have already been filed.

Llangefni Electric Light & Power Co., Ltd.—Capital, £3,000 in £1 shares (2,750 pref. and 250 ord.). Return dated April 15th (filed September 5th), 1914; 2,566 pref. and 250 ord. shares taken up; £2,566 paid; £250 considered as paid. Mortgages and charges: £1,900.

Fredk. Jones & Co., Ltd.—Capital, £15,000 in £1 shares Return dated July 6th, 1914; all shares taken up; £7 paid; £14,993 considered as paid. Mortgages and charges: Nil.

W. R. Sykes Interlocking Signal Co., Ltd.—Capital, £50,000 in 10s. shares (87,500 "A" and 12,500 "B"). Return dated September 30th, 1914; 42,297 "A" and 12,500 "B" shares taken up; 3s. 9d. per share called up on 42,297 "A" shares; £7,936 18s. 9d. paid (including £6 5s. paid in advance of calls); £16,824 5s. considered as paid (being 10s. per share on 12,500 "B" and 5s. per share on 42,297 "A"). Mortgages and charges: £12,500.

Thos. W. Ward, Ltd.—Capital, £450,000 in £1 shares. (150,000 pref.). Return dated October 12th, 1914; 150,000 pref. and 263,814 ord. shares taken up; £233,814 paid; £180,000 considered as paid. Mortgages and charges: £88,717 3s. 11d.

Brecknell, Munro & Rogers, Ltd.—Capital, £20,000 in 2,000 pref. shares of £5 each and 20,000 ord. shares of 10s. each. Return dated May 8th, 1914; 14,829 ord. and 1,058 pref. shares taken up; 10s. per share called up on 767 ord. and £5 per share on 1,058 pref.; £5,673 10s. paid; £7,031 considered as paid on 14,062 ord. shares. Mortgages and charges: £2,661 18s. 8d.

CITY NOTES.

Amazon Telegraph Co., Ltd.

Mr. George Keith (chairman and managing director) presided on Tuesday at the twentieth ordinary meeting, held at 42, Cannon Street, E.C.

In moving the adoption of the report, the Chairman said he regretted to say the income of their business fell very short of what it was last year. The scarcity of money, due to the severe fall in the price of rubber, had very seriously affected the trade of Manaos, which was the terminal station of their cables, and the principal source of their revenue. During the first three months commencing July last year the financial crisis led to a considerable increase in the traffic passing over their cables, but, onwards unfortunately for them, trade in general became very depressed and stagnant, and their traffic fell off in consequence during the remainder of the year. The traffic receipts showed a decrease for the whole year of £23,105, whilst interest on investments and the year's cash balance brought in £442 more. The total revenue, including subsidy and transfer fees, amounted to £82,751, or £22,915 less than last year. On the other hand, there had been a satisfactory saving in the expenditure. Station expenses showed a general decrease under the various items of £1,871. The expenses of maintenance of cables also showed a large decrease of £5,068, due principally to the fewer repairs being required by the cables, and to less cable having been used for that purpose during the year. The expenses of the *Viking*, including the cost of the extensive repairs she underwent, were also less. The *Viking* was laid up for that purpose nearly six months, and the *Ramos* did cable repairs during that time, which accounted for the increase in her expenses. Insurance and other miscellaneous expenses were also lower. Income-tax was £482 more, and the aggregate of the other charges came out £174 less. Altogether the working expenses amounted to £52,460, or £6,631 less than last year. After meeting these expenses and providing £22,966 for debenture interest and sinking fund, the directors recommended the payment of a dividend of 3 per cent., less income-tax, and the carrying forward of £5,840, as compared with £5,571 brought forward into the year's accounts. Their business was now suffering badly from the dislocation of trade due to the European war, and the outlook for the present year was anything but bright, but recent reports stated that trade in the Amazon was again beginning to show some signs of recovery. The cost of collecting rubber was being reduced to meet the lower price, and more attention was being given to the cultivation of fruit and other produce, and to the rearing of cattle. All this should no doubt in time further reduce the cost of rubber production, and add to the prosperous condition of the Amazon, and he thought they could still look forward to better business when the terrible war was over.

Mr. Ellice Clark seconded the motion.

Replying to a shareholder, the Chairman said he believed there were some signs of rubber being planted, but there was no mention of it in the latest Consular reports. He should have thought the planting of rubber in a place where it grew wild would be profitable.

The motion was carried.

On the resolution for the payment of the dividend, the Chairman said that the recommendation to pay it less income-tax was an innovation.

Mr. Ellice Clark said the idea of the board was to make the carry forward as large as possible.

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Edison & Swan United Electric Light Co., Ltd.

Mr. C. J. Ford (Chairman) presided at the annual meeting at Winchester House, E.C., on Monday.

The Chairman, in proposing the adoption of the report, first dealt with the balance sheet, and said sundry creditors had risen from £36,000 to £48,000. This was in consequence of the increased business which the company had transacted during the year and was in respect of larger quantities of raw material and goods purchased. Loans, which previously stood at £20,000, now appeared at £7,000. On the credit side, their investments had been reduced from £58,346 to £10,643. This was wholly in respect of sales during the year of their interest in the Altrincham Electric Supply Co., Ltd. Last year he mentioned that the directors were proposing to take steps to dispose of a portion of their interest in that concern. As the shareholders were aware, they had sold the whole of the debentures, and, since he last addressed them, they had sold a portion of the 6 per cent. preference shares. As they were aware, the company held 33,346 ordinary shares in the Altrincham Co., and considering the substantial profits earned by it during the last few years, and the very favourable prospects for the future—the last dividend being at the rate of 8 per cent. per annum—they felt that these shares ought to be realisable at a figure considerably in excess of their face value; but the difficulty was to carry this into effect. They therefore got the Altrincham Co. to convert the whole of this ordinary share capital into 6 per cent. cumulative preference shares, and in consideration of the shareholders agreeing to limit their dividend to that rate they were offered the opportunity of subscribing at par for a 1s. deferred share in respect of each five ordinary shares held. These deferred shares were entitled to the remaining surplus profits after the payment of 6 per cent. upon the preferred capital, and their holding of deferred shares now amounted to 6,669, which shares they considered a valuable asset, although in the balance sheet they were only included at the amount paid for them, viz., £333. They were fortunate in disposing of the preference shares at par before the commencement of the war. In addition to the fully-paid preference, they held 5,000 similar shares partly paid, and they proposed to dispose of the whole of these as occasion offered. Of course, they had to pay the ordinary broker's commission upon the sale and there were other necessary expenses in connection therewith and the disposal of the debentures, all of which had been written off to profit and loss. Freehold and leasehold property stood at £65,846 against £69,346 last year, a reduction of £3,500. This difference was accounted for by the amount represented by the Benwell works, which had now been sold, and depreciation written off the remaining properties. Fixtures, fittings and office furniture had been increased from £4,456 to £10,247. This increase was represented by the expenditure upon the new show-rooms and offices in London and the depôts in the provinces. Plant and machinery had slightly increased by additions to the Ponders End works, all renewals having been charged against revenue. The stocks had been increased by, approximately, £32,000, which was accounted for by the general expansion of the company's trade, and sundry debtors were also higher by reason of the increase of the company's turnover. They had brought their goods prominently before the public by means of advertising, both by posters and in the newspapers, and during the past year the expenditure under this heading had been considerable, but he was pleased to be able to say that the result obtained had in every way warranted this expenditure. Probably during the current year the amount so to be expended would be somewhat reduced, as they found that at the present moment the works were very full of orders, and it might not be necessary, therefore, to incur such a heavy expense for the time being, but this, of course, was a matter which they were carefully watching. Up to the present he was pleased to say they had not felt any ill-effects from the war, excepting that they found, in common with all other traders, some difficulty in collecting accounts. The war had had one beneficial effect on them. It had stopped the importation of German lamps, etc., which were previously dumped here in large quantities, and he only hoped that after the cessation of hostilities the British public would continue to decline to purchase these German goods, and whole-heartedly support British manufacturers like themselves. Taking the accounts as a whole, he hoped the shareholders would agree that they were a great improvement on those of the previous year. Turning to the profit and loss account, they would notice that the amount brought to the credit from trading account a year ago was £17,603, whilst now it amounted to a considerably higher figure, viz., £51,244. Of course, he was aware that previously certain expenditure which was now shown in the profit and loss account was charged direct to trading account, but still, after allowing for this, there was a very great improvement, particularly in view of the fact that profit and loss had been debited with over £21,000 in connection with the new London show-rooms, provincial branches, the realisation of the Altrincham securities, and the removal of the clerical staff offices to the Ponders End works, advertising, etc., the greater part of which had not been incurred previously. On the other hand, the accounts before them did not include any benefit from the opening of the new London show-rooms, as owing to the long-continued building strike it was not possible to commence business until after the date of the period covered by the accounts; but he was pleased to say that the extensive display of modern high-class fittings, etc., was now having a very marked beneficial effect upon their sales. They had had a very anxious year, but in spite of the heavy extraordinary expenditure which he had referred to, a great deal of which at the date of the accounts had not been felt the full benefit of, they had converted a loss for the previous year of £4,700 into a profit for this year of, approximately, the same figure, which accounted for a difference in the results of the two years of close upon £10,000. With a view of increasing the company's output, the board had decided to extend the manufacturing facilities at the works to cope with the considerably increased business which, in common with other British manufacturers, they had participated in since the outbreak of the war, and which they had reason to believe would result in a permanent increase in the company's turnover. He thought it must have been very gratifying to them to learn that in a year of depression such as they had been passing through they were able to show such marked improvement in the result of the year's working, and he felt that the shareholders would now agree that the economies recently effected were beginning to produce the desired effect, and, further, that the shareholders would confirm that his statement that the business must be built up gradually was correct. He did not want to be too sanguine for the future, but, taking everything into consideration, the directors felt justified in looking forward to increased success.

Mr. Ellice Clark seconded the motion.

Mr. Wilson inquired if there was any large increase of workmen as compared with last year.

Mr. Parsons asked if any further explanation could be given as to what particular class of goods accounted for the large increase in the stock.

Mr. Rayment said they all knew that many companies had been advertising to the public that they were British and were in no way dependent on Germany or Austria. He recently met a man, largely interested in the electrical lamp trade, who told him he understood that the company had to pay very large sums in the way of royalties to German and Austrian firms in connection with their lamps. He was astonished to hear that, and thought it ought to be cleared up, because if they had to pay large royalties for their patents and other things they were not, strictly speaking, a British concern.

The Chairman said the staff had been increased to the extent of about 15 per cent. owing to the increase of business, and they were having rather a difficulty to get men. The stocks were increased all round. He was glad Mr. Rayment asked the question he did, as it gave him the opportunity of explaining the exact position. For a very considerable time they had made no payments to Germany. Last quarter, up to 30th September, which was certainly a heavy quarter, their payments were £75 to Germany under an old agreement, which, of course, was quite insignificant. The position to-day with regard to lamps was this: The old squirted lamp was owned by the Osram Lamp Co., and that was a German patent. Their company did not make these lamps. They had a few left in stock, which they were selling as quickly as they could. The lamp made to-day was the drawn-wire lamp, which was an American patent, and the whole of the lamps sold were made under that American patent. They would understand that there were certain raw materials which in the past, and, possibly, in the future, manufacturers in this country would have to draw from Germany, because they could not be got from anywhere else. Mr. Gimingham had pointed out to him that potash used in making lamps came from Westphalia, which was the only place in the world from which supplies could be got in convenient quantities.

Mr. Parsons asked if the lamp business was on a really satisfactory basis—he meant their business arrangements with regard to lamps.

The Chairman said he was not prepared to say that the arrangements which existed could not be improved, and they were doing their best to improve them. He could not say anything more at the moment because certain negotiations were pending which he hoped would be carried through satisfactorily.

The motion was carried, and the retiring directors and auditors were re-elected.

Mr. Parsons proposed a vote of thanks to the board and staff, and remarked that the improvement in the financial position of the company was a good augury for the future.

Mr. Rayment seconded the motion and spoke in flattering terms of the work of the Chairman.

The Chairman, in acknowledging the vote, referred to the very great assistance he had received from Mr. E. Gimingham and Mr. C. E. Hunter.

Western Telegraph Co., Ltd.

Sir J. Wolfe Barry, K.C.B. (Chairman), presided over the 81st ordinary meeting at Electra House, E.C., on November 11th.

In moving the adoption of the report (Elec. Rev., p. 634), the Chairman said the statement of accounts presented was in respect of the period of twelve months ended June 30th

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last. Heretofore they had always been for periods of six months. Those which they had to consider were closed before war was declared, and therefore were not affected by this terrible calamity The receipts from messages compared with the previous twelve months showed an increase of £3,137, rents, interest on investments, etc., £11,734, together £14,871; but dividends on investments in other telegraph companies and interest on money on deposit were less by £1,745, leaving a net increase of receipts of £13,126. On March 1st, 1913, a service of "week-end" telegrams was instituted with Argentina, and in August of the same year this service and "deferred" messages were extended to Chile and Peru. The convenience of these lower-priced telegrams had been appreciated by the commercial and general public, and the growing use of these cheaper services had displaced a considerable amount of fully-paid ordinary traffic, resulting in a large volume of correspondence being transmitted, and this during a period when trade in Brazil and Argentina suffered a relapse which it was hoped was only of a temporary nature. These remarks would have prepared them for an admission of materially increased general expenses. Those in London were more by £232, which called for no comment. At the stations abroad, however, there was a net increase of £18,812. This increase was due to a necessary augmentation in the number of staff and improved scales of pay necessitated by the higher cost of living in South America, which accounted for nearly £14,000. The furnishing of new offices at Buenos Ayres and new staff quarters at Monte Video accounted for about £3,500. The other items, some more and some less, about balanced one another. Other expenses debited against the revenue account showed a net decrease of £3,819, principally in respect of land-lines and apparatus. The maintenance of the cables entailed an increased expenditure of just under £14,000, due to more cable having been used in repairs as cables got older, and to higher cost of their own and chartered cable-repairing steamers. Income tax was increased by nearly £1,300. The net result was that the balance of profit was £10,000 less than that for the previous year. Three interim dividends, amounting to £93,568 10s., had been paid, £160,000 transferred to the general reserve fund, £30,000 to the land and buildings depreciation fund, and £130,000 to the provision on account of investment fluctuation. The directors now recommended the declaration of a final dividend of 3s. per share, making, with the interim dividends, a total dividend of 6 per cent. for the year, also the payment of a bonus of 2s. per share, both free of income tax, which together would amount to £51,982, leaving a balance of £33,157 to be carried forward. The amount transferred to the general reserve fund was smaller than in past years, and although the total standing to the credit of that fund was nearly £1,700,000, he might again remind the shareholders that their two main cables between Europe and Brazil were laid many years ago, the one in 1874 and the other in 1884. These were each over 3,500 miles in length, and would sooner or later require renewal, and at present prices would cost somewhere about a million and a half, which when the time came would have to be charged against the reserve fund. During these abnormal times it was impossible to fix a value for their investments, consequently the board had considered it necessary to make a further provision on account of investment fluctuations. With regard to the current period—viz., since July 1st last—they would remember that war between France and Germany commenced on Aug. 2nd and between Great Britain and Germany on Aug. 4th. The Government's censorship of telegrams was put in force on this side immediately, and Argentina and Brazil subsequently enforced similar restrictions. Circumstances necessitated the suspension of "deferred" and "week-end" telegrams until Oct. 1st, when the "deferred" service was resumed, as the company found itself in the position of again being able to carry deferred telegrams without any excessive delay. The shareholders would be glad to learn that the staff of the Associated Cable Companies was second to none in patriotism, and they had been able to grant permission to nearly 25 per cent. of the head office staff to join the colours, and it was only the efficient carrying on of the special work which had prevented their being able to sanction a very much larger number of applications at home and abroad; but he must add that in this matter they were acting in conjunction with the War Office. It gave him pleasure to remark that the staff were remitting handsome contributions monthly to the National and Belgium Relief Funds.

Sir J. Denison-Pender seconded the motion.

Mr. F. W. Fuller asked what the position of the company was since the declaration of war.

The Chairman said that during the first four months of the current financial year their revenue had been well maintained, but it did not show the increase which was generally anticipated would result from the abnormal conditions prevailing at the present time.

The report was then adopted.

Replying to a vote of thanks to the board and staff, the Chairman said the period had been one of very great stress since the outbreak of war, and Sir John Denison-Pender had been at work day and night, and on Sundays, in keeping the business of the company together. Sir John had very heavy burdens upon him, and he would like to take that public opportunity of saying how deeply that company and the associated companies were indebted to him for the care and judgment and unwearied application he had given to their affairs.

Hongkong Tramway Co., Ltd.

An extraordinary general meeting of the shareholders was held on Monday, at the offices, 19, St. Swithin's Lane, Cannon Street, E.C., Mr. Robert Miller presiding.

The Chairman, in proposing a resolution to alter certain of the Articles of Association, remarked that he had very little to add to the information contained in the circular convening the meeting. As many of them were aware, for some time past there had been a considerable demand for the company's shares in Hongkong and in the East, and the result was that ultimately the majority of the shares had come to be held there. Not unnaturally, he supposed, the shareholders felt they would like the company to be under local control. Matters continued to develop until August 1st, when an informal meeting of shareholders was held in Hongkong under the chairmanship of Sir Paul Chater. At that meeting a committee was appointed to take the necessary steps to change the control of the company by substituting a board of local gentlemen for the present directors. It was not possible for him (the Chairman) and his colleagues to forecast in any way the result of that change—time alone could prove that—all they could say was that they hoped for at least as much success in the future as in the past. In any case, the wishes of the majority of the shareholders, subject to the company's legal obligations to its debenture-holders, must be the determining factor as to its management, and the position having been laid before the trustees for the debenture-holders, who raised no objection, there was nothing more to be said. The accounts for the six months ending June 30th had been approved, and in the ordinary way the directors in London would probably have been able to recommend an interim dividend at the rate of 10 per cent. per annum. As, however, a new board would be elected at the meeting called for December 1st, the present board offered to leave the final decision as to the amount of the interim dividend to be settled by them.

Mr. Harwood seconded the resolution, which was adopted without discussion.

Electrical Companies in Germany.

The German newspapers are publishing extracts from the reports or financial statements of various manufacturing companies. A few of these are reproduced below:—

It is reported that the *C. Lorenz A. G. Telephon und Telegraphen Werke, of Berlin*, is largely provided with war orders, but private contracts have declined since the outbreak of hostilities. The amount of business with neutral countries is comparatively slight. It is added that the financial results for 1913-14 cannot yet be ascertained, and that the directors have not heard anything of the branch at Petrograd for some time past.

The A. E. G. Unternehmungen, A. G., of Frankfort-on-Main—a financial enterprise which was taken over by the A. E. G. from a manufacturing company two or three years ago—records gross profits of £36,000 for 1913-14, as compared with £39,000 in the previous year. Out of the net profits of £31,000, as against £32,000, it is intended to pay a dividend of 6 per cent. on the share capital of £500,000, being the same rate as in 1912-13.

The Bergmann Elektrizitats Werke, A. G., of Berlin, is stated to reckon with the possibility of a total passing of the dividend for 1914. The company has been seriously affected by the complete stoppage of oversea transport, as new orders from abroad only arrive to a limited extent, and deliveries under old contracts are greatly hampered at present. On the other hand, some compensation has been afforded by the receipt of important orders from the military authorities and the departments concerned are well provided with work.

The Deutsche Gasglublicht (Auer) Gesellschaft, of Berlin, which is interested in the Osram wire lamp, as well as in incandescent gas equipments, reports that the company's principal departments are being unfavourably influenced by the war, especially owing to the cessation of exports to a number of countries. For the year 1913-14 the accounts indicate net profits, after appropriating £24,000 for depreciation as against £25,000 in 1912-13, amounting to £263,000, as compared with £431,000. It is proposed to pay a dividend of 5 per cent. on the preference capital and 25 per cent. on the ordinary shares, being the same rates as in the preceding year, and to carry forward £101,000 as contrasted with £33,000 in 1912-13.

The Kabelwerk Rheydt A. G., of Rheydt, has declared a dividend of 12 per cent. for 1913-14. At the recent general meeting the Chairman stated that the financial circumstances of the company were favourable, a fact which was due to economic management and an economic dividend policy. How far the company had proceeded in that direction was shown by the ability on that occasion to pay the dividend without having any necessity to have recourse to outside sources. The Chairman exercised great reserve in regard to giving an expression of opinion as to the future of the undertaking. It was hoped that the German armies would be victorious, and in that event the company would also experience a further happy development. At present the works were occupied as far as they could be employed, and the company was earning plenty of money.

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Chloride Electrical Storage Co., Ltd.—The *Financial News* states that the directors have determined, in existing circumstances, not to pay any interim dividend on the ordinary shares, but warrants in respect of the interim dividend at the rate of 6 per cent. on the preference shares will be posted on the 30th inst.

Castner-Kellner Alkali Co., Ltd.—The directors have declared a final dividend of 10 per cent for the six months ended September 30th, 1914, making a total of 15 per cent. for the year.

Rawlings Brothers, Ltd.—According to the *Financial Times*, the accounts show a net profit, including £945 brought forward, of £4,282. The directors have declared a dividend of 3 per cent. on the ordinary shares for the year ended March 31st, and £700 has been placed to reserve, leaving £1,196 to be carried forward.

West India and Panama Telegraph Co., Ltd.—The directors recommend the payment of dividends of 6s. per share on the first preference shares and 6s. per share on the second preference shares for the six months to June 30th, 1914, and 1s. 3d. per share on the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

This week's settlement, which had been regarded in advance with such anxious misgivings by the whole of the Stock Exchange, has turned out to be less terrifying than most people expected. As usual when there is plenty of time to face difficulties, the preparations which were laid sufficed to blunt the keen edge of the prevailing fears. Heavy sacrifices are demanded, but these have been made—and cheerfully in most cases.

Little harm can be done by lifting the veil of official discretion with the statement, now, that a large number of Stock Exchange men prayed the Treasury to grant a kind of indefinite moratorium in respect of the accounts that were open at the end of July. To these the Treasury, with the Chancellor of the Exchequer and the Lord Chief Justice, opposed a refusal as blank as it was polite. They declined to give shelter to the Stock Exchange, when in the case of all other branches of the community, the raising of the moratorium on November 4th left people to make shift for themselves, aided with the assistance afforded by the banks. Therefore the Stock Exchange has been obliged to hold the settlement this week; as to its outcome, it is impossible to say much at present, except that indications point to a comparatively smooth arrangement of the account. Several weeks will probably be required before the Stock Exchange really knows how it stands, but the loose talk of hundreds of House failures occurring as the direct consequence of the settlement is not at all likely to be verified.

As we write, the investor is on the alert for the National War Loan prospectus. People have been holding back their savings, for some time past, with a view to lending money to the Government through the medium of the War Loan. We know of cases in which investors—mostly small, it is true—have deliberately refused to put money into tempting securities that pay good yields, preferring to subscribe to a War Loan, even though it may mean a difference of ½ per cent. per annum in their income, with the possibility of a loss in capital value if the news does not happen to be good. Patriotism cannot complain that it has no free scope these days.

As to the news from the front, Throgmorton Street is well persuaded that the war is going on fully as satisfactorily as could be wished by anyone who was not an impatient enthusiast for impossible events. And it is generally expected that when the November 18th settlement is fairly out of the way, and the war loan publicly launched, there will be a resumption of activity in Stock Exchange markets that shall have an immediately strengthening effect upon quotations.

In view of the fact that prices are beginning to re-establish themselves on reliable bases, it has been decided to begin in these columns the publication week by week of leading securities connected with the electrical markets. Middle quotations are furnished in each case, this being because in some instances it is difficult to buy, or difficult to sell, as the case may be. Just at present, for example, the demand for electricity supply shares is so feeble that double quotations might convey a false impression. So we content ourselves—and, we hope, our readers—with a selection of middle prices of representative stocks and shares in companies connected with the electrical industry; and if there is a desire for others, previously given in our weekly lists, and at present omitted from the accompanying tables, careful effort shall be made to ensure their correct quotation upon our receiving a request for such.

Home Electricity Supply Companies.

Brompton Ordinary	8⅜	Kensington Ordinary	7½
do. 7 per cent. Pf.	8¾	London Electric	1½
Charing Cross Ordinary	4⅜	do. do. 6 per cent. Pf.	6
do. do. do. 4½ Pf.	4½	do. do. 4 Deb.	85½
do. do. City Pf.	4⅜	Metropolitan	3
do. 4½ Deb.	86⅞	do. 4½ per cent. Pf.	4½
Chelsea	4⅜	do. 1st Deb.	91½
do. 4½ Deb.	91½	do. 3½ Deb.	81½
City of London	15	St. James' and Pall Mall	9
do. do. 6 per cent. Pf.	13	do. do. 7 per cent. Pf.	7
do. do. 5 Deb.	115	do. do. 3½ Deb.	83
do. do. 4½ Deb.	98	South London	6
County of London	11½	South Metropolitan Pf.	14
do. do. 6 per cent. Pf.	11½	Westminster Ordinary	8½
do. do. 1st Deb.	99	do. 4½ Pf.	4½
do. do. 2nd Deb.	97		

Manufacturing Companies.

Brit. West. Pf.	1½	Electric Construction	11s.
do. 4 Deb.	72	do. do. Pf.	1
do. 6 p. lien	98	Gen. Elec. Pf.	10
Callenders	11½	Henleys	14½
do. 5 Pf.	4⅜	,, 4½ Pf.	4
do. 4½ Deb.	97½	,, 4½ Deb.	97½
Edison & Swan, £2 pd.	6s.	Telegraph Con.	3⅞
do. do. £7 pd.	1⅜	Castner-Kellner	24½
do. do. 4 Deb.	69		
do. do. 2nd Deb.	63½		

Telegraphs and Telephones.

Anglo-Am. Tel. Pf.	101½	Gt. Northern Tel.	29½
do Def.	21	Indo-European	58
Chili Telephone	7	New York Tel. 4½	96½
Constantinople Tel.	4½	Oriental Tel. Ord.	2
Cuba Sub. Ord.	8½	do. Pf.	1½
do Pf.	15½	Tel. Egypt Deb.	97
Eastern Extension	11⅝	United R. Plate Tel.	6
do. 4 Deb.	94	do. Pf.	5
Eastern Tel. Ord.	122½	West India and Pan.	1½
do. 8½ Pf.	74½	Western Telegraph	12⅜
do. 4 Deb.	95	,, 4 Deb.	96½
Globe Tel. and T. Ord.	15½		
do. Pf.	12⅜		

Foreign Trams, &c.

Anglo-Arg. Trams 1st Pf.	4½	Bombay Electric Pf.	11
do. 2nd Pf.	4⅜	do. 4½ Deb.	96
do. 4 Deb.	86½	Mexico Trams.	53½
do. 4½ Deb.	95½	do. 5 per cent. B'ls.	73½
do. 5 Deb.	88½	do. 6 per cent. Bds.	72½
Brazil Tractions	50	Adelaide Sup. 6 per cent. Pf.	5⅝
		do. 5 Deb.	10½

The Castner-Kellner Alkali Company declares a dividend of 10 per cent, making 15 per cent. for the twelvemonth. This latter compares with 22½ per cent. a year ago, when, however, a bonus of one new share for two old was distributed through capitalisation of part of the reserve. Making allowance for this, the dividend for 1913-14 is the same as that for the previous year. Castners are now 53s. bid, and shares in most chemical companies are a good deal in demand, on the assumption that their manufactures will take the place of a lot of stuff hitherto imported from Germany. Incidentally, it may be mentioned here that Rubber shares are again on the mend, evidence accumulating to the effect that there is a rubber famine threatening in Germany, while on this side the approach of winter has already caused the War Office to place big contracts of all kinds of waterproof material, not only for the troops, but for their horses also. In addition to which, of course, there are the hospitals, which will be taking, unfortunately, large amounts of rubber in connection with comforts for the wounded.

Brazilian Traction shares have improved to 50 bid, some four or five dollars higher than the price stood comparatively lately. Matters in the Brazilian Republic seem to be getting better, but in Argentina the continued pressure of the moratorium appears to have the effect of checking business all round, so that English companies operating in that Republic are doing none too well just at present. The Mexican imbroglio exhibits no new development. Mexico Trams are 52½, while both classes of bonds are quoted 70-75.

Home Rails are distinctly firmer in tone and price. The sudden activity noticed on the Northern suburban lines early in the week, gave rise to the report that a quarter of a million fresh troops were being despatched to the Continent. Speculation busies itself with the discussion as to what percentage of the men who are seeing active service, and who will return from the war, is likely to settle down contentedly to desk, office, warehouse, Stock Exchange or similar pursuit hereafter. Metropolitans rose to 30½, after dipping to 30. Districts are steadier at 18½. The new London and South-Western 5 per cent. Preference stock, which was issued at 99¾—the money being required for electrification of the line—holds its price at 103½. Various new issues are being talked about, but it is worth noticing that the Government has warned off some of the big Colonial borrowers by the simple expedient of lending them the money itself, and including these loans in the national war stock.

The Western Telegraph Company's report is a good illustration of the prudent finance shown by the best-class cable undertakings. The revenue for the year ended June 30th last came to £903,000, the working expenses to £390,000. After providing for Debenture interest and income-tax there remained a divisible balance of £499,000, out of which the dividends and bonus for the year took only £155,000. The company has invested reserve funds of £1,896,276, while other items bring the reserves to over two million pounds sterling. In the current balance-sheet £300,000 is deducted as provision on account of investment fluctuations. Figures like these give some idea of the remarkable strength of the best telegraph companies, and show how slight is the chance of the dividend being reduced in any but an insignificant way, if at all. Western Telegraph shares can be bought at 12½, or a little less, so that, at the present price, the return on the money comes to £5 9s. 10d. per cent.

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EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING OCTOBER, 1914.

Although not up to the level of the period before the war, the October returns of electrical exports and imports show a great improvement.

The exports, which for the first half of the year averaged half a million pounds a month, fell to £239,000 in August, increased to £288,000 in September, and reached £401,107 in October.

The import figures comparable with the above were:—Six months' average £275,000, August £87,000, September £111,000, and October £168,431.

The re-exports for October amounted to £15,547, as compared with some £26,000, the average of the first six months of the year.

Of the individual export sections, machinery exports improved to the extent of some £86,000, and increases were shown in the telegraphic, lamp and miscellaneous sections; cable exports were nearly stationary, while some falling-off is shown in the telephonic exports. Russia was a good customer during the month, some £43,000 of machinery going to that destination; India, Argentina, Australia, Japan, &c., were also prominent customers of this country.

The increase in the imports is mainly traceable to business with the United States, which jumped up some £53,000 in the month.

Machinery imports increased by over £40,000; a considerable advance occurred in lamp imports, principally from Holland, but also from the U.S.; but telegraphic and telephonic imports decreased. Sweden and the U.S. were active importers of telegraphic and telephonic material, while Switzerland figured as a machinery importer. No doubt the dislocation of manufacturing in this country, due to military engineering requirements, accounts for the entry of a proportion of the imports.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	5,745	501	248	2,476	97	1,964	48,415	1,175	260	352	2,216	6,216	69,665
Germany	...	...	...	...	...	...	...	...	...	...	...	...	...
Netherlands, Java and Dutch Indies ...	252	1,044	312	...	305	268	694	711	232	...	...	360	4,178
Belgium	265	...	...	...	...	7	11	...	143	...	...	65	491
France	139	...	103	12	...	...	150	...	...	81	...	1,222	1,707
Portugal	5	...	157	...	...	50	351	66	124	27	154	216	1,150
Spain, Canary Isles and Spanish N. Africa...	879	...	181	...	...	66	591	667	172	...	12	123	2,691
Switzerland, Italy and Austria-Hungary ...	119	...	736	...	...	872	5,085	240	...	67	...	...	7,119
Greece, Roumania, Turkey and Bulgaria ...	...	...	...	...	...	...	53	55	...	...	...	...	108
Channel Isles, Gibraltar, Malta and Cyprus...	81	339	39	18	...	...	152	...	22	...	7	84	742
U.S.A., Philippines and Cuba	238	...	819	379	...	121	655	29	10	4	...	312	2,567
Canada and Newfoundland	193	3,573	957	799	...	405	5,961	...	1,081	10	99	198	13,276
British West Indies and British Guiana ...	30	36	28	214	...	...	197	...	45	...	112	205	864
Mexico and Central America	34	108	67	20	...	...	265	...	...	...	...	36	530
Peru and Uruguay	16	17	...	19	...	...	179	...	15	...	592	993	1,831
Chile	61	462	74	23	...	18	927	...	...	...	26	649	2,240
Brazil	263	86	205	69	30	503	1,145	516	...	...	1,545	41	4,403
Argentina	10,939	1,598	395	180	...	62	7,753	809	617	153	1,219	2,264	25,989
Colombia, Venezuela, Ecuador and Bolivia...	114	105	55	301	...	75	64	...	...	...	9	100	823
Egypt, Tunis and Morocco	309	327	379	...	16	68	1,092	...	30	43	33	474	2,771
British West Africa	108	81	...	37	40	...	775	32	143	...	351	333	1,899
Rhodesia, O.R.C. and Transvaal	827	53	1,070	2,222	...	466	313	5,456	22	...	43	...	10,466
Cape of Good Hope	959	1,027	591	626	10	430	5,966	88	723	27	5	392	10,844
Natal	743	4,948	386	986	58	239	3,536	521	81	...	83	617	12,198
Zanzibar, Brit. E. Africa, Mauritius & Aden	8	275	4	138	...	...	...	11	272	...	...	99	807
Azores, Madeira and Portuguese Africa ...	93	552	84	...	...	...	12,633	12	...	70	...	28	13,422
French African Colonies and Madagascar...	...	...	...	...	...	...	...	...	...	...	...	...	...
China and Siam	960	124	568	46	32	65	3,505	1,762	12	...	12	3,089	10,125
Japan and Korea	328	...	1	23	...	1,159	16,988	63	1,515	3	...	335	20,419
India	2,803	13,621	3,737	1,415	16	1,311	13,991	9,005	2,606	18	2,892	4,742	56,157
Ceylon	392	516	82	97	...	3	826	...	71	...	13	1,745	3,745
Straits Settlements, Fed. Malay States and Sarawak	1,487	577	599	29	39	51	3,067	80	521	...	872	6,244	13,516
Hong Kong	662	1,120	588	...	...	283	629	9	91	...	14	145	3,541
West Australia	414	425	293	140	...	421	501	...	443	15	121	88	2,861
South Australia	394	25	666	40	...	18	657	470	48	...	188	444	2,950
Victoria	1,321	12,871	1,241	2,734	...	1,353	3,514	186	1,167	4	4,615	3,396	32,402
New South Wales	1,054	10,366	1,209	1,566	209	534	9,051	3,452	952	20	714	7,329	36,456
Queensland	191	816	53	169	...	...	2,054	35	734	84	806	...	4,892
Tasmania	7	24	168	41	...	...	156	...	...	...	1,600	5	2,001
New Zealand and Fiji Islands	582	3,246	970	398	...	1,798	8,920	1,266	762	12	945	362	19,261
Total, £	32,965	58,863	17,016	15,217	852	12,610	160,822	26,710	12,914	940	19,297	42,901	401,107

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	25	56	66	...	423	...	3,285	...	68	960	6,192	11,075
Germany	...	...	...	...	...	...	...	...	...	...	...	...
Holland...	195	137	...	6,336	5,375	...	172	112	15	...	...	12,342
Belgium	...	22	4,356	...	...	...	...	...	20	...	...	4,398
France	8	...	487	113	19	...	64	...	4,554	2,873	202	8,320
Switzerland	250	112	75	...	104	749	7,568	...	...	684	...	9,542
Italy	72	2,566	20	...	...	...	1,806	300	...	...	272	5,036
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...	...
United States	7,219	1,048	610	118	3,567	23	27,838	67,025	1,034	2,313	5,687	116,482
Total, £	7,769	3,941	5,614	6,567	9,488	772	40,733	67,437	5,691	6,830	12,353	167,195

Additional imports: Spain: carbons, £684. Victoria: electrical machinery, £58. Canada: electrical goods, £85; meters, £355; machinery, £54.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above... ...	2,121	1,016	...	804	105	...	7,157	...	140	231	3,973	15,547

Total Exports: £401,107 Total Re-Exports: £15,547 Total Imports: £168,431

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

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NOTES ON MODERN CONTINUOUS-CURRENT MOTORS.

By T. H. DENNIS, A.M.I.E.E., Singapore.

The more one studies the so-called improvements in manufacturers' latest patterns of machines, the more it becomes impressed upon one's mind that the sole factor governing modern design appears to be cost of manufacture.

This is undoubtedly as it should be—to a certain extent—but when these methods are carried to an extreme and *all* other considerations are lost to view in the continued striving to cut down material, some parts are made of such small dimensions, or of such inconvenient patterns, as to be a nuisance.

The designer appears to lose sight of the fact that the machines are made for *use*, and in his anxiety to cut down the material used to the absolute minimum, he apparently keeps common-sense and practical knowledge right at the back of his head.

In this article are noted various details that have actually been met with by the writer, and some suggestions for improvements prompted by practical application.

Slow-Gearing.—As instancing the lack of practical common-sense displayed by designers, has anyone ever seen a makers' standard pattern of slow-geared motor illustrated with the pulley or half-coupling fitted at the *same* end of the slow-speed shaft as the spur-wheel? The writer has not been able to find such an illustration, and yet is not this the correct position for the pulley?

A motor is always erected, if possible, with the belt running close to a wall or partition or guard; thus with the standard arrangement of spur-wheel and pulley the commutator end of the motor is brought towards the wall, easy access to the commutator being then prevented both by the wall and by the proximity of the belt, or of the driven machine when a coupling is used. As the commutator of a machine generally requires constant attention (low-tension motors are the machines actually referred to in this article), and brushes require renewing very often without its being convenient or possible to stop the motor, this point concerning the position of the pulley or half-coupling is quite important.

With the pulley fitted at the *same* end of the slow-speed shaft as the spur-wheel, the belt and gearing are kept remote from the commutator, and the latter is, in all probability, not close up to a wall, and it is, of course, right away from the driven machine.

The writer has in mind a dozen small slow-geared motors driving similar parts in one large machine; these motors are erected in line several feet apart, and their half-couplings are close up to the long side of the large box-like machine referred to. Fortunately, when these motors were ordered it was emphasised that the half-couplings should be at the *same* end of the slow-speed shafts as the spur-wheels, and the result is that all the commutators are easily accessible and easily inspected, as they are remote from the large (driven) machine, and also they are away from the grease and dirt of this machine. Had these motors been of the standard pattern with the half-couplings at the commutator ends, it would have been most difficult to inspect and clean the commutators and change the brushes and so on.

In every case that one considers, the best arrangement seems to be that with the pulley at the same end of the slow-speed shaft as the spur-wheel. Why, then, do manufacturers not make this the standard design, instead of continuing to illustrate their motors with the pulleys close up to the commutators?

High Speed.—A favourite method of lowering the price of a motor for a given horse-power is to make the speed unreasonably high. This is often the case when a slow-geared motor is ordered and the speed of the slow-shaft only is specified. It is always advisable when ordering slow-geared motors to state a limit for the armature speed as well as to give the slow-shaft speed required.

The tendency is to increase the limit of maximum speed for plain motors, but it is the writer's experience that it is advisable to specify as low a speed as reasonably possible, owing to the commutator, brush wearing and sparking troubles at high speeds. Many manufacturers appear to make no difference in their brushes for high speeds, and even in those cases where different quality brushes are fitted there is generally trouble with excessive wearing of the commutator at very high speeds; thus it pays to give a little more for your motor in the first instance, and have it built to run at a reasonably low speed.

In many cases, too, the makers' standard pulleys (at the standard high speeds) appear to be too small to give satisfactory running in practice, unless the driven machines be working under almost ideal conditions with ideal belt drives.

The foregoing forms rather a wide generalisation perhaps, but the intention is to show that, as the standard high speeds and consequent small pulley diameters seem to be solely the outcome of the aforementioned striving by designers to cut down their manufacturing costs, and so to undersell their competitors in certain (horse-power) sizes, it is better in the long run to use a motor having a reasonable speed and pulley diameter than to adopt a high-speed machine with a small pulley, even if it *is* a manufacturers' standard and recommended as being quite suitable.

Brush-Gear.—Brush-gear lends itself to many and various designs, and although the box-type now appears to be almost universally used, there are few patterns that are quite satisfactory.

In the majority of holders it is a difficult matter to renew a spring, and in most patterns the springs are so made and fitted that it is almost impossible to clean them, and so keep them from becoming clogged up and useless. Also, it is a very difficult matter to persuade manufacturers to give you phosphor-bronze springs instead of steel. Steel springs, even if they are plated, rust very quickly in moist tropical climates, and, even at home, one would think phosphor-bronze springs would be much preferable.

Some makers are now standardising *steel* brush spindles and *steel* brush boxes as well as steel springs, &c., and although this sort of thing might be suitable for use at home (even this seems doubtful, as motors frequently have to work in damp positions at home as elsewhere) it is out of the question for moist tropical atmospheres.

An annoying point in this respect is that the purchaser is frequently told that the steel spindles, &c., are not fitted for the sake of *cheapness*, but this seems to be the only obvious reason. Could some brush spindles not be cheapened (without this being detrimental to the buyer) by making them of hollow instead of solid brass?

A curious and aggravating fault in the matter of brush-holder spindles is that, although the designer is for ever cutting down the material used, he very frequently makes the heavy solid brush-spindles longer than necessary. In the majority of patterns the brush-holders are placed in position by passing them over the ends of the spindles, and if there is not sufficient space between the ends of the spindles and the commutator lugs to allow of the brush-holders being taken off without interfering with the spindles, it takes a long time to take off the holders for cleaning purposes, and entails sometimes a great amount of what should be unnecessary work.

In some cases it is possible by loosening the nuts holding the spindles in position to push the spindles sufficiently far through the brush-rocker arms, but in other instances it is not possible to get the holder off without taking off the pulley and end-shield, to allow the armature to be withdrawn a short distance.

Only a few days ago the writer had $\frac{1}{4}$ in. cut off the ends of some $1\frac{1}{4}$-in. diameter brush spindles. In this machine the screws for clamping the brush-holders to the spindles are cut down to the smallest possible dimensions, and are frequently getting broken, yet these machines are presumably being manufactured daily, so to speak, with every $1\frac{1}{4}$-in. diameter brush spindle at least $\frac{1}{4}$ in. too long; this is a case in which a little practical knowledge, combined with a little common-sense, would save the maker a very considerable amount of brass and machining, and would at the same time benefit the user of the motor.

Another machine has eight 2-in. diameter spindles, each carrying 13 brush-holders, and in no case can any of these brush-holders be taken off without shifting the spindles.

In still another machine the spindles were in such close

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proximity to the commutator lugs that slight end wear of the bearing bush would have allowed the lugs to touch. A quarter of an inch was cut off these also.

In the case of two similar motors the holders could be just got off one and could be just not taken off the spindles of the other, and in both the spindles could well have been ¼ in. shorter.

The explanation of the foregoing seems to be that the designer wishes to ensure the whole width of the commutator being available for the brushes; but in the cases mentioned the brush boxes are wider than the holders which carry the boxes, and which are clamped on to the spindles, so that shortening the spindles did not prevent the inner brushes being fixed as close as necessary to the commutator lugs.

Most types of brush-holders, as already noted, are made to be passed over the ends of the spindles, and clamped on to them by means of one small tightening screw; this pattern may be cheap to manufacture, but they are generally a positive nuisance, as anyone who has chipped pieces of skin off his knuckles trying to get the holders on and off will appreciate. They are either bored out to such a large diameter that the tightening screws will not cause them to grip the spindles reliably, resulting in broken screws, or the holes are so small that the spindle is loosened in the brush-rocker arm by the holder seizing on to it.

Then, again, when the holders are bored out carefully and correctly, the nature of the brass is not always such that it allows of the holder springing open sufficiently when the tightening screw is loosened, to permit the holder to be easily slipped along the spindle,

A much better type of holder appears to be coming into more general use; in this pattern the part which clamps on to the spindle is hinged, and those with which the writer is familiar are very well made and have substantial clamping screws. With these holders any one can be taken off easily and quickly without disturbing any of the others, and although they would perhaps appear at first sight to be more expensive than the other type, owing to the hinge, it is doubtful if they do cost the manufacturer any more—especially if they are made in cast-iron (!) as appears to be some makers' standard practice.

Taking into consideration the fitters' time, as well as the machining, it is quite possible the hinged pattern are cheaper than the others, as there is no time wasted in dealing with holders that seize on to the spindles.

Brush-holders should be so made (at any rate in the case of low-voltage machines) that a brush can be changed without stopping the motor, and without the necessity of one hand having to be used to hold the spring out of the way of the brush and from touching the commutator; the particular hinged holder referred to possesses these advantages also.

A common fault with box-type holders and brushes is that the tails attached to the brushes are often too stiff and short, thus preventing the brush from sliding freely in its holder, and, in many cases, the tail is so fixed that the brush cannot be easily taken out for cleaning. Some brushes fit too tightly in their holders to allow of free movement, and in most cases the brushes have to be taken out periodically, owing to dirt collecting and causing the brushes to stick; thus they should be made easily removable.

Oil-rings.—With some recently-manufactured machines, wherein, as already noted, everything appears to be sacrificed to low cost of production, the oil-rings are so placed that they can only just be seen; that is, provided there is nothing in the way to prevent one's head being brought down to the level of the oil well, and one carries matches, and has good eyesight; the rings at the pulley end cannot be seen at all with the pulley in position—these machines have one ring to each bearing. In the case of some larger similar motors, with two rings to each bearing, the outer ones can just be seen at the commutator ends (not at the other ends with belt-pulleys running), but the inner rings cannot be seen at all.

The reason for this is apparently that the designer has not been able to make the oil-box cover come approximately vertically over the oil-ring and at the same time get the oil-ring placed at the centre of the bush; one appreciates the difficulty, but the fact remains that in most older machines the oil-rings can be easily seen through the oil-box covers, two covers being generally fitted if there are two rings.

Oil-rings very frequently get displaced during transit, and it is generally a more or less difficult matter to get them back into their correct positions, especially when they cannot be seen, when in place, from the oil-box covers.

It would not appear to be very difficult to fit the oil-rings so that they could not get out of position, or to hold them temporarily in position during transit; when a machine or several machines arrive with both rings right out of the bearing and resting close up to the commutator end-plate, it takes a long time and requires a lot of practice and patience to get them back into position by means of bent wires—nearly as bad as picking a lock of which you have lost the key.

WIRELESS SOCIETY OF LONDON.

A well-attended meeting of this Society was held on Friday, November 13th, in the theatre of the Institution of Electrical Engineers, the speaker of the evening being Prof. J. A. Fleming, who delivered an address on "The Function of the Earth in Radio-telegraphy." The chair was occupied by the President (Mr. A. A. Campbell Swinton), who explained that the experiments that night were shown by special permission of the Post Office. Prof. Fleming suggested that, during the period of idleness enforced on wireless workers, so far as practical radio-telegraphy was concerned, there were many mathematical and scientific problems awaiting solution which might profitably be attacked. It was an undoubted fact that the nature of the earth's surface exerted a most important effect on wireless transmission over it. In certain districts there was quite abnormal wave attenuation as, for instance, north and north-east of Newport (Rhode Island), in the district where Dr. Austin's experiments were carried out between Brant Rock and the cruiser *Birmingham*. The speaker showed how, by comparatively simple mathematics, the depth of penetration of an electric wave into a conducting material could be calculated. If ρ represented specific resistance, μ permeability, and n frequency, then at a depth of $1/2\pi \cdot \sqrt{\rho/\mu n}$, the current would have fallen to 0·368 of its surface value, and at four times this depth it would have fallen to $(0{\cdot}368)^4$ of its surface value, *i.e.*, to a negligibly small value.

Assuming standard physical properties, the depth of the "current skin" in copper was about ¼ mm., but in iron it was only $\frac{1}{60}$ mm., owing to the high permeability of this metal. By means of striking cymometer experiments, Prof. Fleming demonstrated the marked difference between depth of current penetration in these two cases, and showed that while insulating coverings did not affect the damping produced by the magnetic properties of iron, galvanising provided a skin of zinc thick enough to carry the high-frequency current without permitting the latter to reach the iron core. Galvanised iron wire was, therefore, permissible for aerials and for earth connections so long as the galvanising remained continuous and uncorroded.

The materials of the earth's crust were conducting dielectrics, and the problem of current penetration was complicated by the fact that conducted current and dielectric current had both to be taken into account. The conductivity of all dielectric materials, even if imperfect dielectrics, was much greater for alternating than for direct currents, and was vastly greater still when carrying currents of radio-telegraphic frequency. Thus, the conductivity of slate was 50,000 bimhos at 920 cycles, 204,000 bimhos at 5,000 cycles, and no less than 2,500,000 bimhos at 2,500,000 cycles per second. At yet higher frequencies the conductivity again decreased. There was a fertile field for research in measuring the conductivity and dielectric constants of sea water and earth crust materials at radio-telegraphic frequencies, and particularly valuable results might be expected from really large scale experiments (say, with huge electrodes ¼ mile or so apart, which would give reliable averages for various kinds of soil under various conditions).

Prof. Fleming showed mathematically that refraction of electrostatic fields between air and earth or water produced a considerable horizontal component near the surface, thus producing a periodic displacement or wave in the earth's crust. This phenomenon the speaker demonstrated experimentally, and to it he attributed the possibility of reception of time signals on such unorthodox aerials as bedsteads, bicycles and dustbins. Atmospheric refraction had, no doubt, a marked influence on long-distance transmission, and if our atmosphere were exclusively of krypton (or were otherwise brought to the same vertical density gradient as given by krypton), light or Hertzian waves would travel right round the earth by refraction. Though much yet remained to be learned, it was definitely established that good conductors prevented deep current penetration; that penetration and attenuation occurred apart from mere weakening by diffusion; that attenuation was greater for short than for long waves, and reached a maximum at certain values of permeability, resistance and dielectric constant; and that the curvature of the earth weakened the true space wave, degrading it as function of the angular distance of transmission. At 3,000 to 6,000 miles, most of the received effect was probably due to bending by ionic refraction. Long-distance reception was complicated by many factors, and our earth was probably unique

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in being the only planet on which long-distance radio-telegraphy was possible.

In opening the discussion, Mr. W. Duddell agreed that earth currents probably contributed considerably to long-distance transmission by long waves. He thought, however, that these currents were an essential part of the radiations, and to consider their action was only another way of regarding the problem as a whole.

Prof. G W. O. Howe supported this view, saying that if the space wave were not associated with an earth wave, it formed a closed loop and was lost to us for purposes of signalling. As regarded the wide variations in strength of the Eiffel Tower time signals, as received by the author in London, it would be necessary to erect a control station near Paris to determine the emitted energy on different days, before drawing conclusions from the London curves.

In his reply, Prof. Fleming said that space and earth waves were certainly part of one entity, but the earth currents were a very active component in many cases.

The President, in moving a vote of thanks, announced that the authorities had adopted very effective means to deal with illicit wireless stations, and though the proffered assistance of the Society could not be utilised in this connection, steps were being taken to schedule members of all wireless societies in the kingdom, and their assistance would then be accepted in certain matters by the local police authorities.

ECONOMICS OF ELECTRIC RAILWAY DISTRIBUTION.

By H. F. PARSHALL, D.Sc., M.Inst. C.E.

(*Abstract of paper read before the* Institution of Civil Engineers. *November 17th*, 1914.)

Practically all modern traction systems of the larger class are referable to the same class of power house and transmission system, and these are not affected to any important extent by the sub-station arrangement, which is determined with reference to variations in the operating result occasioned by the spacing and the capacity of the individual sub-stations.

In the book by Mr. Hobart and the author on "Electric Railway Engineering," most of the problems entering into the design of electric railway installations have been dealt with. The question of the economic arrangement of sub-stations and the distribution conductors was not dealt with at length, because at the time the book was written sufficient operating data were not available to furnish a basis for different calculations. Such a wide difference of opinion existed between different engineers as to the cost of operating and maintaining a system of sub-stations that it did not appear advisable to treat the subject except on general lines. Since the publication of that book a great deal of experience has been gained, as a result of which engineers have come into more general agreement as regards sub-station practice. The present paper is written with a view to assist towards the standardisation of electric railway sub-station practice. Many years ago Lord Kelvin formulated a law as to the economic use of conductors in transmission systems. The number of independent variables when a complete system with sub-stations has to be dealt with is so great that the mathematical expression, from which might be deduced the minimum cost, would in practice be open to some suspicion. In this paper a complete balance-sheet embodying every item has been worked out for each case, and the tabulated result is included as a part of the paper; hence, for different conditions it would be possible for an engineer to make the necessary corrections, so that, without any great amount of labour, the methods and results of the paper may be applied to practically any class of electric railway installation. The paper has not been extended to include the electric traction installation as a whole, since the process of standardisation in respect of motor equipments is still proceeding, and conclusions that might be drawn under present conditions would in another short time be incorrect. So far as the distribution is concerned, the conclusions are likely to be lasting, since the operating conditions on which the general results are founded are likely to obtain for a considerable time to come.

With the given energy-consumption per unit of length of line that follows from a given train movement, the capacity of the sub-stations increases directly with the distance between them. The energy loss in distribution conductors of a given section varies with the cube of the distance between sub-stations. The cost of attendance is within wide limits independent of the size of the sub-station. The cost of the plant per kilowatt falls off with the size of the units, but the maintenance and renewals per kilowatt are more or less constant. The paper embodies a series of curves showing graphically the arrangements of sub-stations that will operate different train services on different electrical systems and at various voltages with a minimum total operating cost. With rotary-converter sub-stations and a working voltage of 600 volts, and for certain assumed average conditions of train-weight, speed and energy-consumption, the most economical sub-station spacings are 8½, 5½ and 3½ miles for train-services of 6, 12 and 24 trains per hour, respectively. For a working voltage of 1,200 volts the sub-station spacings are 11, 7½ and 5 miles respectively, while when 2,400 volts is adopted the most economical sub-station spacings are 16, 12 and 8½ miles for the three train-services respectively. Curves are also given illustrating the advantage gained by working at higher voltages, and these confirm the author's view that with the present arrangement of rotary-converter sub-stations there is little advantage in a higher voltage than 2 400 volts for the track conductor. The economy of higher voltages is shown to be approximately the same whatever the train-service. As between 600 and 1,200 volts there is a saving of 14 per cent. in the total annual costs of the distribution system; as between 1,200 and 2,400 volts there is a further saving of 7 per cent., or 21 per cent. as between 600 and 2,400 volts. If the working voltage is further increased to 3,600 volts, there is a decrease in total annual expenditure on sub-station and overhead conductor equipment of only 3 per cent., which will be less than the additional costs of the rolling stock.

For single-phase distribution at 5,000 volts the most economical sub-station spacings are 31, 24 and 16 miles for train-services of two, three and six trains per hour respectively. At 10,000 volts single-phase, the most economical sub-station spacings are 45, 34 and 26 miles for the same three train services respectively. With three-phase distribution at 5.000 volts the most economical distances between sub-stations are 38, 31 and 18 miles for the same respective train-services. In most of these last cases, however, the economical distance between sub-stations thus determined is greater than would be permissible in practice from considerations of both traffic-operation and voltage-drop. Further, in the case of single-phase operation, the lower pressure of 5,000 volts is found to be the most economical for certain services and the higher pressures of 10,000, 12,000 and 15,000 volts in vogue on the Continent are explained by consideration of voltage-drop.

An appendix to the paper summarises the sub-station operating costs of the Central London Railway, which have been used to a large extent as a basis for the calculations embodied in the paper.

CABLES.

By C. J. BEAVER, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *November 12th*, 1914.)

Pressures up to 20 kilovolts have called for no special effort on the part of the cable maker; he has had to pay more attention to potential gradients in 20-kilovolt to 30-kilovolt cables than in those already standardized by the Engineering Standards Committee for working pressures up to 11 kilovolts. But apparently nobody had the courage or opportunity to take the step of reversing the practice of increasing the thickness of the dielectric as the size of the conductors increased.

The importance of this, however, disappears at higher voltages. For instance, at 20 kilovolts working pressure the commercial considerations which entail the selection of such a voltage also to some extent automatically determine the most commercially economical (from the transmission and distribution point of view) size of cable. This will not vary widely from 0.1 sq. in. to 0.15 sq. in.

At still higher working pressures, 50 to 100 kilovolts, another set of conditions preponderates, the maximum stress conditions tending to fix a size of conductor on account of considerations of the economical construction of the cable—that

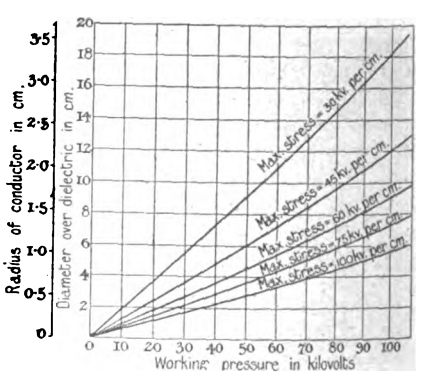

Fig. 1.

is to say, a cable required for these working pressures has, in order to keep dielectric thicknesses within practicable limits, to be designed so that the conductor radius, r, is proportioned to the maximum stress permissible in the dielectric, according to the formula $r = V/S$, where V is the working voltage, and S the maximum stress permitted in the dielectric. It is at these working pressures, therefore, that the factors of character and curvature of conductor surface, and dielectric properties of the insulating material, become of paramount importance, and that any grading device which will tend to keep down the potential gradient must and will be eagerly sought after.

Let us first consider the curvature and character of the conductor surface. Conductors would invariably be made in hollow form to a radius determined by the above-mentioned formula.

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The most economical radius of conductor for a given working voltage at a given maximum stress is shown in fig. 1. The scale of "diameter over dielectric" refers to single cable. As the radius of conductor, r, is the most economical for each condition of working voltage and maximum stress, the radius, R, over the dielectric is equal to $r\epsilon$, where ϵ is the base of Naperian logarithms, = 2.718.

Fig. 2 shows a further aspect, *i.e.*, the bearing of the radius of the conductor on the breakdown pressure for given thicknesses of dielectric, assuming 200 kilovolts per cm. to be the

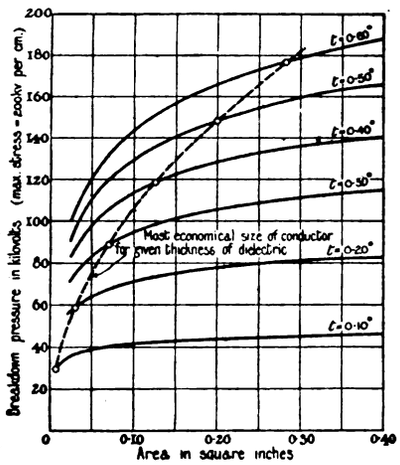

FIG. 2.

maximum stress that the dielectric is capable of supporting.

The proposal, first made, the author thinks, by Dr. Borel, to "lead sheath" the conductor, had the advantage of being a very practical method from the cable point of view, because the attainment of a smooth surface, for instance by means of copper conductors in strip form, is not only difficult but entails risks of greatly enhanced stresses in case of displacement of the strips under the exigencies of handling and bending the cable. Jona used this lead-sheathing method in his graded cable, and calculated that by doing so he obtained a reduction of 20 to 30 per cent. in the maximum stress on the innermost part of the dielectric.

From the point of view of practical construction, it will be seen that the essentials for very high-pressure cables are a large conductor radius, a smooth surface, and true cylindrical form. To secure the latter, the author prefers to form the hollow core of a substantial lead tube. The other conditions are complied with by stranding the necessary number of copper wires upon the tube, and sheathing over them with a thin wall of lead.

Fig. 3 shows the dimensions of a conductor designed on these lines for a 50-kilovolt cable, allowing for a maximum

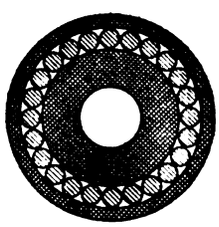

FIG 3.

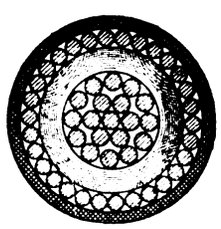

FIG. 4.

FIG. 3.

Inner lead tube	0.256 in. bore, 0.140 in. radial.
Conductor	24/0.082 in.
Outer lead sheath	0.05 in. radial.
Complete diameter	0.80 in.

FIG. 4.

Inner conductor	19/15 S.W.G.
Paper layer	0.117 in. radial.
Conductor	30/0.053 in.
Outer lead	0.05 in. radial.
Complete diameter	0.80 in.

stress in the dielectric of 50 (R.M.S.) kilovolts per cm.

Fig. 4—comparable with fig. 3—illustrates the useful fact that under these conditions of large conductor diameter the embodiment of the split-conductor arrangement now largely used in E.H.T. cables in connection with Merz-Price protection gear does not entail any increase in the overall dimensions of the cable.

Turning to the matter of dielectric properties, the question naturally arises as to how far the proposals of O'Gorman and Jona as to varying the composition of the layers in order to obtain a series of capacities of the required values are practicable from the cable-manufacturing point of view.

Some degree of variation of specific inductive capacity could be brought about with pure papers (free from loading matter) by varying their fibrous composition, without interfering with their dielectric strength or impregnation, the difference between linen, manila, jute, and wood-pulp papers due to their composition and structure being appreciable. It is doubtful, however, whether sufficient variation could be obtained for the purpose by this means alone, or even by varying the composition of the impregnating compound at the same time.

Similarly in Jona's cable shown at the St. Louis Exhibition in 1904, and at the Milan Exhibition in 1906, the adjustment of the capacity by loading the layers of vulcanized rubber must affect the dielectric strength and therefore limit the breakdown value of the dielectric to that of the layer having the highest specific inductive capacity.

From the cable-manufacturing point of view the simplest and most reliable method of grading is by what may be described as the intermediate-sheath method of potential distribution, which consists of the interposition of metallic layers in the wall of the dielectric and of "anchoring" them at suitable predetermined potentials. This method relieves the situation from manufacturing complications because it is much easier to ensure a high and uniform standard of dielectric strength than to control suitable capacity grading.

The majority of large cable users would be more inclined to pin their faith to a single dielectric material with a fully proved history as regards durability, than to a combination of materials. Another practical point of vital interest to large users would be the question of jointing, which would obviously be much more difficult in cables graded by varying materials than in cables having a single dielectric material graded by intermediate sheaths. An incidental advantage of this type of grading is that the electrostatic discontinuity difficulty, which is liable to occur between layers of materials of different specific inductive capacities, is minimised. In the author's opinion the effect of the consequent distortion of the electrostatic field due to imperfect contacts between conductors and dielectrics is of such practical importance that he has proposed to use metallized paper layers—the metal coating being next to the conductors—in order to minimise such effects.

The author prefers the inter-sheaths to be in the form of a lead tube, which enables a close fit to the dielectric to be uniformly maintained and presents smooth surfaces. In most cases the minimum practicable thicknesses of such sheaths will easily carry the charging current. This construction gives the important advantage, from the point of view of efficient manufacture, that the cable may be thoroughly tested after each intermediate sheath is applied, and also between sheaths in the completed state. It will be appreciated that this feature is a very satisfactory one from the purchaser's point of view also.

Various methods of accomplishing the necessary distribution and anchoring of potential for both continuous-current and alternating-current cables have been patented by Tanner and Claremont. One method, by adding suitable external capacities in the form of condensers connected between the potential-distributing sheaths, was patented by the Land and Sea Cable Co.

Professor J. T. Morris suggested inter-sheaths connected to transformer tapping points; an arrangement on similar lines applied to the windings of high-voltage machines was patented by the British Thomson-Houston Co. in 1907.

Another well-known instance of a somewhat similar type of grading is found in the condenser type of terminal now largely used in high-voltage transformers. In this case the capacities of the various layers (forming condensers) are adjustable by trimming back the tinfoil layers to the required extent, this adjustment being sufficient in such short conductors approximately to equalise the potential gradient.

These methods entail the disadvantage from the user's point of view, that they require modifications or additions to the apparatus to which they are connected. It is clear, therefore, that from the commercial aspect it is desirable to keep down the number of inter-sheaths, so that the saving on the cost of the cable due to the method of grading shall not be counterbalanced by the cost of modifications to the connected plant.

With this aspect in view it is interesting to take the concrete example of a 75-kilovolt alternating-current single cable and to examine the effect of using one or more potential distributing layers under given conditions of maximum stress, say 45 (R.M.S.) kilovolts per cm.

(To be continued.)

Discussion.

Dr. Alex. Russell, in opening the discussion, said he believed this was the first paper on cables before the Institution by a man engaged in the manufacture of them. The author had described many novel phenomena and new methods of manufacture; incidentally the paper proved that rule-of-thumb methods were no longer popular. He was most interested in the inter-sheath method of grading; distinct economies could be effected with this method of construction for high voltages. While formerly he had recommended the Jona method, he was now convinced that the inter-sheath was much the better solution. Users were not prepared to admit that the specific inductive capacity would remain constant throughout the life of a cable with graded insulation. They would expect capacity currents with inter-sheaths and it was obvious that the capacity between the inter-sheath and lead-sheath was much larger than the original capacity of the cable. The function of the capacity currents was to level down stresses in the dielectric.

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For longer lengths than ten miles possibly some method would be adopted for feeding the capacity current in at certain points and the sheathing would be suitably modified, but for very long cables some other method must be found. This type of construction was quite suited for long lengths of direct-current cable as used in the Thury system.

Mr. E. H. RAYNER thought that the use of a central lead tube in the inter-sheath cable appeared to be expensive, and it might be possible to use a paper core. He asked whether any single cable of the type described had been used practically. It seemed there might be a difficulty in the use of potential dividers. During the last few months useful results had been obtained by the method of superposing direct current on alternating current in breakdown tests on paper cables. The author gave no definition of the properties of insulating materials used for high-voltage cables.

Mr. P. V. HUNTER said the paper might be taken as recommending single-core cable for E.H.T. work, and, though he agreed with the author largely, he did not think it would be possible to supersede the present three-core cable system for general transmission purposes; where the pressure was too high, the single-core inter-sheath cable would be useful. With very high voltages it was evident that a large amount of energy had to be transmitted, and in that case a large radius would be attained. It would be necessary to take steps to meet reactance and capacity effects with single-core cables, and he feared that at times something more than working voltage would be impressed on the inter-sheath due to surges, and this would have to be provided for.

Prof. SCHWARTZ said insulating material should possess recognised mechanical, physical and electrical properties, which should be maintained over a number of years. It was possible to forecast the life of these properties by mechanical and physical tests, the latter indicating the degree of permanence of the electrical properties. So far as the natural deterioration of rubber was concerned, plantation smoked sheet compared well with fine Para, and had already reached a stage which the author had expected to be reached in the future.

Mr. F. C. RAPHAEL dealt at some length with the question of breakdown of inter-sheath cables and the difficulties of testing such cables.

Mr. J. H. C. BROOKING pointed out that while the author had discussed the insulation of cables he had not touched on the protection of them, although this was becoming more and more important. Much trouble arose from the effect of vibration on lead sheathing—more than would be credited.

Mr. C. P. SPARKS, referring to the author's description of a 3-core cable joint with porcelain spacers, said he much preferred an ordinary carefully made joint with the insulation reinforced. The National Physical Laboratory had carried out exhaustive tests on temperature rise and fixed a very low limit. He asked what did the author consider the upper safe limit of temperature rise. He totally disagreed with the author's remarks on bitumen cable, which had proved treacherous in the past, and should only be used in special circumstances.

Prof. MORRIS drew attention to the peculiar movements shown by the author's cable expansion diagrams, especially as regarded the free ends. Lead-sheathing appeared to make a concertina movement with regard to the copper core, and he thought it might be possible to introduce some method of mechanically coupling them. He had some years ago concluded that inter-sheath cables might be of use, and with the Thury system it would be possible, by coupling the sheaths to intermediate terminals of the series of generators, to maintain the potentials at the desired amounts.

Mr. C. H. WORDINGHAM said it had not been recognised how very important was the question of tinning in rubber cables. They were also ignorant as regarded the damaging effects on dielectrics of temperature.

Mr. MELSOM disagreed as to the accuracy of the curves showing temperature rise in cables, especially such curves as were supposed to be derived from his and Mr. Booth's formula. There was a tremendous difference between the author's curves and any others published. The above formula applied to wiring in houses, and not to buried cable; he also pointed out that no data was given as regards the cables referred to.

Mr. BEAVER, in replying, said he thought inter-sheathed cables would be used to connect up to overhead lines. It would be necessary to fix the voltage of the sheaths by tapping transformers, and for direct-current, resistances or tappings from generators in series might be employed. He did not wish it to be thought that he suggested the use of single-core cables until the 3-core type became too bulky. It was no good having intermediate sheaths unless there were some terminals to connect up to, and so it would be necessary to have the co-operation of the manufacturers in their use.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

21,872. "Wireless or radio-telegraphy." C. HORTON. November 2nd.

21,881. "Machine for winding electro-magnetic coils." C. H. THORDARSON. November 2nd. (Complete.)

21,891. "Electrical conductors." BRITISH THOMSON-HOUSTON Co., LTD. November 2nd. (General Electric Co., United States.)

21,895. "High-tension discharge apparatus." H. R. RIVERS-MOORE. November 2nd.

21,901. "Dynamo-electric machines." W. A. PRICE. November 2nd.

21,904. "Telephone-call registering devices." V. THOMPSON. November 2nd. (Complete.)

21,906. "Reversible connector for electrical apparatus." W. A. S. BENSON & Co., LTD., and E. ELWOOD. November 3rd. (Complete.)

21,921. "Loud-speaking telephone apparatus." H. J. C. FORRESTER. November 3rd. (International Callophone Corporation, United States.) (Complete.)

21,925. "System of electrical wiring for buildings." D. S. MUNRO. November 3rd.

21,936. "Electrical relay apparatus." C. B. BURDON. November 3rd. (Siemens & Halske Akt. Ges., Germany.) (Complete.)

21,939. "Automatic device for the operation of electric switchgear. H. V. JAMES. November 3rd.

21,952. "Telegraphic systems." E. A. GRAHAM. November 3rd.

21,955. "Inter-communication telephone systems." W. BLOGG & STERLING TELEPHONE & ELECTRIC Co., LTD. November 3rd. (Complete.)

21,966. "Distributors for electrical generators." C. T. MASON. November 3rd. (Divided application on 29,655/13. December 23rd.) (Complete.)

21,968. "Miners' electric safety lamps." J. G. PATTERSON. November 3rd (Divided application on 25,210/13, November 5th.) (Complete.)

21,978. "Electrical switches." MIDLAND MANUFACTURING Co., LTD., & W. BARBER. November 4th.

21,992. "System of self-actingly switching-off defective sections of electric distributing nets." M. HOCHSTADTER. November 4th. (Convention date, November 5th, 1913, Germany.) (Complete.)

21,998. "Electrical switches." H. LEITNER. November 4th.

22,016. "Handles particularly adapted for electric switch levers and also applicable to other instruments." F. R. WADE. November 4th.

22,030. "Miners' oil and electric safety lamp combined." J. T. PRESTWICH. November 5th.

22,042. "Apparatus to control the voltage of electric generators." G. INES. November 5th.

22,044. "Dash-pot plungers." ELECTRIC & ORDNANCE ACCESSORIES Co., LTD., and J. ETCHELLS. November 5th.

22,045. "Arrangements for self-actingly switching-off defective sections of electric distributing nets." M. HOCHSTADTER. November 5th. (Complete.)

22,047. "Electric advertising devices and signs." F. C. REILLY. November 5th. (Complete.)

22,057. "Manufacture of tungsten filaments for electric incandescent lamps." E. R. GROTE & J. W. H. REYNOLDS. November 5th.

22,062. "Electric generators for lighting mechanically-propelled vehicles." H. C. H. SMYTH. November 5th.

22,113. "Overhead arrangements for use at cross-overs or switches on electric trolley lines." C. B. BURDON. November 6th. (Siemens-Schuckertwerke G.m.b.H., Germany.) (Complete.)

22,119 "Electric cables." W. C. KNIGHT & CALLENDER'S CABLE CONSTRUCTION Co., LTD. November 6th.

22,131. "Dynamo-electric machines." BRITISH THOMSON-HOUSTON Co., LTD. November 6th. (General Electric Co., United States.)

22,133. "Self-induction coils for use in duplex or multiplex telephone connections." A. H. OLSSON & H. B. M. PLEIJEL. November 6th. (Convention date, November 7th, 1913, Sweden.) (Complete.)

22,134. "Signalling." R. A. FESSENDEN. November 6th. (Convention date, January 10th, 1914, United States.) (Complete.)

22,150. "Electric water-heater." J. F. WHEELOCK. November 6th. (Complete.)

22,154. "Electric-lamp holders." W. D. FOX. November 7th.

22,174. "Electrical switchgear." T. MILLS & SPENCER & Co., LTD. November 7th.

22,176. "Mounting indicating-instruments in switchboards, more particularly used on motor-cars and other vehicles." C. A. VANDERVELL. November 7th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford, price, post free, 9d. (in stamps).

1913.

20,798. PROCESS AND APPARATUS FOR ESTABLISHING SYNCHRONISATION BY MEANS OF ELECTRIC WAVES. M. P. Otto. September 15th. (September 16th, 1913.)

22,157. TELEPHONE TRANSMITTING APPARATUS. A. H. Foote. October 1st.

23,332. ELECTRIC RELAY. W. R. Sykes Interlocking Signal Co. & R. W. Tarrant. October 15th.

23,342. TERMINALS FOR HIGH-TENSION ELECTRIC APPARATUS. F. Coates & A. Reyrolle & Co. October 15th.

23,565. TELEPHONE EXCHANGE SYSTEMS. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.). October 17th.

23,601. CAPS OR MOUTHPIECES FOR TELEPHONIC TRANSMITTERS AND OTHER SOUND INSTRUMENTS. A. Marr. October 18th. (Cognate application 24,595/13.)

24,755. MEANS FOR USE IN THE MANUFACTURE OF TELEGRAPH AND LIKE INSULATORS. F. Hancock. October 31st.

27,660. PROTECTION OF ELECTRICAL DISTRIBUTING OR CURRENT-CARRYING SYSTEMS. H. W. Clothier & A. Reyrolle & Co. December 1st.

27,905. TELEPHONE SWITCHING MECHANISM. M. S. Conner. December 4th.

28,415. APPARATUS FOR THE PRODUCTION OF ELECTRICITY FOR USE IN THE TREATMENT OF BIRDS AND ANIMALS. T. T. Baker. December 9th.

28,499. ELECTRIC IGNITION OF GAS-BURNERS. E. Plumstead. December 10th. (January 26th, 1914.)

28,554. WATER PRESSURE, AIR LEAKAGE, AND AIR PRESSURE INDICATORS. C. W. Thompson. December 11th.

1914.

1,143. SUPPORTS FOR ELECTRICAL CONDUCTORS OR OTHER PURPOSES. Callender's Cable & Construction Co., C. W. Kay. January 15th.

2,499. SPARKING PLUGS FOR EXPLOSION ENGINES. C. Spada. January 30th. (April 1st, 1913.)

5,542. PROTECTIVE DEVICES FOR ELECTRIC DISTRIBUTION SYSTEMS. E. E. Creighton. March 4th. (March 19th, 1913.)

9,092. ELECTRIC RELAY APPARATUS FOR TELEPHONIC AND OTHER VARIABLE CURRENTS. H. de Forest Arnold. April 9th. (Addition to 29,384/13.)

15,324. APPARATUS FOR ELECTRICALLY IGNITING MINERS' SAFETY LAMPS. V. E. Joyces and Spagnoletti, Ltd. June 26th.

17,603. APPARATUS FOR ELECTROCUTING ANIMALS. E. G. Fairholme & A. D. Clarke. July 24th.

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THE

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Vol. LXXV.] CONTENTS: November 27, 1914. [No. 1,931.

	Page
Trading with the Enemy	709
Fees of Consulting Engineers	711
Rubber	711
The British Trade Position in South Africa	711
Over-Pressure Protective Gear for High-Tension Circuits, by K. Edgcumbe (*illus.*)	712
Correspondence—	
From the Front	714
About Electric Radiators	714
Legal	715
War Items	717
Business Notes	718
A Military Cooking Installation (*illus.*)	723
Heating and Lighting Appliances (*illus.*)	724
New Electrical Devices, Fittings and Plant (*illus.*)	726
Notes	729
City Notes	732
Stocks and Shares	733
Market Quotations	734
Trade of South Africa	735
Institution of Electrical Engineers	735
Cables, by C. J. Beaver (*illus.*) (*continued*)	738
New Patents Applied For, 1914	740
Abstracts of Published Specifications	740
Contractors' Column ... ... Advertisement page	xx

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TRADING WITH THE ENEMY.

THE minds of business men continue to be exercised with that very difficult matter—trading with the enemy. Where they are purchasers and free to buy wherever they please their difficulty has been easily solved by their avoiding new transactions with any firm or company which has appeared to them to be German. In many cases the mere suspicion of German ownership has sufficed to justify their passing a certain firm by, in spite of the fact that the concern was giving employment to British workmen, if they could find a completely British source from which to obtain their requirements. When they have not been free to do as they have pleased, but have been subject to the approval of Committees, councillors, or other public authorities, they have found it necessary to make investigations at Somerset House and elsewhere as to the *personnel* and extent of German ownership in order to see whether by placing business with particular suppliers they were putting profit into the hands of those who would subsequently pass it on to the enemy. With penalties of no light amount hanging over their heads, it has been most important that traders should make absolutely sure of their ground in the placing of new business. But the subject has been greatly complicated by the hatred of everything German that has been engendered by the abominations that have accompanied the course of events on the Continent during the past four months. These feelings are the most natural in the world, and they have been quite as much responsible for the desire to avoid transactions with German-owned British concerns, as has the wish to comply with the law preventing silver bullets from reaching Germany. But while excusing, as we can, remembering all the circumstances, the desire to break such connections, we have from the first tried to persuade our readers to remember that, whoever owned the capital, if a company was legally registered here, and was employing British workmen to any extent, they were required neither by the Trading with the Enemy Bill nor by their own lofty spirit of patriotism to take the law into their own hands. There can be little doubt that sentiment has adversely affected those whom the Trading with the Enemy proclamations were never intended to touch. And not only does this remark relate to German-capital concerns, but to others which some rumour or other, or some encouraged fancy, had wrongly labelled Teutonic though they were as far removed therefrom as the two poles are apart. So far as all criticism of the original Bill is concerned, we do not think that sufficient allowance is made for the multitudinous new problems which overwhelmed every department of the Government when this unparalleled war-cloud burst upon us. Everybody recognises that he is in a world totally different from that of the early summer. The Bill was passed in its first form as an Emergency Statute, and, like many other things, it had to be done in a comparative hurry, and without any previous experience to go upon. We have now had four months' discussion, correspondence and experience, and most of us have recognised that there has been something wanting. Many have had misgivings as to the efficacy of the measures taken to prevent the money getting to the Continent, and refusals to pay accounts in what were regarded as doubtful cases have been very numerous.

Several cases have been brought before the Courts, and one of them, after being decided by one Judge along lines

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of sentiment rather than of law, was carried to a higher Court, where the sentimental decision was described as erroneous, and reversed by Mr. Justice Horridge and Mr. Justice Rowlatt, who held that when once a company was registered in this country according to English law, it became resident in this country and was not an alien enemy incapable of suing because one of its members might be prevented from doing so on the ground that he was an alien enemy. Another decision has also been given this week to the same effect, so that we presume readers who have been in doubt as to what were their legal obligations during the war for past debts, will now have their minds set at rest.

In the event of firms fearing that under these latest rulings of the Courts there is still the danger that moneys will reach enemy hands, we think they will find satisfaction in studying the provisions and requirements of the Trading with the Enemy Amendment Bill, and the speeches delivered by the Attorney-General in the House of Commons on November 20th and 24th. Sir John Simon said that time had now shown what changes were desirable, and, in consequence, it was proposed to create an authority which would receive and preserve in safe custody in this country some portion of the money and interests which, if not put under such custody, might find their way to the support of the enemy state. The Public Trustee will act in England and Wales as custodian of any profits payable to shareholders with German or Austrian addresses. He may either put them on deposit or invest them, and they will remain under Government control till the end of the war. What is aimed at is the stopping by every reasonable means of the transmission of money or the creation of credit which would be of advantage to the enemy. Dividends payable to agents of enemy companies in England as well as dividends transmissible across the seas will be subject to attachment. Anybody in this country holding property in trust for, or collecting dividends on behalf of, an enemy in Germany, Austria-Hungary or Turkey, is required under penalty to furnish particulars to the custodian within a month from the passing of the Act. Sir John Simon was careful to point out that there was no intention to practise indiscriminate confiscation, and we agree with him that it is a matter of considerable importance for our credit as a commercial nation that we should comply with the ordinary rules of good faith and fairness; the property will be preserved till the end of the war. "What was to happen to it then was a thing that could be very properly decided then." We shall then want to be satisfied that our interests in the enemy countries have been equally fairly dealt with.

The Bill provides, among other things, that when the custodian has in his hands property paid to him as representing some particular enemy creditor, that property will be available as far as it will go to pay debts owed to other persons in this country by such enemy. Another of its far-reaching provisions is designed to prevent Germany from utilising credits due to her from neutral countries for satisfying claims against her in this country. Cases had arisen where when once the claim was assigned the neutral put forward a claim against the British merchant for the payment of the debt. While the Attorney would not promise that they would succeed in stopping such things altogether, they must do their utmost, and one of the clauses in the Bill should go a long way in that direction.

One other matter—a serious source of leakage in the past three months—is also to be dealt with. Many Germans and Austrians held shares in English companies, and they could transfer those shares to a neutral, who could present the transfer to the secretary, who, according to the law as it previously stood, could not refuse to alter the register and enter the neutral name. It is also provided that enterprises which are German in character shall not be so easily able to transform themselves into British concerns; they will have to make a declaration, in applying for registration of a new company during the war, that such company is not being formed for the purpose, or with the intention, of acquiring any part of the undertaking of an enemy. It is believed that this will relieve the public of "a very natural anxiety."

The Amended Bill is being considered by a Committee of the whole House, and in that stage of the proceedings many points are being gone into very closely. It is recognised that the public interest in the subject is very great, and is, for the most part, inspired by patriotic feeling, and those who hold that the measure is still open to criticism because it does not go far enough in certain particulars, will have an opportunity of securing a hearing during the Committee stage. But we feel convinced that the Attorney-General will carry with him those who are anxious to preserve the best British traditions when he suggests that our object should not be to harry and worry every unfortunate German or Austrian who happens to be trading in our country, but to see that the trade they are carrying on can by no possibility result in adding to the financial strength of the enemy.

A member of the House wished to include as enemies any limited companies in which 75 per cent. of the shares were held by enemy subjects, but to whom, according to recent legal decisions, British debtors were bound to pay the money due. It is clear that the Government had already seriously considered this matter, for the Attorney-General reminded the said member that under the original Act an inspector was appointed for all such companies, one-third of whose shares or directorate was in alien hands, and a controller was appointed where an offence under the Act had been or was likely to be committed.

We greatly dislike the prejudice which boycotts concerns because their capital is partly German, but we fear that, however strong the Trading with the Enemy Bill may be, that prejudice will still have to be reckoned with in a number of places. It is not remembered, when prejudice is in haste, that "Boycott German Capital" may mean the reverse of "Employ British Labour." That requires hammering into the lay journalistic and the municipal mind. The discussions that have taken place at various municipal corporation meetings show which way the wind is blowing, though Councillors may be brought back to their senses by the ruling of the Town Clerk as to the legal position. We receive so many inquiries concerning firms in the electrical industry, that we are led to wonder whether it would not be in their interests if they advertised the fact very plainly when they have no German connections, financial or otherwise. We may, as we say, greatly regret it when prejudice becomes so strong as to call for any such steps, but that prejudice is very real, and while it has to be fought, its possible effects have also got to be faced.

There are other aspects of this question of enemy trading that are of interest, but they are not matters calling for consideration by Parliament. They are matters of common sense and common fairness rather than law, and we believe that it is only necessary for a little more prejudice masked as patriotism to be cleared away for these to adjust themselves. Mischief has been wrought by medium of newspaper advertisement and by newspaper article too, which makes one suspect the motive. Advertisements sailing very close to the wind have reflected upon the wares of rival advertisers in what seems an unwarrantable fashion. It will be found, we believe, that as much business will be lost as gained by such methods. A good thing will sell better if it is not necessary to name another article which competes with it in such a way as to call forth an advertisement response which shows the original advertiser to be making unfair and unworthy suggestions. We are not concerned, as a journal, either with fountain pens or Christmas cards, we are concerned more with principles. We have received communications this week urging us to appeal to our readers to remember how British the Christmas card business has become, and to what large numbers of our own people it gives employment. We are only remotely interested in the doings of the shopkeeper, but in the case of many a man of this class who is as English as we are ourselves, there will be a poor Christmas in store if we are to influence the purchasing public so as to make him the victim, in respect of his laid-in and paid-for stocks, of our efforts to penalise somebody else. The public cannot be expected to know what are the circumstances which have led the shopkeeper to lay in German stocks so well as the shopkeeper or the advocates of a boycotting campaign. The public, when it now refuses to buy German goods which it has hitherto accepted without question, does so

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because it does not want to assist the enemy to shoot more British soldiers, but it has no wish to penalise the Englishman on the other side of the counter, who may be as patriotic as itself, unless he is really a screen to hide a German. In this and many other matters there is room for the exercise of a good deal more common-sense in the conduct of the campaign.

Fees of Consulting Engineers.

We have received a booklet issued by the Association of Consulting Engineers for the use of its members, in which, in addition to the professional rules governing the relations between the consulting engineer and his client, a list of fees chargeable is given. As the matter is of interest to all professional engineers, whether members of the Association or not, we give below a summary of the fees.

For legal work, such as attendance before Parliamentary Committees, expert evidence, arbitrations, and so on, a retaining fee, plus a charge for each day's attendance of six hours, is usual, the amount depending upon the standing of the engineer and the importance of the case. From 10 to 15 guineas per attendance is a usual fee. For purely advisory work, preparation of evidence, consultations, inspections and the like, including time occupied in travelling, a fee of two to three guineas per hour is said to be usual. We suggest that for ordinary inspection work two to three guineas per day is a more usual fee, and that such a charge per hour is both excessive and prohibitive. The work of inspection, important as it is, is usually undertaken by the younger and less prominent members, often acting on behalf of the leading lights of the profession ("devilling" is, we believe, the recognised term), and we very much doubt if any such fee as two to three guineas per hour has ever been paid by the latter for such services. But perhaps the "inspections" referred to are of a legal nature—and we know how expensive the law is.

The usual commission, according to the scale of fees, for constructional work—which covers the drawing-up of specifications, preparing contract drawings, advising on tenders, instructing contractors, directing during construction, and certifying the due and proper completion of the work—is 5 per cent. on the amount of the contract, when the contract exceeds £5,000; but when the amount of the contract does not exceed £5,000, a commission of 7½ per cent. to 10 per cent. is said to be usual. We think this should be more clearly stated. It would, for instance, be unreasonable to charge from 7½ per cent. to 10 per cent. instead of the usual 5 per cent., if the amount of the contract happened to be £4,900 instead of over £5,000. There is surely a sliding scale, and the maximum commission is only charged on very small amounts.

For bills of quantities, the adjustment of extras or omissions and variations, the measuring-up on completion and similar services (which, in the case of analogous work, such as architectural, would not be covered by the architect's commission, but would be quantity surveyor's work), a separate charge is usual, viz., 1½ to 2 per cent. on amounts in excess of £5,000, and 2 per cent. to 2½ per cent. on smaller amounts. We assume this refers not to electrical work, where such cases rarely if ever arise, but to civil engineering work which often includes building or structural work, as, for instance, in bridge and dam construction and the like.

It will be seen that the scale of fees adopted by the Association does not err on the side of mercy to the client, and engineers who do not belong to the charmed circle may find it to their advantage to remain outside and charge what they think fit. There is not such a great deal of work about just now as to justify stiff charges for professional services.

Rubber.

The market is to a great extent influenced by war and the export prohibitions referred to more particularly below, and the feeling is rather unsettled at the moment. The total prohibition of exports from this country hit the market a hard blow, and also struck America pretty severely. It seems that the prohibitions enforced in a number of articles are making United States' interests fretful, but they must recognise that what we do is in the ultimate interests of all decent-minded States, and for the ultimate safety of all covenant-respecting peoples. At all costs the Huns must be kept at bay. Towards the close of last week the excessive flatness in evidence owing to the export trade restrictions gave place to a rather harder tendency, the impelling cause of which seemed to come from New York, and the demands met with disclosed very few sellers. The demands came as a surprise, but the theory was advanced that America believes that the absolute prohibition will be only temporary, and that when definite and satisfactory assurances are forthcoming, it will be possible soon to export to neutral countries. Whether this be so or not, the theory is a not unreasonable one, and prices appreciated sensibly. For the present, war conditions seem to be the all-powerful consideration to be kept in mind, and all market factors must be subordinated to these.

The exports of plantation rubber from the Straits Settlements for October (exclusive of exports from the Federated Malay States) totalled, according to official returns, 2,006 tons, against 1,602 tons in September, making 17,023 tons, against 9,449 tons last year, and 4,426 tons in 1912. The exports from the Federated Malay States for September (the last figures available) were 2,903 tons, against 1,850 tons in August, making the total for the nine months 21,574 tons, compared with 16,625 tons last year, and 11,028 tons in 1912. It thus appears that during two years the exports from the Federated Malay States increased about 100 per cent. No doubt, however, the maximum production for a time is near at hand, for there is no inducement to put further ground under rubber at present. The war and its attendant troubles and restrictions of consumption will tell upon rubber as it has on other commodities. The September exports of wild rubber from the four Amazon ports, by way of Para, showed a very heavy reduction this year against 1913.

Naturally there is a very important falling off in the quantities shipped to Europe, the war stopping shipments to Germany, while rubber has been declared contraband in many cases. Germany is, no doubt, hard up for rubber, and would pay excessively high prices for this, as for all sorts of metals, but the doors are locked and barred. The French Government have placed tires and rubber upon their list of absolute contraband, and the Danish Government have prohibited exports of rubber, under heavy penalties, including fines and imprisonment.

Most important, however, is the action of our own Government, which is very properly leaving no stone unturned to put a spoke in the wheels of the Huns. Exports have been forbidden from Ceylon and the Straits Settlements except to British ports, but permits are being issued for Japan, and the Dunlop Company are shipping 50 tons a month from Colombo, and a similar quantity from Singapore, for use in their mills in Japan, while permits will also be granted for Russia and France. By an order published in the *Gazette* a few days ago, raw rubber has been placed upon the list of prohibited exports from the United Kingdom to all the destinations specified in the Proclamation of November 10th last. This is another blow at Germany's war supplies. There is no doubt that rubber is scarce with the savages overrunning France and Belgium, but they seem to have been lucky enough to steal a decent quantity in Antwerp, which will, no doubt, help them along for a bit. The cord is, however, being slowly tightened round their neck, and the steady pressure will tell in time.

The British Trade Position in South Africa.

Sir Sothern Holland's report on trade in South Africa contains much food for reflection savoured by a little encouragement. On another page we give, as far as space will allow, a summary of such portions as will interest electrical manufacturers and contractors.

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Here we would emphasise certain aspects of the position revealed. Taking first of all the point which is foremost in the trading mind just now, viz., German competition, we find that the percentages respectively of British and foreign (mainly German) participation in the imports of electrical, mining and other machinery and plant in 1912 and 1913 were as follows :—

Percentage of total imports from—

Class of goods.	United Kingdom. 1912.	United Kingdom. 1913.	Foreign countries. 1912.	Foreign countries. 1913.
Mining	60·65	59·22	39·34	40·73
Electrical	50·19	48·49	49·80	51·50
General machinery	60·02	58·70	39·00	40·20

The increase in the percentage of foreign imports is disquieting, seeing that it is more than two years since the effects of German finance in the Victoria Falls scheme were supposed to have been nullified. With this influence removed, a better showing by British firms was surely to be expected, particularly as the Union Government authorities have been avowedly in favour of giving preference to British tenderers up to a certain limit. Unfortunately this limit appears to have been reached when British and German tenders were opened for 10 locomotives and 34 coaches, and it was found that by ordering them from German firms the outlay would be £110,000 less than if they were placed in the United Kingdom.

The suggestion of the South African Government that there had been collaboration in the prices submitted by British firms need not be gone into again, but Sir Sothern Holland's corollary should be noted. "The feelings and policy of the Administration make it clear that British manufacturers are now faced with a new position in regard to railway business in the South African market. There is no doubt that our competitors, with the opportunities now given them, will cut their prices as low as possible in order to secure a foothold." He goes on to say that the upward tendency in prices in the United Kingdom during recent years is accountable for many complaints and considerable loss of business, due to foreign firms apparently not finding it necessary to increase their prices to anything like the same extent.

Another grievance against the British manufacturer is on the score of late delivery; and the South African buying departments threaten that penalties for delay will be strictly enforced. It is not an uncommon practice for the Government to accept a tender at a higher price because quicker delivery is offered. If the successful tenderer exceeds the contract period, the Department not only pays the higher price and loses the advantage of early delivery, which it purchased, but is inflicting a hardship on the lower and perhaps more conscientious tenderers.

The two weak points in Great Britain's competitive trade are thus focused, viz., high prices and late deliveries; and confirmation of this is forthcoming from non-official as well as official sources. Sir Sothern Holland hopes that a real effort will be made to bring about a better state of things, in order that prejudices may be removed and more favourable opinions engendered.

Such is the pill which our Trade Commissioner administers to home manufacturers. By way of a little sugar-coating he quotes the following opinion of "one of the most prominent electrical engineers of the Witwatersrand" —a man of great experience with plants of all competing countries. "At the present time, I believe, we have one or two firms in England who can hold their own with any of the Continental houses, and since we have agreed that quality, and not price, shall be our first consideration in placing orders, we have not had nearly so much trouble." We consider this a grudging admission. Never in the past has it taken long for any engineer of experience—great or small—to discover that endless trouble in the long run will be saved by paying for British quality and British finish. And we join issue, too, with the implication that there are still only "one or two" firms in England who can compete successfully—along the lines of *fair* competition—with Continental houses.

OVER-PRESSURE PROTECTIVE GEAR FOR HIGH-TENSION CIRCUITS.

By KENELM EDGCUMBE, M.Inst.C.E.

In his 1913 presidential address Mr. Duddell* gave a most able *résumé* of the conditions under which dangerous pressure rises are likely to occur, and he showed that hardly any circuit could be regarded as immune. Much attention has been given, during the last few years, to the design of apparatus for rendering such over-pressures innocuous, and a survey of the present trend of opinion on the subject may be of interest.

Mr. Duddell dealt exclusively with troubles due to internal causes, and described these as "pressure rises." The station engineer has, in many cases, to deal with those of atmospheric origin as well and the more general term "over-pressures"† is usually employed to cover both categories, viz.:—

A.—Disturbances due to external (atmospheric) causes and affecting overhead lines only.

1. Static charges.
2. High frequency or steep fronted waves.

B.—Disturbances due to internal causes and affecting both overhead and underground mains.

1. Resonance.
2. Switching and sudden changes of load.
3. Faults.

A.—Disturbances due to External Causes.

1. *Static charges* accumulate on overhead lines owing to various causes such as contact with electrified bodies (*e.g.*, hail or mist), or to the line passing through air strata at different potentials. Or, again, a charged cloud may cause a very considerable potential difference to earth as indicated in fig. 1. Whatever their origin, such static charges are best relieved by means of a choking coil permanently connected between each line and earth. The static charge flows to earth as a continuous current, and such a coil may have a low ohmic resistance but yet allow a negligibly small alternating current to pass.

The only alternative which has been used at all extensively is the water jet arrester. This takes the form of a jet which flows from an earthed nozzle and impinges on an electrode connected to the line, thus interposing a high resistance to earth. The objections to such an arrangement are obvious, amongst them being waste of water, indefinite resistance, and considerable loss of current, since the resistance is the same to the line current as to the static charge. Such an apparatus need hardly be considered, and certainly not for use in this country.

The earth choking coil may have a secondary winding to which voltmeters can be connected if desired. Such voltmeters form rough leakage indicators on insulated systems.

2. *High frequency or steep fronted waves.*—These disturbances may be due to direct lightning strokes or to the effects of induction. When a line is subjected to a direct stroke no gear so far devised has been found to be of any real service in protecting the line itself. Fortunately, however, such strokes are comparatively rare and the trouble is in most cases localised, so that, unless the line should happen to be struck near a point at which plant is installed, the danger is not likely to be extensive.

Of much more common occurrence are surges due to induction. These were at one time thought to be of enormously high frequency, several million periods per second being freely suggested, and were, it was thought, due to magnetic induction from lightning discharges in the neighbourhood. Elaborate theories have been evolved on this as-

* Journal Inst. E.E., Vol. 52. p. 1.

† French "Surtensions," German "Ueberspannungen."

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sumption and many systems based upon them, but on the grounds both of probability and experience moderate frequencies of a thousand periods per second are now generally accepted.

De Bois* quite recently obtained some oscillographic records of the charges induced on an overhead conductor by lightning discharges in the neighbourhood, and fig. 2 is typical of the majority of the discharges observed by him. In these experiments the oscillograph was connected between the overhead conductor and earth, that is to say, it occupied the same position as would the winding of a generator feeding an overhead line. The most noticeable feature of the curve in fig. 2 is the extremely steep wave front, followed by one less steep, dying away and (in this particular case, although not always present) by a number of oscillations of a frequency of some 15,000 periods per second.

The production of such a wave may be accounted for somewhat as follows: In fig. 1 a negatively charged cloud is supposed to be approaching the line where it gradually causes the accumulation of a positive static charge tending to flow to earth. This

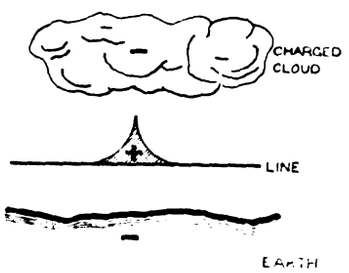

Fig. 1.

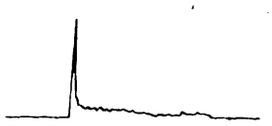

Fig. 2.

forms, as has already been pointed out, one of the causes of a "static" charge, to relieve which a path to earth must be provided. Should the cloud approach so near that the air breaks down, this corresponds to the line being struck, but it is more probable that the cloud will discharge to earth or to another cloud. In either case the charge on the line will be "freed" and will rush along the conductor in both directions with a velocity approximating to that of light. When first released the front of such a wave is extremely steep (see fig. 2) and the amplitude may be large. As it travels along the line the wave front is flattened out and its height reduced owing to the gradual dissipation of energy in the resistance of the line. In fact, if the line is a long one so that the disturbance passes over some 20 or 30 miles of conductor, the wave will in most cases be rendered innocuous. Fig. 3 shows, in a diagrammatic way, the passage of the wave in each direction, the dotted curves represent-

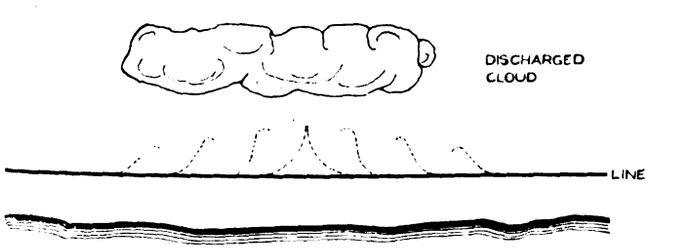

Fig. 3.

ing successive stages in the process. The danger of such surges lies not only in the pressure which has to be withstood by the line insulators, etc., but in the abnormal strain thrown on the end turns of transformer or generator windings in the path of the wave, due to concentration of potential on them.

The concentration of potential on a few turns may be accounted for, roughly, as follows. In fig. 4 a line is shown connected to one phase of a generator, winding G.W. having the neutral earthed. The left-hand dotted curve may be supposed to represent an oncoming surge, and the condensers C, the capacity which the generator windings have to earth. As soon as the surge reaches the winding, part of it tends to flow to earth through the first condenser C. Owing to the rapidly increasing potential difference of the oncoming wave (*i.e.*, to its steep front, see fig. 2) the condenser C, in spite of its comparatively low capacity, forms almost a short circuit to the wave so that the full P.D. of the surge is applied to the part of the generator winding between the points *a* and *b*.

Thus it comes about that during the time the condenser C is being charged, the winding *a b* has the full P.D. of the surge imposed upon it, so that even with a surge of quite moderate amplitude neighbouring turns of a winding, separated possibly by nothing but two layers of cotton covering, may have several thousand volts applied between them. The resulting breakdown frequently takes place only after some time, probably during ordinary working, and may therefore not be traced to its true cause.

As soon as the condenser C is fully charged up the process is repeated as regards the section of winding *b d* and so on, progressively, until the wave has passed through the whole winding. This being the case, it might be thought that all the turns would suffer equally as the surge passed through them, whereas experience shows that in nearly all cases it is only the first turns that are damaged.

The explanation is that as the surge travels along the winding it encounters at each point a capacity to earth which it charges up before passing on, and as this takes an appreciable time it follows that the wave is flattended out and the steepness of its front reduced. This has the effect of reducing the concentration of potential on the windings as the wave front passes further along the coil, so that it is the first few turns which suffer most. This effect is illustrated in fig. 4 by the right-hand dotted wave

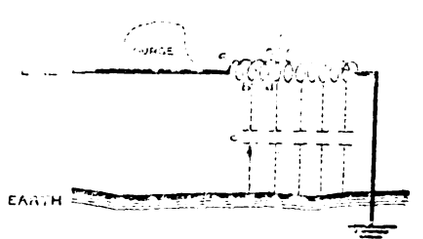

Fig. 4.

front which is shown as much less steep than the other. It may be mentioned that low tension machinery is actually found to be less susceptible to damage from such wave fronts than high tension, no doubt owing to the large number of turns which are brought near to one another in the latter case (*e.g.*, in each slot).

Protective Gear.

An earthed wire suspended over the line affords a certain amount of protection. In fact, Petersen* has shown, from theoretical considerations, that a simple wire run over a 3-phase 20,000-volt line may be expected to reduce the amplitude of a surge by 40 per cent. and the energy liberated by more than 50 per cent. The action of the earth wire is twofold. It reduces the charge on the line by interposing an earthed shield, and also reduces the potential difference due to a given charge by increasing the capacity to earth.

The earth wire, however, cannot do more than reduce the danger, and considerable controversy has raged round the question of how best to deal

* L. A. de Bois. Paper read before Am. Inst. E.E., 1914.

* W. Petersen, *E.T.Z.*, Vol. 35, p. 1, 1914.

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with such surges. It is not enough to employ spark gaps which can only limit the value of the P.D. to earth since the danger is due almost as much to the steepness of the wave front as to its amplitude. As already mentioned, it was at one time widely believed that surges due to lightning were of enormously high frequency, and it was suggested, first by Thury and later by Giles and others, that condensers connected between lines and earth would afford an easy path, and so "conduct away" the energy of the high frequency surge while allowing but a negligibly small current to flow at the line frequency. The Moscicki "bottle" type condenser was specially designed for this work some ten years ago. It is made up into batteries of say 12 tubes, grouped in series or parallel according to the pressure of the system, the inner coating of each being connected through a fuse to the line and the outer coating to earth.

Now that the idea of an abnormally high frequency in the case of atmospheric disturbances has to be abandoned it is clear that no condenser of practical dimensions can "conduct away" any appreciable surge. The only function which such a condenser can fulfil, therefore, is to flatten out the oncoming wave just as a surge in passing through a winding has its front flattened due to the capacity of the winding (see fig. 4). Moreover, the condenser is necessarily a delicate piece of apparatus, and should it break down it puts a dead earth on the line and gives rise to most serious surges, and that in the worst possible position, namely, close up against the machinery it is designed to protect. In order to guard against this danger it is usual to provide each condenser with a fuse connected between its inner coating and the line. This practice, however, is open to the very serious objection that the fuses may blow without the fact being noticed, thus putting the apparatus out of action and leaving the plant more or less unprotected.

Although a very large number of lines on the Continent have been fitted with condensers during the last seven years, it must be admitted that, quite

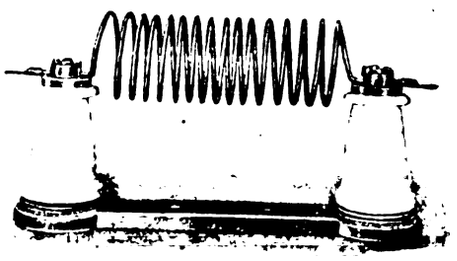

FIG. 5.

apart from the expense involved, it is very doubtful whether the protection afforded is really adequate. In the case of one very large transmission system in Germany, fully equipped with condensers at a cost of some £10,000, it was found (*E.T.Z.*, Vol. 35. p. 417, 1914) that the annual charge to cover the cost of repairs and renewals, and interest on capital amounted to about £2,000 per annum. In spite of this more than 12 per cent. of the transformers installed broke down in their end turns during the first year's working. It was actually found that more transformers broke down in sub-stations which were protected by condensers than in those which were not, owing to the frequent failure of the condensers themselves which caused severe surges. It is only fair to add that in the case of other stations much more successful results have been obtained but, all things considered condensers must at present be regarded as expensive luxuries.

A much more rational, cheaper and more widely used method is to connect a choking coil between the line and the plant to be protected, see fig. 15. This arrangement amounts to removing the end turns (*i.e.*, those liable to damage) from the machine itself and placing them in the line where they can be well insulated and will form a sort of breakwater to the on-coming wave. Fig. 5 shows a usual pattern of line choker for this purpose. In another form, which presents some advantages for comparatively low voltages, the winding consists of a coil of flat copper strip, adjacent turns being separated by a band of insulating material. The self-induction of such a coil is higher, but its liability to break down between turns is somewhat greater than in the case of the air insulated choker shown in fig. 5.

A choker performs two useful functions—it flattens out the wave as it passes through the winding in the way already described, and it also has the property of holding back the surge in virtue of its self-induction, thereby giving the spark gaps time to conduct away a large part of the energy which would otherwise pass through the machine winding. A further portion of the energy is reflected back along the line where it is gradually dissipated in heat. Owing to these valuable properties a choking coil should always be installed on overhead lines even where condensers are used.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

From the Front.

Thank you for kindly sending me your REVIEW. I always like to keep in touch with the electrical world. I get plenty of hard work to do attending to electrical plant, also have to take a guard. I have had no sleep for a week, but I hear that we shall have a rest next week, owing to our 7th Division losing a great number of men in the battle of ——. However, the Germans are losing men wholesale, and, in my opinion, the war will be over before this time next year. Some of the Boys out here say that it will be over in a few weeks. But we must remember that the Germans have still got an army. My friend is a wounded prisoner of war in Brandenburg Royal Auxiliary Hospital; he can only write once a month. I myself am not in the actual firing line, but, at the same time, I am near enough. We always come across many spies and stragglers, who are only too willing to give themselves up on account of being short of food. It makes one feel very depressed to see old men and women with their children marching from village to village with their homes on their backs; also to see the dead bodies in the trenches, &c. I am not allowed to give any names of places, &c., so must now come to a close. Thanking you for your kindness,

M. D. Boddy,
Expeditionary Force.

About Electric Radiators.

Why Mr. Sharp should think Mr. Belling is aiming his remarks at the Jackson heater only I fail to see, as there were several "boxed-up" fires on the market before the Jackson was brought out. I admit Belling is just a bit too formidable with his "Beware"; at the same time he is correct in denouncing the type of heater he has in view.

I agree with Belling that the "two statements are correct," and this because my "intelligence and training" prove that they are true. It probably suits Mr. Sharp to read Belling's wording wrongly, but men of "intelligence and training" will realise that the concentrated and boxed-up fire will dry up the moisture more than the open type.

As to the comparison with the coal fire, I think all will agree that the coal fire is not by any means always satisfactory. It is at times "too fiercely radiant," and at other times there is not sufficient radiant heat from it. I am making this statement more or less from memory, as I have not lived with a coal fire for eight years. The coal fire also "burns up the small particles in the air," but has the saving grace of passing these particles up the chimney—like Prof. Vivian Lewes's cremated microbes on the ceiling.

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I think Mr. Sharp would be but just to his firm if he were to admit that the principle of the Belling fire is correct, and it would do a great deal towards furthering the use of electric heating if his firm and other makers were to modify their designs accordingly.

I think I can claim that I handle as many radiators as any one who comes into direct contact with consumers, and I have no hesitation in saying that the Belling fire is the favourite.

I hope other manufacturers will not be so easily made to squeal as Mr. Sharp, but will come out openly with their advertisements, and also prove to us that they "know better than the other fellow how to make radiators."

I wish to congratulate Mr. Belling on doing more than anyone before him to make electric heating a success. I have no particular interest in his firm, and have seen him in the flesh but once. The opinion I had of him then was that he was altogether too modest for a salesman, but it is very evident he is going through a process of being sharpened up.

More power to him, is my wish.

Thomas Smith,
Distribution Engineer.

Corporation Electricity Department, Wolverhampton,
November 17th, 1914.

Some months ago we carried out experiments to determine if better results could be obtained with our fires by increasing the heat intensity of the fire-bars.

The result of various trials persuaded us to keep the bars at a medium heat intensity, as previously, and to provide for free air movement around them.

We cannot say that this conclusion was entirely pleasing, as it would have been possible for us to manufacture fires of a given power more cheaply had we been justified in increasing the heat intensity.

It was these experiments that gave rise to the points in our advertisement in your issue of the 6th inst. We were not a little surprised, therefore, to see from the letters in your issues of November 13th and 20th that some electric fire makers had considered our advertisement an aspersion on their manufactures.

Now, Sir, we have no wish, and certainly no necessity, to disparage any of our competitors' fires, and if our advertisement wounded their sensibility, we are sorry.

We do not wish to encroach unduly on your space by entering into long technical arguments; we would rather do this in your advertisement pages—to which we endeavour to confine our advertisements—but just a few words, if we may, in reply to your correspondents.

With regard to Messrs. Ferranti's letter, a few years ago we also thought it impossible to err on the side of too "fiercely radiant" heat, but with the more perfect materials now available the limit marking the greatest utility seems to be much below the limit of reliability of the material. Another point raised in this letter we have dealt with in our advertisement elsewhere.

With regard to Mr. Sharp's letter, we see no reason to argue out the first part, and will just suggest with regard to the last but one paragraph that our advertisements should be read intelligently; that two sentences which are obviously distinct and have no connection one with the other, should not be grouped as if they had.

On the matter of the last paragraph we have a perfectly clear conscience.

In conclusion, might we suggest that if your correspondent made more use of your advertising pages, we might in turn have an opportunity of criticising his efforts. Such would certainly be of just a friendly nature.

For **Belling & Co.**

C. R. Belling, *Acting Partner.*

Edmonton, *November 23rd*, 1914.

LEGAL.

The Armorduct Manufacturing Co.'s Appeal.

[The Position of English Companies with Alien Shareholders.]

A Divisional Court of the King's Bench Division, composed of Justices Horridge and Rowlatt, on Thursday, November 19th, heard the important appeal brought by the Armorduct Manufacturing Co., who are engaged in the manufacture of tubes in which electric wires are inserted, and who have offices in London and a factory near Birmingham, against a decision in the City of London Court by Judge Atherley Jones in favour of the defendants, Defries & Co., of New Oxford Street, in an action the plaintiffs had brought to recover a debt of £1 10s. for goods supplied at a period prior to the war.

Mr. J. H. Campbell, K.C., and Mr. Hinde appeared for the appellants, and Mr. Tebbs represented Defries & Co.

Mr. Campbell, in opening the appeal, said that the amount involved here was small, but the question of principle involved was of the greatest importance. The facts in the case were practically admitted. The plaintiffs were a company registered in England, with an office in London and a factory near Birmingham. They were registered according to English law, and the defendants owed them this sum of money for goods supplied before the war, and there was no conflict on the point that the debt was due, and the only question that the defendants had raised was that by reason of the fact that the plaintiff company, not entirely, but to a large extent, consisted of shareholders who were Germans, therefore the company was not entitled to recover. The Judge seems to have been satisfied with this, and he there and then, without further ado, entered judgment for defendants. He based his decision on the one ground that to allow the plaintiffs to recover the debt would be contrary to public policy. He (Mr. Campbell) would have to show that this decision was totally wrong. He would show that the Courts had warned against this principle of allowing this matter of public policy to operate upon the minds of judges, and he would show that there was no question of public policy here. The case before the Judge only lasted for a few minutes. It was apparent, from an inspection of the register of the shareholders, that the large proportion of them were not English subjects, and, to the mind of the Judge, this disposed of the case. It appeared from his note that 380 shares were held in England by naturalised Germans, and 1,435 were held by Germans, on the Continent. The capital was of £15,000 divided into 2,000 £5 shares and 5,000 £1 shares. The Judge's notes of these facts were substantially correct, but the fact was there were four or five English shareholders. The Judge here took the view that substantially the whole of the share interest was held by Germans, and it was not denied that the bulk of the shareholders were Germans. Before going on with his argument, counsel desired to say here on behalf of the plaintiffs, that since the beginning of the war they had never had any transactions of any kind at all, pecuniary or otherwise, business or commercial, with any foreigner; the entire trade carried on by them since the war had been exclusively confined to British subjects; and they had served a notice since the war that no transactions outstanding with regard to any foreigners would be recognised.

Mr. Justice Horridge: I am not surprised that you state that.

Mr. Campbell: I do not think it is altogether immaterial, having regard to the point of view that the Judge took. He based his judgment on the point that this was trading with the enemy, and that it was contrary to public policy in time of war to give the plaintiffs judgment. I say that he entirely misconceived the whole position, because clearly there was no trading by us with the enemy at all.

Mr. Justice Horridge: If it was trading with the enemy it was being done with you.

Mr. Campbell went on to say that the defendants were without question an English company, and the mistake that the Judge made was that he imagined it was contrary to public policy that foreigners should carry on within this country during war-time their trade with us, and he forgot that that might be one of the greatest possible advantages to us. We may have foreigners registered in this country who are carrying on a trade in some particular product which we cannot make for ourselves, and there it would unquestionably be for the benefit of our country that that trade should not be interfered with.

Mr. Justice Horridge: Yes, as long as the money is not remitted.

Counsel: Yes.

Mr. Campbell proceeded to read at length the judgment of the County Court Judge. The Judge, in effect, said that the profits of this company would go to alien enemies, and therefore he was bound to dismiss the action. Judge Atherley Jones made the following remarks:—"It is purely a question of public policy. This company is of German capital nearly. . . . No Englishman wants to behave ruthlessly to German trades. Whatever may be done by others, Englishmen would observe the ordinary requirements and conditions of international law. In this case if I found for the plaintiffs I should be offering the benefit of this Court for the purpose of ministering sustenance to the enemy. This doctrine of alien enemies has not been expounded with absolute lucidity; no alien enemy can avail himself of these Courts to assist his country in the prosecution of a war, directly or indirectly, against this country. It is quite different to giving legal protection to a German against crime. I would be shocked if protection was not given in this country to a German where the safety or security of his person is concerned. It appears that the profits of this company go to alien enemies, and I think I am bound to dismiss this action, which I do. . . ."

Mr. Campbell went on to argue that this judgment of Judge Atherley Jones was entirely fallacious. The Judge had said: "If it is shown that although this is an English company the profits go to alien enemies, I think I am bound to dismiss this action, which I do." So far from this being the true view, the Legislature had directed no prohibition against trading being continued by a company that is registered here, although the majority of its shareholders were alien enemies. The Legislature expressly recognised such trading. There was no suggestion before the County Court Judge, and there was not now such a suggestion, nor was there any evidence that the plaintiff company from the date of the declaration of war had carried on any trade with the enemy, and, therefore, the case came down to this point—"Is a company registered in England, subject to English law and under the protection of English law, disqualified from dealing with British subjects the moment war is declared, merely because the bulk of its shareholders are alien enemies?" Counsel also pointed out that this was not a company that merely had an office here, it was a company registered in England. It was subject to English law, registered under English law, liable to the obligations of English law, carrying on business in England, and subject to the privileges as well as the obligations of English law.

Mr. Justice Horridge: You say that this is an English com-

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pany, and by Act of Parliament the Legislature has expressly recognised its right to trade, although there are placed certain limitations with regard to inspectors being appointed to see that there is no trading with the enemy?

Counsel: Yes.

The Judge: And you say that by the general law a company registered here is an English company, although it has got German shareholders?

Counsel: Yes.

Mr. Justice Horridge (to Mr. Campbell): You are in Parliament. Have you seen the Bill with regard to alien enemies that is being introduced to-day?

Mr. Campbell: Well, my Lord, I am not behind the scenes to that extent.

Mr. Justice Horridge: I did not think it was a matter of being behind the scenes. I thought the matter was fairly generally known. I suppose it would not affect our judgment here unless it is made retrospective.

Mr. Campbell went on to argue that Parliament could easily have directed that no company of this character should carry on trade, but it had expressly said that no such prohibition should apply. Parliament had only said that the books should be inspected to see that there was no trading with the enemy.

At this stage Mr. Justice Horridge asked Mr. Tebbs (for the defendants) what he had to say.

Mr. Tebbs then said that he did not put this as a case of trading with the enemy at all. It was an established rule that an alien enemy could not sue in respect of a debt during the continuance of war where one or more of the partners had become tainted with the character of alien enemies by residence in the country with which this country was at war. If this company was a partnership he would submit that they could not sue, and that the right to recover was taken away. This company was in the same position as a partnership—a corporate body could only proceed by its members, and a corporation did not exist apart from its members. The Court might be of the opinion that if they upheld the decision of Judge Atherley Jones it would have far-reaching consequences, but any position that arose could be met by legislation. He (Mr. Tebbs) would go to the extent of saying that if there was only one German shareholder that was enough for his case—it was not a question of the quantity of alien shareholders at all. The only question was whether the plaintiff company came within the rule that prevented alien enemies during a period of war from recovering debts incurred before the war, and he submitted that they did. He asked the Court to uphold the judgment of the County Court Judge.

Mr. Justice Horridge, in giving judgment, said that in this appeal the point was no doubt one of importance, and it had been ingeniously and well argued for the respondents by Mr. Tebbs, who had sought to support the Judge's decision. The plaintiffs sued to recover money due to them. There was no dispute that the sum was due, but the Judge decided that on the composition of the plaintiff company they were not entitled during the war to sue in respect of such debts. The company was registered in England eight years ago. There was a holding of about 1,345 shares by Germans on the Continent, and 380 by naturalised Germans in England. Mr. Campbell had said that there were four or five shareholders who were British born. Be that as it may, the Court would take the facts as proved before the County Court Judge, and the fact was clear that the holding was largely in the hands of aliens. It seemed clear to him that the plaintiff company, being registered in England according to English law was resident in this country, and was not in the position of alien enemies in regard to the right to sue. He was of opinion that the company were entitled to sue, and that the judgment of the County Court Judge was wrong and should be reversed, and judgment entered in favour of the company for the amount claimed, with costs.

Mr. Justice Rowlatt concurred. The plaintiff company was a company registered here, and it did not seem to him that the company could be regarded as a trustee for foreign persons. It did not appear to him that payment made to the company was money for the benefit of any particular shareholder. It might be that dividends to aliens might be intercepted, but he did not know, and he expressed no opinion, but there was no consideration of that kind to lend any support to this judgment. He agreed that the appeal should be allowed, with costs.

Mr. Campbell: My Lord, my clients recognise that the defendants did not fight this with any desire to avoid liability, but to fight a constitutional principle, and as the decision will be to the benefit of the plaintiffs in other transactions, we do not ask for any costs of the appeal.

Mr. Justice Horridge: Quite right.

Mr. Campbell: We ask for the ordinary costs in respect to the Court below.

The Judge: It will only be a matter of a few shillings.

Mr. Campbell: Very well, it is not worth troubling about.

Appeal allowed accordingly, without costs, and judgment entered for the plaintiffs.

The Magnet Galvanising Co., Ltd.

On Tuesday in the Chancery Division, Mr. Justice Eve had before him the matter of the Magnet Galvanising Co., Ltd.,—Laird *v.* The Company, upon a motion on behalf of the plaintiff, for judgment in default of defence in a debenture-holder's action. The plaintiff was the holder of 10 debentures of £100 each, issued by the company, and counsel, in support of the application, said the company carried on the business of electrical engineers, &c.

His Lordship made the order asked for.

Bosch Magneto Co., Ltd., *v.* Bain.

Before Judge Bray at the Bloomsbury County Court, on Friday, the plaintiffs made a claim to recover the sum of 15s. for work done to a magneto belonging to Mr. R. Stewart Bain, of Leigham Court Road, Streatham, S.W., the managing director of the London Electric Supply Corporation, Ltd.

Mr. R. Thomas, who appeared for the defence, said that the defendant did not object to paying a reasonable amount for the work done, but he was defending the case on principle. The Bosch Magneto Co., Ltd., had three directors, two of whom were resident in Germany. According to a decision given in the High Court, the company was an English concern. That decision might be appealed against, and Counsel therefore submitted that in the present case the plaintiffs had not the right to sue. The company had 50,000 shares, but only 50 were held in this country by British subjects.

Judge Bray said that in view of the High Court decision, he would have to rule against the defendant on that point.

Mr. Thomas said that two of the three directors of the Bosch Magneto Co. were necessary to form a quorum. Presumably no meeting of the directors had been held since the war began, as only one director was in this country and the other two were resident in Stuttgart.

The solicitor for the plaintiffs (Mr. Hill) said the director in this country had a right to act under a power of attorney which he held from the other members of the board.

Mr. Thomas: Are we to assume that the English director has been communicating with alien enemies?

Mr. Hill: No. He added that the Bosch Magneto Company was now working entirely for the British Government.

The cashier of the plaintiff company said that they sent a man to fix a magneto to the defendant's car, and they charged 2s. 6d. an hour for the man's time. The company paid the man at the rate of 1s. an hour. The charges they made were fair and reasonable. In cross-examination he admitted that there was nothing in the minute book of the company which gave authority for the present action to be brought. The present action was brought at the direction of the secretary of the company. The director in this country had nothing to do with the bringing of the action.

Evidence was also called to show that the charge of 2s. 6d. an hour for a man's time was fair and reasonable.

The defendant said he had always been willing to pay a fair amount for the work which the plaintiffs had done for him. He contended that their charges were excessive, and said he had offered to pay 7s. for work done. The Bosch Magneto Co. sent him an impertinent letter after he had complained to them of the extortionate charges they made. He pointed out to them that the company was a German concern, and in reply they wrote saying that if his patriotism took the form of evading his liabilities, then his patriotism would not be of much service to anybody.

After hearing further evidence, the Judge decided that the company had the right to sue, but he held that the charges made were excessive, and gave judgment for the plaintiffs for 7s. 6d.

Nottingham Corporation *v.* Cox.

His Honour Judge Allen, at the Nottingham County Court, has now announced his decision in this case, which was reported in the Electrical Review for November 6th. Plaintiffs sued for the cost of a terminal-box and electric line on defendant's premises. Judgment was given in favour of the Corporation, but leave was given to appeal.

His Honour held that the apparatus came under the definition "electric line," which the Electric Lighting Order provided should be paid for by the owner or occupier of the premises on which it was installed.

Installing an Electric Fan.

In the Lord Mayor's Court, on November 19th, before Assistant Judge Jackson and a jury, a claim was made by the Electrical Installations, Ltd., 27, Martin's Lane, Cannon Street, E.C., against Mr. Henry Line, of Peckham, for £9 3s., balance of account for fitting up and wiring an electric fan upon the defendant's instructions at the office of the Marconi Telegraph Co., 1, Fenchurch Street.

Mr. Slater was counsel for the plaintiffs, and the defendant conducted his case in person.

Mr. Thomas A. Hill, engineer, in the employment of the plaintiffs, gave evidence of having received the order from the defendant to wire and fix an electric fan at the office of the Marconi Co. The work was done and an account sent in to the defendant for an amount of £9 18s. From that a deduction had to be made of 15s. per contra account. Subsequently, the defendant called upon him and asked to be allowed a discount, but was told that none could be allowed. The cost price of the fan to the plaintiffs was £6 6s. Afterwards complaint was made that the plaintiff company's workmen had damaged a mahogany counter in fixing the electrical fan. The plaintiffs' workmen, however, denied damaging the counter.

The Defendant said he first intended to place two small electrical fans in the office of the Marconi Co. for ventilating purposes, at a cost of 30s. each. After seeing the plaintiffs' engineer, he arranged to fix one electrical fan, the cost of which was to be about the same as the two small fans. Upon receiving the plaintiffs' account, he found the amount was much more than he had anticipated. He had sent in the plaintiffs' account to his customer, relying upon the discount for his profit. When he

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approached the plaintiffs, they told him there would be no discount. When he informed the Marconi Co. of this they told him that that was not so, and that they could obtain 33⅓ per cent. discount. The Marconi Co. took off 20 per cent., and left him what they said would be 13⅓ per cent. discount for his profit. With regard to the damage to the mahogany counter, there were nail marks and scratches upon it which would cost £3 to repair. The jury found a verdict for the plaintiffs for £6 3s.

WORKMEN'S COMPENSATION.

AT Oldham County Court on November 19th, Messrs. Ferranti Ltd., of Hollinwood, paid £100 in settlement of liability under the Workmen's Compensation Act, in respect of an accident, whereby Joseph Buckley, 19, lost an eye whilst in their service. An order was made for £18 to be paid out to the mother, and for the rest to be invested for the youth.

WAR ITEMS.

Electrical Men Wanted.—The Signal Company, Royal Engineers (T.F.), whose headquarters are at 10, Victoria Park Square, London, N.E., have received authority to largely increase their numbers. Electricians, electrical engineers or students, telegraphists, linemen or well-educated men, and men used to horses and who can ride are required as drivers. Pay and allowances amount to about 25s. to 35s. per week while in town, the lodging allowance being discontinued on the company leaving. Separation allowances substituted for those entitled to it. All applications to be made in person at the above address.

London Electrical Engineers (T.F.).—The Corps of London Electrical Engineers (Territorial Force) is again open to recruiting. Electrical engineers, central station engineers and engine drivers are specially required. Forms of particulars can be obtained from the Officer Commanding, at 46, Regency Street, Westminster, S.W.

Manchester Tramways and the War.—An excellent summary of what the Manchester Corporation tramways department is doing in connection with the war has been posted in the city tramcars this week, and it reads as follows:—"(1) Nearly 1,000 employés of the department have joined the Army; (2) the dependents of these men are receiving wages from the department which aggregate nearly £700 per week—this is in addition to what they receive from the War Office; (3) our employés are contributing from their salaries and wages a sum of £100 per week to the local relief fund; and (4) the collections we have established on the cars have realised nearly £5,000 (thanks to the generosity of the tramway passengers.)" The notice adds: "Can you suggest what else we can do? If so, please send your suggestion along." The Manchester tramcars are pretty much like miniature bill-posting stations just now.

Hackney Men with the Forces.—The following is a list of members of the Hackney Electricity Department who are engaged in the Army and Navy:—

G. W. Dawkins, T., Herts Yeomanry.	A. Smith, A.R., 1st Essex Regt.
F. W. Beadle, T., Herts Yeomanry.	J. Alefounder, A.R., 1st Essex Regt.
R. S. Nye, T., 17th County of London.	W. Elstone, A.R., Royal Artillery.
F. G. Taylor, T., London Irish Rifles.	E. Rolfe, T., London Irish Rifles.
A. G. Hilling, R.N.D. Electrical Engineers.	A. T. Atkins, T., London Irish Rifles.
	A. Hastings, A.R., 1st Middlesex.
J. G. Charlton, T., London Irish Rifles.	F. G. Smith, A.R., Berkshire Regt.
R. Prankherd, 8th Batt. East Surrey Regiment.	A. Miles, A.R., Berkshire Regt.
	C. Turner, Nat. Res., Contingent.
E. Bendall, R.N. Reserve.	G. Stiling, 2nd Batt. Royal Fusiliers.
H. Fuller, R.N. Reserve.	E. D. Scottow, T., 7th Essex.
H. A. Cole, 8th Batt. East Surrey Regt.	J. James, T., 7th Essex.
J. Waters, A.R., Yorks Light Infantry.	W. Munns, T., 10th County of London.
C. H. Kidd, T., 4th Royal Fusiliers.	A. Doe, T., 10th County of London.
W. Hepworth, A.R., 9th Lancers.	H. Krasemann, Royal Engineers.
W. L. Harper, R.N. Reserve.	J. Self, Royal Fusiliers.
E. Pogson, A.R., Royal Artillery.	W. Moran, T., 10th County of London.
T. Clark, A.R., 1st Middlesex.	

T.—Territorial; A.R.—Army Reserve.

Change of Name.—Messrs. A. Albrecht & Co., of Milburn House, Newcastle-upon-Tyne, have changed the title of their firm to the North British Engineering Equipment Co. This step has been taken particularly in view of the Royal Proclamation prohibiting aliens from making such a change, as it should at once set at rest any doubts that may have been occasioned by the firm's name. Both the principals and the staff are of British nationality, no foreigners have ever been employed, and there is no foreign capital employed in the business.

A.E.G. Exporting Activity.—A correspondent at Constantinople writes under date October 28th as follows:—"It would interest you to know that, contrary to what our papers are saying in England, German trade is not quite dead yet. The Allgemeine Elektricitats Gesellschaft, Berlin, are at present booking orders here for immediate deliver" for electrical cable "at the same prices" as ruled before the war. The cable is shipped here via Italy at a cost of 20 marks per 100 kilos., presumably by Italian steamers. One would have thought that the exportation of copper, even in the form of cable, from Germany would have been prohibited, but it evidently is not so yet."

Oldham Corporation Contracts.—The contracts which the Oldham Corporation placed some time ago with the Tudor Accumulator Co., and which have formed the subject of much discussion, were again referred to at a meeting of the executive council of the Oldham Chamber of Trade on November 19. The matter had previously been before the Chamber, and it was now decided, after hearing a statement of the position on similar lines to that presented at the recent T.C. meeting and reported in our columns, that it would be futile to protest against the action of the Electricity Committee in agreeing to the carrying out of the contracts.—At a meeting of the E.C. on the previous day, Councillor Stanbury drew attention to an account for £91 to a firm which, he said, was a German concern, and with which the Corporation Gas Committee had decided to stop business. It was pointed out that the Committee was bound to pay the account in England, and that the Board of Trade would see that the money was not sent abroad. Councillor Stanbury said he wanted to know whether they intended to continue to trade with the firm. The reply was given that it would not be necessary to purchase any more tubes for a very long time, and that all new tenders were being closely scrutinised, and particulars were being sought wherever there was any doubt as to the firm. Councillor Sugden said the engineers ought to note that the Committee did not intend to deal with German firms any more. The matter then ended.

Messrs. Edison Accumulators, Ltd., write as follows:—"In view of a statement made at Oldham recently, to the effect that it was not possible to find a company engaged in the manufacture of accumulators that was not in some way connected with Germany, we would be much obliged if you could find space in your columns to announce that so far as this company is concerned such a statement in no way applies. The manufacture of Edison Accumulators is carried out partly here and partly in the United States, and nothing German enters into any detail, either of material or labour. This company is a purely English concern, and all its capital is held in this country."

The Siemens Companies.—In the House of Commons on Monday Mr. Joynson Hicks asked the President of the Board of Trade whether any receiver or inspector had yet been appointed to any of the Siemens companies in this country. Mr. Runciman replied that an inspector was appointed some time ago under the provisions of the Trading with the Enemy Act in the cases of Siemens Bros. & Co., Ltd., and Siemens Bros. Dynamo Works, Ltd.

Board of Trade Reports.—The Commercial Intelligence Branch of the Board of Trade for dealing with the enquiries and lists has now prepared a fifth list of articles which enquirers desire—(a) to purchase, and (b) to sell. It may be obtained by United Kingdom manufacturers and traders, together with copies of the previous lists, on application to the Branch. No. 94, of the Board of Trade series of pamphlets on German and Austrian export trade deals with copper goods.

Copper as Contraband.—A Reuter dispatch from Washington states that Sir Cecil Spring Rice recently informed Mr. Bryan that when Italy prohibited the exportation of copper she did not prevent its transit over Italian territory. Consequently Great Britain felt compelled to detain copper shipments for Italy unless assured that they were for Italian consumption or for transit to Switzerland.

Whist and War.—The employés of the South Lancashire Tramways Co., and the members of the Athletic Club, held a successful whist drive at Howe Bridge last week, nearly 400 persons attending. The whole of the proceeds, about £25, were devoted to the Leigh and Atherton Belgian Refugees' Fund.

Foreign Trade Debts.—A Foreign Trade Debts Committee has been appointed, with offices at 119, Victoria Street, S.W., to consider applications under the scheme for making advances to British export traders in respect of foreign and colonial trade debts.

Trade with Russia.—The "Times" understands that arrangements are in progress for the formation, under Government auspices, of an international clearing-house to facilitate commerce between this country and Russia.

Oldham Tramway Employés.—One hundred and thirty-one tramway employés at Oldham have joined the colours, and the tramways department is paying out £78 per week to dependents.

Rochdale Tramway Employés.—There are forty-two members of the Rochdale tramway staff on active service, and half wages are being allowed to their dependents, which will mean a cost of over £1,700 a year.

Roll of Honour.—Mr. George Jackson, of Winton, who, before rejoining his regiment, was employed by Messrs. Glover, Trafford Park, has been killed at the front. He has left a widow and two young children.

Private Thomas Talbot, of the Royal Scots Fusiliers, formerly a Corporation tramcar driver at Blackburn, has been killed in action.

Able Seaman A. Powell, R.N., who was employed as jointer's mate at the Battersea B.C. electricity generating station, was lost in H.M.S. "Aboukir."

Personal.—Private James Munro, 1st Highland Field Ambulance (T.F.), was presented by his fellow workers in the telephone department at Aberdeen Post Office with handsome gifts on the occasion of his departure to join his corps.

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Private Geo. Nield, formerly an Accrington tram conductor, and a reservist of the Royal Field Artillery, has been decorated with the French Legion of Honour for distinguished service in the war.

Driver Wm. Riley, a motorman employed on the Rawtenstall tramways, is a prisoner of war in Germany.

Rifleman C. Crook, a Manchester tramway guard, who was called out for service with the 1st King's Royal Rifles and was subsequently reported missing, is a prisoner in Germany.

Lance-Corporal Wm. Corcoran, a motorman on the Ashton Corporation tramways, has been wounded at the front, and is now in hospital.

BUSINESS NOTES.

Australia.—H.M. Trade Commissioner for Australia reports that a firm in Melbourne wishes to get into touch with United Kingdom manufacturers who can supply arc lamp globes to replace those hitherto obtained from Germany. Communications should be sent to the Commissioner at Commerce House, Melbourne.

Russia.—An Association in Petrograd wishes to get into communication with United Kingdom manufacturers of electrical measuring apparatus, metal-working and wood-working machines, machine tools, engines of various kinds, steam installations, furnaces, locksmiths' tools, &c.

An engineer in Ekaterinoslav desires to obtain supplies of metal and carbon-filament lamps, dynamos and electric motors, electric ventilators and other electrical apparatus.

A gentleman in Kharkov wishes to get into touch with United Kingdom firms willing to enter into business relations with him in organising, constructing and working tramways, electric lighting, equipment of mines, water works, &c., for public bodies. He claims that he has already successfully carried out electric lighting and water supply works for municipalities.

Communications respecting all of these matters should be forwarded to the British Consulate, Petrograd.—*Board of Trade Journal.*

Italy.—H.M. Consul-General at Genoa (Mr. W. Keene, M.V.O.) reports that a trader in Bologna, formerly representing a Berlin firm, wishes to get into touch with United Kingdom manufacturers of apparatus for electrical illumination, and also hydraulic and hygienic apparatus. Communications regarding the inquiry should be sent to the British Consulate-General, Genoa.

Liquidations. — The Mordey-Fricker Electricity Meter Co., Ltd.—A meeting of creditors will be held at 82, Victoria Street, S.W., on December 23rd, to hear an account of the winding up from the liquidator, Mr. F. Miller.

The Boddy Life-Saving Appliances, Ltd.—A meeting of creditors will be held at 5, Broad Street Place, E.C., on December 21st, to hear an account of the winding up from the liquidator, Mr. T. Gurney Pocock.

The Llanelly Motor and Electrical Engineering Co., Ltd.—This company is winding up voluntarily, with Mr. A. Collins, of 28, Baldwin Street, Bristol, as liquidator.

The Premier Lighting and Engineering Co., Ltd.—This company is winding up voluntarily, with Mr. J. P. W. Goodwin, of Chancery Lane Station Chambers, Holborn, W.C., as liquidator.

The Leitner Electrical Co., Ltd., Maybury, Woking.—First meetings of creditors and contributories December 4th, at 33, Carey Street, W.C.

Equiluxo Glassware.—The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., have sent us a neat ash tray moulded in "Equiluxo" glassware, and will present a similar one to any interested inquirer. This ware has been used in the form of bowls and spheres for showroom lighting in many large shops and stores, with excellent effect.

Greece.—H.M. Consul at Syra (Mr. H. F. Hastings) reports that a commission agent in that town wishes to get into touch with United Kingdom manufacturers of electrical apparatus and fittings, metals, glassware, ironmongery, &c. Communications regarding the inquiry should be addressed to the British Consulate, Syra, Greece.

Bennis Contracts.—Business seems to be proceeding pretty much as usual at the works of Messrs. E. Bennis and Co., Ltd., at Little Hulton. They have experienced an increased demand from colliery owners for their hand-fired furnaces and for coal-handling and elevating plant. We have before us a list of recent contracts for stokers and furnaces for steel manufacturers, collieries, paper works, flour mills, breweries, oil refineries, blanket and woollen factories, &c. For the Eccles Corporation electricity department a coal elevator and U link chain conveyor is ordered to serve a range of four 8-ft. diameter Lancashire boilers fitted with mechanical stokers; and through Messrs. Siemens Bros. Dynamo Works, Ltd., a plant has been ordered for shipment to India, which will consist of an elevator arranged to elevate the coal from a storage bunker below the ground level to the mechanical stoker hoppers on two water-tube boilers.

Manchester. — It is announced that the British Westinghouse Electric and Manufacturing Co., Ltd. have commenced the manufacture of electric lighting and engine starting sets for petrol motor vehicles at their works at Trafford Park, Manchester.

Italian Trade.—The effects of the war on the Italian market for electrical machinery and raw materials during, and since, the month of September, are described by the *Rivista Tecnica d'Elettricità*. Machines weighing over 1 metric ton have been imported to 409 cwt. (metric quintals), against 1,740 in the previous year; lighter machines to 413 cwt., against 1,086 cwt. Transformers have been imported to 2,207, against 870 cwt. in September, 1913, and 1,255 in the same month of 1912. Only in the class of transformers is there any advance in the imports, and as Germany and Austria have contributed none, the advantage rests with Switzerland and the other countries. Of lamps Italy has imported 300,000, against more than 700,000 in the preceding year which have come almost exclusively from Austria-Hungary. Imports of apparatus were almost nil—173 cwt. of heavy, against 686, and of light 42, against 123 cwt. The consumption of sheet-iron has lessened; during July it sprang to 23,870 cwt., but in August had fallen to 3,755 cwt., which is a normal quantity. In September this figure fell away to 3,000 cwt., according to Customs returns. It is right, however, to state that the Customs are paid on iron already existing in bonded warehouses, and that a diminution (if any there be) will be shown in the October figures. But it is believed that no diminution will be shown, as the falling off in arrivals affects the weekly receipts, whereas the warehouses are generally supplied by the quarter. English manufacturers have not been able to forward any supplies, for either reasons of price or conditions of impost, but while the Treaty lasts Germany has begun shipments again. Passing lastly to carbons, we notice that during July the importations rose to 1,630 tons, equal to those of 1913, but at the end of August they were almost 1,700, with a loss of 100 tons compared with the preceding year, and at the end of September they reached about 1,750, or a total loss of over 400 tons on 1913. The imports of carbons for furnace electrodes appear to be about normal, but carbons for other electrotechnical uses showed decline. These data show apparently that the national production has proceeded, if not upwards, at least without losing ground. Foreign imports have undergone a strong contraction.

Bankruptcy Proceedings.—J. Swainson (J. Swainson and Co.), electrical contractor, 22, Booth Street, Manchester. —Last day for receiving proofs for dividend, December 8th. Trustee, Mr. A. Yearsley, 27, Brazennose Street, Manchester.

J. Brockie, mechanical engineer, 41, London Road, Forest Hill. A first dividend of 1s. 3d. in the £ is payable on December 2nd, at 129, Lambeth Road, S.E.

William H. Wood, electrical engineer, Lorna Doone School Lane, Hall Green, Birmingham.—Receiving order made November 20th on creditor's petition.

Catalogues and Lists.—British Thomson-Houston Co., Ltd., Rugby.—Three illustrated descriptive lists have been issued in the company's standard style as follows:—No. 2,440a. B.T.H. current transformers (in this list prices, dimensions and shipping information are fully given); No. 3,811, truck type iron-clad switchgear; No. 4,160, draw-out oil-break switchgear.

Messrs. Mirrlees, Watson Co., Ltd., Scotland Street, Glasgow. —Illustrated leaflet of the Mirrlees-Leblanc "Multijector" air pump.

Messrs. J. & W. B. Smith, 15-23, Farringdon Road, London, E.C.—Advance illustrated and priced pamphlet (24 pages) of their all-British "Glasmi" luminous and hot-bar type electric radiators.

Dowsing Radiant Heat Co., Ltd., 105, Great Portland Street, London, W.—New electric heating catalogue (78 pp.) showing a wide collection of luminous radiators and convectors, hot-bar radiators and radio-convectors, electric cooking and domestic apparatus and cognate accessories. A number of new designs are included. Several other illustrated circulars relating to these and other Dowsing manufactures for the coming season have also been received. The Dowsing Co. have purchased the business of Messrs. Eastman & Warne, as from October 23rd, and the soldering irons domestic and laundry irons, and other apparatus of that firm, are covered in the present batch of Dowsing literature.

Mr. Robt. H. Lash, 31, Carburton Street, London, W.— Pamphlet containing an illustrated description of the Linisher patent surface grinding machine specially adapted for electrical work.

Messrs. Siemens Bros. & Co., Ltd., Woolwich, S.E.—Leaflet (A701) describing their patent engine revolution tell-tale.

Messrs. Donovan & Co., 47, Cornwall Street, Birmingham.— Illustrated price list of Barwick motor starters and motor-starting panels, in English, French and Spanish.

The Linolite Co., 25, Victoria Street, London, S.W.—New circular tabulating technical particulars of "Tubolite"; also one describing the Woodhouse steel casing. The firm mention that all their lamps have been made in this country for the past 12 years by the Edison & Swan Co., and every part of "Tubolite," the Woodhouse casing, and their other general manufactures, is made in Great Britain.

Messrs. Best & Lloyd, Ltd., Cambray Works, Handsworth, Birmingham.—List No. 111 (eight pages), containing illustrations, prices, code-words, &c., together with descriptive notes, relating to the "Best" electric fires, with a new form of heater that they are just putting on the market.

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Book Notices.—*Scientific Illumination—its aid to Business*, is the title of a neat brochure which has been issued by the General Electric Co., Ltd. The contents consist of photographic illustrations of illuminated shops on the G.E.C. "Dalite" system, of which the main principle is "Light on the object, and not on the eye." The effectiveness of the system is well shown by these views, which include also examples of restaurant and railway lighting. In most cases the Osram drawn-wire lamps are used, but some relate to the Osram half-watt lamp, with Superlux and Equiluxo glassware and reflectors. The text contains useful advice to the trader who wishes to adopt up-to-date methods of lighting, and explains the necessity of adopting scientific principles in order to attain the best results by the most efficient means. The services of the Illuminating Engineering Department of the General Electric Co., Ltd., are freely placed at the disposal of proprietors of shops for this purpose. A "stop-press" note adds the interesting information that the company's glassworks have just produced a new type of glassware to be known as "Atmos," having the characteristic of preserving the relative colour values of textile fabrics.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIII, No. 11. New York: The Institute. Price $1.

"*Engineering* Directory of Advertisers." No. 59. October, 1914. London: *Engineering*, Ltd.

"Report on the Work of the Department of Technology (City and Guilds of London Institute) for 1913-14." London: J. Murray.

Deed of Assignment.—George Braulik, electrical engineer, 8, Lambeth Hill, E.C.—Last day for claims December 7th. Trustee, G. E. Corfield, Balfour House, Finsbury Pavement, E.C.

Trade Announcement.—The address of the Irish agent of Messrs. Simplex Conduits, Ltd., should read:—88, Wellesley Avenue, Belfast, not Wallasey Avenue.

LIGHTING and POWER NOTES.

Aldershot.—Year's Working.—The gross revenue of the electricity undertaking for the year ended March 31st last was £6,469, the gross expenditure £3,553, and after paying interest on loans, £762, sinking fund, £1,345, there was a net profit of £807. The number of units generated was 1,535,680, an increase of 49,164 on the previous year.

The U.D.C. has decided to reduce the price of current to ordinary consumers from 5d. to 4½d. per unit, as from January 1st next, and the charge for public lamps by 5s. each per annum. Current is to be supplied at the reduced rate of 1d. per unit to the Y.M.C.A. for premises used by troops.

Ashton-in-Makerfield.—In connection with the sewage scheme, the B. of T. has given its consent to the provision of an electric installation.

Australia.—The inauguration of the Rushworth (Vic.) Municipal Council electric supply took place recently. The installation was designed by Messrs. McCarty, Underwood & Co.; the contract for the equipment of the power house, distributing mains, and street lighting was carried out by the India-Rubber G.P. and Tele. Works Co.

Beckenham.—The Council is to supply current free of charge to hospitals in the district where wounded soldiers are under treatment.

Belfast.—The Tramways and Electrical Committee on Monday reported that the revenue of the electricity undertaking for the past seven months showed a credit balance of £16,717. Four different reports on the working of the electricity station were submitted by four members of the Sub-Committee appointed to make a report. A special meeting of the Committee was arranged for, to discuss the same.

Birmingham.—Reduced Lighting.—Owing to the request made a month ago by the Home Secretary for a reduction in the lighting not having been generally complied with, an order has now been received for the compulsory reduction of lights, including sky signs and powerful external lights, and provision is also to be made for a further reduction on the lines at present adopted in London, if necessary.

Workhouse Lighting.—The B. of G. has decided to carry out a scheme of E.L. for the Dudley Road Infirmary and the Western Road House, current to be supplied from the Corporation works. The Board will discontinue making its own gas.

Bolton.—Street Lighting.—The E.L. Committee has been requested to submit a scheme and estimate for the lighting of Long Lane by electricity.

Clonakilty.—E.L. Scheme.—According to the Cork papers, the local E.L. company, for whom the Ampere Co. are contractors, has practically completed the installation of electric light in the town. In the streets oil lamps have been superseded, and many public and private buildings are adopting electric lighting, the prospects being regarded as favourable to the company.

Continental Notes.—France.—The Société Pyrenéenne d'Energie Electrique, which was formed in 1907, with a capital of 6½ million francs, started operations with 60 parishes as customers; it utilises a number of waterfalls, and when all these are harnessed the company will dispose of 85,000 H.P.

At present the company has three electrical stations at work in the neighbourhood of Toulouse. The total length of the transmission cables is 1,109 km., of which 230 km. are operated at 55,000 volts, while on the remaining 879 km. the pressure varies between 25,000, 13,000 and 10,000 volts.

The capital of the company has been increased to 8 million francs, and its area has been extended so as to comprise 128 parishes, with a population of nearly half a million. The number of consumers has been brought up to 11,528, using 35,000 20-watt lamps, while the quantity of power supplied amounts to 8,500 H.P. The charges made for lighting varying from 6d. to 7d. per KW.-hour.

Norway.—A public valuation has recently been made of the Eidsfos, a waterfall belonging to Chamberlain Cappelen, the owner of the Ulefos Electrical Iron Works. The estimated capacity of the fall is about 3,000 H.P., which, however, can be increased to 6,000 H.P., when the river course is regulated properly. The valuation was made on behalf of the Hollen municipality, which intended to expropriate the waterfall, and the result was that the present value of the property was estimated at £22,000. It is, however, very probable that the idea of the purchase will be abandoned on account of the high value fixed. The waterfall was sold in 1907 for £11,000, and afterwards resold to Mr. Cappelen for £13,500, and the value has thus risen by 100 per cent. in the course of seven years.

Crayford.—Cottage Lighting, &c.—The West Kent Electric Co. having been asked to light the whole of the houses to be erected by the Crayford Cottage Society, Ltd., by electricity, has approached the P.C. with reference to the public lighting of the newly-developed area. The company offers to lay the necessary mains, &c., and provide lamps and standards, and supply current and maintain lamps, at £2 10s. per lamp per annum. The Council is considering the offer.

Croydon.—Greater London Supply.—The L.C.C. scheme of electric supply for Greater London, as laid down in a proposed Bill in Parliament, has again been discussed on letters from the Surrey County Council and the West Ham Corporation. It was resolved to support these bodies in their request to the L.C.C. to postpone the introduction of the Bill until the session of 1916. The fear was expressed that if Croydon was absorbed as far as the electricity supply was concerned, the process might be continued in regard to water and other municipal enterprises.

Epsom.—The U.D.C. is considering a proposal to install an electrically-driven turbine pump at the Downs reservoir.

Greenock.—Electricity in the Gas Works.—In the new installation of plant at the gas works there is a power house containing three Westinghouse generating sets, comprising gas engines of 42 B.H.P. coupled to shunt-wound protected type generators. The current is to be distributed to the various motors at 440 volts. Motors are used in the reconstructed gas works to operate elevators, coal breakers and other machinery.

Grimsby.—The report of the first six months' trading in 1914 of the Electricity Committee shows that the revenue from current sold in 1914 was £10,389, against £9,413 for 1913, an increase for the six months of £976.

Horton-in-Ribblesdale.—The Bentham R.D.C. has granted Mr. Thomas Davidson permission to use overhead lines for lighting Horton-in-Ribblesdale by electricity.

Kirkcaldy.—Electrical Haulage.—At an inquiry by the L.G.B. Commissioner into the local town planning scheme, which is intended to prevent the sinking of a pit in the neighbourhood, Mr. Neil A. Wilkie, engineer for the Fife Coal Co., said all precautions would be taken to interfere as little as possible with the amenity of the district. There would be no overhead gear and no smoke, as they intended to have an incline instead of a shaft, and to use electric haulage.

London.—Hammersmith.—The Electricity Committee has decided to recommend applications to the L.C.C. for loans of £10,000, including £5,650 to cover the cost of works executed, and £4,350 for anticipated work during the next 12 months.

In connection with the proposed electricity legislation by the L.C.C., the E.L. Committee considers that there are serious objections to the scheme as proposed, and that the County Council should be urged not to proceed with it until more opportunity of considering its effect on existing concerns has been granted.

Hackney.—The Electricity Committee recommends that the existing tariffs for heating, cooking and domestic purposes other than lighting, and for lighting and other domestic purposes, on the telephone system, be available to all consumers without restriction as to use of any form of illuminant.

Islington.—The L.G.B. has refused to sanction the application of the local B. of G. (in May last) for a scheme of electric lighting in certain of the buildings.

Bermondsey.—The town clerk is to be instructed to write to the Commissioner of Police with a view to obtaining permission to increase the local public lighting.

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The Balham and Tooting Traders' Association is to draw the attention of the Commissioner of Police to the question of reduced lighting and the discrepancy between the methods adopted in the case of different districts and individual traders.

WESTMINSTER.—The Westminster Electric Supply Corporation has informed the B.C. that, owing to the increased price of coal and other expenses, it is unable to agree to the continuation of the contract for one year for the supply of energy for lighting purposes at 2½d. per unit, and suggests that a new agreement be made for three years at 3d. per unit for lighting and 1d. for power purposes. The Contracts Committee recommends the Council to agree to the revised charges, subject to the termination of the agreement, by giving three months' notice, expiring at the end of the first year or at the end of any succeeding year.

FULHAM.—In connection with the agreements with electricity consumers for outside lamps, the Electricity Committee recommends, in view of the reduction in outside lighting, that such agreements be suspended as from October 1st for the period of the prohibition, providing that accounts on the basis of the charge for 500 hours per annum are paid, and that the consumer agrees to extend the contract for a year after the prohibition period.

Mansfield Woodhouse. — STREET LIGHTING.—The U.D.C. has decided to have double 50-C.P. electric lamps placed in St. Edmund's Avenue for public lighting. The mains will be provided by Mansfield T.C., at a cost of £220.

Mountain Ash. — The U.D.C. has applied to the B. of T. for consent to use overhead wires at Abercynon for the supply of current at a pressure of 230 volts.

Mutford and Lothingland (Norfolk). — WORKHOUSE LIGHTING.—With a view to considering the advisability of laying down E.L. plant at the workhouse, the B. of G. has decided to obtain estimates for lighting the institution by a system other than air gas, which was recommended for adoption by the House Committee.

Parkhurst.—CAMP LIGHTING.—The Isle of Wight Rural Council has granted permission for the Isle of Wight E.L. and Power Co. to use overhead wires for lighting the new Military huts and camping ground at Parkhurst, the contract for which has been secured by the company.

Penrith.—The B. of G. has decided to have electric light installed at the Public Offices, and to obtain estimates for the installation.

Perth.—A scarcity in the supply of carbons is being felt by the Corporation in connection with the lighting of the streets, and it is feared that the lighting will have to be curtailed.

Reading.—EXTENSION OF E.L. AREA.—The Reading and District Electric Supply Co., Ltd., has applied to the B. of T. for an order extending the area of supply so as to include the borough of Henley-on-Thames and the parishes of Badgemore, Eye and Dunsden, Harpeden, Kidmore End, Rotherfield, Pippard, and Shiplake, in the area of the Henley R.D.C., and Arborfield, Barkham, Earley, Newland, Remenham, Ruscombe, Shenfield, Sonning Town, St. Nicholas, Hurst, Twyford, Wargrave, Winnersh, and Woodley and Sandford in the area of the Wokingham R.D.C.

Redditch.—PLANT EXTENSIONS.—The Council recently decided to reconstruct and modernise the works, at a cost of some £18,000. Since then the B.S.A. Co. has approached the Council asking for a supply for ten years of some two million units a year for power purposes, and an agreement has been entered into, which will necessitate further extensions of the electricity works plant at an additional cost of £10,000, making the total projected expenditure £28,000. In the Council it was stated that the increased demand would provide a permanent revenue amounting to a minimum of £3,000 per annum.

St. Germans (Cornwall).—The B. of G., after considering the question of lighting the Scattered Home, has decided to have the electric light installed.

Selby.—PROPOSED E.L. SCHEME.—The U.D.C. has decided to hold a special meeting to consider the question of electric light for the town.

Thorne.—PUBLIC LIGHTING.—The P.C. has referred to the Lighting Committee a request from the Yorkshire Electric Power Co. to be allowed at the proper time to tender for the lighting of the 2,600 yards of Moorends Road.

Tullamore.—WORKHOUSE LIGHTING.—The B. of G. has adopted the scheme prepared by the consulting engineer for the installation of an electric lighting plant at the institution, and application has been made to the L.G.B. to sanction the scheme, and to recommend the Board of Works to advance a loan for the purpose.

Tasmania.—The contract under which the Tasmanian Government takes over the electrical scheme of the Hydro-Electric Power and Metallurgical Co., has been signed and possession given. It is expected that the first instalment of 9,000-H.P. will be completed by July next year. The company's metallurgical works at North-West Bay will now be proceeded with.

Tunbridge Wells.—EXTENSION OF E.L. AREA.—The T.C. is applying for an order to include in the area of supply the urban district of Southborough, and so much of the following parishes as are within a radius of three miles from the centre of the western door of Holy Trinity Church, Tunbridge Wells — Bidborough, Speldhurst, Ashurst, Tonbridge Rural, Pembury, Penshurst and Frant.

Watford.—LOAN SANCTION.—The U.D.C. has received sanction to borrow £1,331 for the provision of electric meters.

Willesden.—WORKHOUSE LIGHTING.—The Electricity Committee is to consider the question of making an allowance in respect of the reduced consumption of current for public lighting consequent upon the restricted lighting order.

The B. of G. last week considered a report from the Works Committee respecting the proposal of the L.G.B. that the Guardians should terminate their agreement with the D.C. for the supply of current to the infirmary. In this respect a letter has been received from the Council stating that it is not prepared to cancel the agreement.

The engineer-in-charge submitted a report showing the comparative costs of steam production and electrical energy for the years ending October, 1913 and 1914 respectively, from which it appeared there was an increased cost of £363 since the contract with the Council has been in force; the Committee, therefore, recommends that the D.C. be notified that it is the intention of the Guardians to discontinue the use of the supply of electrical energy from December 1st next, for a period of 12 months, during which period the Guardians propose to use their own plant to generate electricity in order that a more efficient test might be made as to the comparative costs of the methods of producing steam and electricity necessary for the requirements of the institution.

TRAMWAY and RAILWAY NOTES.

Australia.—MELBOURNE SUBURBAN ELECTRIFICATION.—The Victorian Railway Commissioners in their annual report state in regard to suburban electrification, that despite the large amount of preliminary and detail work inseparable from a scheme of such magnitude, satisfactory progress has been made with the different portions of the work of electrifying the suburban lines, and Mr. E. P. Grove, who, as the representative of Mr. Merz, arrived in Melbourne in October last, has, with his staff, since been actively engaged in the supervision of the work already in hand at the sub-stations, the Jolimont car repair shed, and the Newport power house. The principal contracts which had been let at June 30th, 1914, were:—Condensing plant, circulating water pumps and accessories for the power station, G. Weymouth Proprietary, Ltd., £85,252; equipment for sub-stations, Siemens Bros. Dynamo Works, £201,624; overhead contact lines and power transmission lines, British Insulated and Helsby Cables, Ltd., £278,286; power station buildings and boiler equipment, Babcock & Wilcox, Ltd., £427,720; six 10,000-KW. sets of turbo-alternators and transformers, C. A. Parsons & Co., Ltd., £182,0[illegible]; switchgear for power station and sub-stations, Siemens Bros. Dynamo Works, £140,070; equipment for motor and trailer coaches, General Electric Co. (of New York and England), £676,189; provision and laying of 20,000-volt feeder cables, &c., British Insulated and Helsby Cables, Ltd., £259,121; total, £2,250,299. The different contractors have the manufacture of the necessary plant and equipment well in hand, and substantial progress has been made with the erection of the power house, as well as with the excavations for the conduits, pits, &c., and the provision of sidings. A large quantity of boiler house plant and steel work for the power house buildings has been delivered, and is now in course of erection. It is anticipated that the first section of the car repair shed at Jolimont will be completed about December, 1914.

Blackpool.—PARCELS SYSTEM.—A system of parcels collection and distribution is to be commenced on the Corporation tramways in conjunction with the Fleetwood and Blackpool, St. Anne's and Lytham tramways. The maximum weight of parcels will be 28 lb.

Brighton.—DEPOT EXTENSIONS.—The Tramways Committee of the T.C. has recommended application for a loan of £4,000 for extensions at the tramways depôt.

Clayton-le-Moors.—The L. & Y. Railway Co. has decided to apply for an order of extension of time limited by the Clayton-le-Moors Light Railway Order, 1912.

Continental Note.—SPAIN.—La Compania de Ferrocarriles y Tranvias de Valencia has applied for the necessary concession for two new lines of electric tramways in the town of Valencia.

East Ham.—ASSESSMENT.—A conference of the T.C. with the Assessment Committee of the West Ham Union as to the assessment of the East Ham tramways undertaking has agreed to provisionally fix the assessment at a net rateable value of £4,[illegible] to take effect from April 1st, 1915, and to remain in force until September 30th, 1915. This will result in a saving of £1,46[illegible] per annum.

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East Kent.—The East Kent Light Railway Co. has informed the local authorities that it has requested the Light Railway Commissioners to postpone proceedings on its application for an order, during the war crisis.

Edinburgh.—Electric Vehicle.—An electric motor lorry is to be secured for the use of the electricity department. The cost will be under £700.

Hull.—Tramway Extension.—The T.C. is applying to the B. of T. for power to construct two lines of electric tramways at Sculcoates.

London.—Hammersmith.—Motor Haulage.—Owing to the number of horses and vans impressed for military purposes, it has been decided to substitute to some extent motor traction, and the borough surveyor has submitted details of three types of vehicle suitable, viz.:—(*a*) An Edison electric van, of 3-ton capacity, fitted with a crane; (*b*) a National steam car, of 10 cb. yards' capacity; and (*c*) a Thornycroft petrol van of 8½ cb. yards' capacity. The estimated cost of the electric van was £1,215 (chassis £980, tires £55, crane £85, body £95); of the steam van, £944 (chassis £620, body £100, changeable water tank £100, tires £60, lamps £19, crane £45); and of the petrol wagon, £780. Figures of running cost calculated by the firms from data supplied show the electric to cost 8·6d. per mile, steam van 6·2d. per mile, petrol van 9d. per mile. An interchangeable water-tank body is included in the last two tenders. The Cartage Committee favours the steam van, but has decided, before purchasing, to make a trial of this vehicle in service.

In the Parliamentary notice of the District Railway Co.'s Bill for next session, one clause provides for the Central London Railway being supplied with energy from the Lots Road power station.

Japan.—Work is well in hand on the construction of an electric railway between Yokohama and Shimbashi.

Manchester.—According to the *Weekly Dispatch*, both the Lancashire and Yorkshire and the London and North-Western Railway Companies propose carrying out important electrification schemes on their systems in Manchester and other parts of South-East Lancashire.

Mexico.—The London office of the Mexico Tramways Co. has been notified that the Mexican Government has increased the wages of all the tramway employés by 25 per cent., and has also forbidden the remittance of further funds abroad until the rate of exchange improves. Urgent representations to the Mexican Government are being made in the matter.—*Financial News.*

Neath.—Municipal Strike.—As a result of the strike of the municipal employés for an increase of wages, the Corporation tramcars have ceased running.

Saddleworth.—It is proposed to extend the tramways from Royal George to Clarence Hotel, Greenfield.

West Ham.—Assessment.—With reference to the appeal of the West Ham Corporation against the assessment of the tramway undertaking, the chairman of the Tramways Committee reports that it was agreed that the assessment should be reduced to £35,000 gross and £10,500 rateable value in the parish of West Ham, and £900 gross and £500 rateable value in the parish of East Ham. These figures are to take effect as and from the April rate, 1913, and to remain in force until September 30th, 1915.

TELEGRAPH and TELEPHONE NOTES.

Cable-Cutting.—In a dispatch from the Governor of Jamaica to the Colonial Office, it is stated that cable communication with Jamaica was interrupted at 6.40 a.m. on August 3rd, within 15 minutes of an earthquake shock that was felt in Kingston, and it was at first supposed that the breaking of the cable was due to the earthquake. It has been ascertained, however, by the captain of the cable-repairing ship that the cable was cut. German warships had been seen near Jamaica a few days earlier. War was not declared until midnight on August 4th.

Marconi Shares.—On Friday last judgment was given in favour of Mr. Godfrey Isaacs, in the action brought against him by Mr. Samuel Segar. Mr. Justice Bailhache expressed the opinion that a contract was made, but that there was no good consideration; he found that the plaintiff's claim from first to last was a blackmailing claim, and that the action was a blackmailing action. Judgment for the defendant, without costs.

Norway.—Up to 1908 overhead telephone wires were used in Bergen, but it was then decided gradually to substitute subterranean wires. This work is approaching completion. The electrical equipment for the new automatic exchange was to have been made in Belgium, but this was prevented by the war. The plant has instead been manufactured in England, whence it was recently shipped to Bergen.

Secret Wireless Stations.—A joint protest has been lodged by the British and French Governments with the Government of Colombia against the alleged use of a high-power wireless station at Cartagena for communication with German warships. On Wednesday a detailed statement was given in the House of Commons regarding the failure of Colombia and Ecuador to maintain neutrality; the British and French Governments had appealed to the United States for their good offices, and had stated that, if necessary, they would take action for the protection of their interests. The U.S. Government had communicated with the Governments concerned.

Two Italians named Fabbri, with German sympathies, who own a wireless station on their estate at Bar Harbour, Maine, are under the surveillance of the United States Secret Service agents in connection with a report that they forwarded information regarding the movements of British ships to German agents. It is stated that their installation is capable of receiving signals from Germany, and can transmit over a range of 150 miles.

It is also reported that a station was found at Alamo, in Southern California, at a height of 4,000 ft., capable of working over 2,000 miles; this station has been seized and closed by Mexican officials.

Telegrams in Code.—The military authorities still object to the use of private codes, but the question whether any published codes can be admitted in addition to those already authorised is under consideration.

Telephone Directory.—In order to avoid coinciding with the pressure of Christmas work in the Post Office, the next issue of the Telephone Directory will take place on February 1st instead of at the beginning of January as in previous years.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—December 9th. 1,200 yd. 0·3 sq. in., 2,400 yd. 0·25 sq. in., 1,600 yd. 0·15 sq. in., 660 yd. 7/16 S.W.G. single-conductor lead-covered cable, 880 yd. 7/16 S.W.G. concentric lead-covered cable, for City Council. See "Official Notices" November 20th.

Brisbane.—January 6th. Copper wire and accessories, paper-insulated lead-covered cable, for P.M.G. See "Official Notices" to-day.

Dundalk.—December 7th. Steel towers for carrying cables, for G. N. Railway Co. (Ireland). Specifications, &c. (£1 1s.) from Engineer's Offices at Dublin or Belfast.

Eccles.—December 14th. Sewage recording apparatus for the Corporation Highways and Sewers Committee. Specifications from the Borough Surveyor's office, Town Hall.

Enniskillen.—December 1st. Sligo, Leitrim & Northern Counties Railway. Twelve months' supply of telegraph materials. Specifications (1s.) from the company's offices.

London.—L.C.C. December 8th. (*a*) H.T. and L.T. switchgear, (*b*) gravity bucket ash conveyor, in connection with the tramways. See "Official Notices" November 13th.

December 9th. Installation, 160 wiring points, 210 lights, at Star Lane Elementary School, Fulham. See "Official Notices" to-day.

December 22nd. Two steam turbo-generators of 8,000 kw., with auto-transformers, &c., for Greenwich generating station (tramways). See "Official Notices" to-day.

Battersea.—The B.C. is recommended to obtain tenders for the provision of additional panels to the switchboard, and for providing a coal bunker in connection with the coal telpherage plant at the electricity generating station.

Bethnal Green.—December 2nd. H.T. and L.T. cables and roadwork, transformers, sub-station switchgear, for the B.C. See "Official Notices" November 20th.

H.M. Office of Works.—December 7th. Twelve months' supply of cable and wire. See "Official Notices" to-day.

Manchester.—December 16th. Corporation. Ten 50,000-lb. water-tube boilers complete; two 15,000-kw. turbo-alternators complete. See "Official Notices" November 13th.

December 1st. The Tramways Committee invites tenders for tramcar trucks. Mr. J. M. McElroy, General Manager.

Spain.—Tenders are at present being invited by the municipal authorities of Llodio (province of Alava) for the concession for the electric lighting of the town during a period of four years; the municipal authorities of Arquillos have also invited tenders for a similar concession for a period of 16 years.

December 4th. The municipal authorities of Pedralva (province of Valencia) are inviting tenders for the concession for the electric lighting of the town.

December 6th.—The municipal authorities of Avanda de Onero (province of Burgos) are inviting tenders for the concession for the electric lighting of the town during a period of twenty years.

Teddington.—December 7th. Electric lighting at the Council's sewage disposal and refuse destructor works. See "Official Notices" to-day.

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Wakefield.—December 4th. Yorkshire (W.R.) Electric Tramways Co., Ltd. Twelve months' supply of electric lamps, fittings, insulating materials, &c.

Walsall.—December 8th. Corporation. Six 250-KW. and one 500-KW. rotary converter equipments. See "Official Notices" November 20th.

West Ham.—December 10th. B. of G. Three months' supply of electrical fittings. Forms of tender from Mr. J. Smith, Clerk, Union Road, Leytonstone, N.E.

Winchester.—December 17th. Corporation. One 500-KW., D.C. turbo-generator, with condensing plant, pipework, &c. See "Official Notices" to-day.

CLOSED.

Dartford.—The U.D.C. has accepted the tender of Mr. C. Collings, of Dartford, for extensions at the Electricity Works, at £1,730.

Faversham.—The T.C. has accepted the tender of Mr. Francis Davis for coal for the electric lighting works, at 34s. per ton

Glasgow.—The Electricity Committee has remitted to the chairman (Bailie W. B. Smith), the engineer, and the town clerk, for further report matters in connection with the renewal of the contract with the Tudor Accumulator Co., Ltd., for the maintenance of the electric storage battery at the Port Dundas generating station.

The Tramways Committee recommends acceptance of the following:—

Electric motors for Coplawhill.—British Thomson-Houston Co., Ltd.
Cast-steel pipe connections.—Stewarts & Lloyds, Ltd.
Asphalt buckets.—P. & W. M'Lellan, Ltd.
Steel sashes for Pinkston power station.—Crittall Mfg. Co., Ltd.
Crane for Dalhousie sub-station.—Alex. Jack & Co.
Special work.—Edgar Allen & Co.
Copper trolley wire.—B.I. & H. Cables.

The Watching and Lighting Committee recommends, in connection with a new system of fire alarms, that there should be accepted the offers of Messrs. Siemens Bros. & Co., Ltd., to supply and install (1) their system in the southern district of the city, at £1,287, and (2) the necessary extra apparatus for connecting the said system with the central station, at £150.

Hereford.—The T.C. has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for 500 tons of Cannop rough small coal for the electricity works.

Leicester.—The Tramways and Electricity Committee of the T.C. has accepted the tender of the Wilson Rolling Shutter Co., of London, for three rolling steel shutters for the car-repairing shops, at £214; and that of Messrs. A. L. Gibson & Co., of Twickenham, for 12 rolling steel shutters for the generating station extension, at £447.

London.—In the list of tenders received by the London Education Committee for school lighting, it was the Alpha Manufacturing Co., of Balham, not the Alpha Manufacturing Co., Ltd., who tendered for this work.

ISLINGTON.—In April last, the Borough Council accepted the tender of Messrs. Witting & Partners, Ltd., to supply and erect two cooling towers at the electricity works. Having regard to the changed conditions due to the war, the firm has now written the Council stating it is are unable to carry out the work at the price stated, but would be prepared to do so at an increased price of £500. The Electricity Committee, being of opinion that it would be to its interests to accept the firm's offer, has recommended the Council accordingly.

HAMMERSMITH.—The Electricity Committee has received the undermentioned tenders for the supply of H.T. and L.T. underground electricity supply cables of the following sizes: high tension, '10, '05; low tension, '2, '15, '1, '025, 7/22 twin; and recommends, in view of the present condition of the copper market, the Council to accept a tender based on a definite figure for cable required for the next three months:—

	Price of 1 drum of each size.
1. Western Electric Co., Ltd.	£433
2. British Insulated & Helsby Cables, Ltd.	440
3. Callender's Cable & Construction Co., Ltd.	443
4. W. T. Henley's Telegraph Works Co., Ltd.	443
5. Johnson & Phillips, Ltd.	448
6. Siemens Bros. & Co., Ltd.	454
7. **Macintosh Cable Co., Ltd.** .. (recommended)	455
8. W. T. Glover & Co., Ltd.	457

Alternative price for any supplies required during three months from acceptance of tender:—1. Variation according to market price of lead and copper. 2. No quotation. 3. Variation as in the case of No. 1. 4. Ditto. 5. Ditto. 6. Ditto. 7. Firm offer for three months. 8. Variation as in the case of No. 1.

BATTERSEA.—The Electricity Committee recommends that the contract with Callender's Cable and Construction Co., Ltd., for the supply of cables, &c., be renewed for a further period of one year from April 1st next, and also that the contract with the Alpha Manufacturing Co. be renewed for a further period of one year for the installation of arc and metallic-filament lamps, &c., on consumers' premises under the hire scheme. Owing to circumstances due to the war, the contractors will not be able to supply coal for the electricity generating station in accordance with their contract; the Committee recommends that the electrical engineer be authorised to purchase such coal as may be required.

ST. PANCRAS.—The Electricity Committee has received a report from the Chief Electrical Engineer in regard to the new cable required in connection with the replacing of old cable and the supply of a new feeder, stating that he had received a communication from the Western Electric Co., Ltd., whose price for cable, with copper at £57 per ton, was the lowest obtainable, notifying that they had the opportunity of purchasing a sufficient quantity of copper for the Council's cable requirements for the next two years at the very low price of £54 per ton, and were prepared to do so if desired. The charge for the cable would then only vary according to the price of lead at the date of ordering of each portion of the two years' supply, the price of lead at the time of quoting being £19 per ton. Having regard to the low price at which it was possible to obtain the copper, the Committee considered it advisable to accept the offer of the Western Electric Co., Ltd., to buy and hold copper at £54 per ton for the Council's requirements, and instructed the Engineer (who advised that 30 tons should be so ordered) to arrange with the company accordingly.

Sheffield.—Messrs. Johnson & Phillips, Ltd., have received an order for the supply and installation of a 3,000-volt main switchboard, power and lighting switchboards, 3,000-volt mining type switchgear, transformers, power cables for surface, also shaft and in-bye, together with lighting and telephones for the complete electrical equipment of the Kiveton Park Colliery, at Sheffield.

Tynemouth.—The Electricity Committee has accepted the tender of Mr. G. A. Beck, for repairing the cooling tower.

Walsall.—The tender of Messrs. Siemens Bros. Dynamo Works, Ltd., has been accepted for the supply of tantalum lamps to the Walsall Tramways Department.

FORTHCOMING EVENTS.

Physical Society, Friday, November 27th. At 5 p.m. At Imperial College of Science, South Kensington, S.W. Papers on "Notes on the Conditions of Electricity at Point Contacts," by Mr. A. F. Hallimond, and "Thermal Conductivity of Badly Conducting Solids," by Mr. T. Barratt.

Junior Institution of Engineers.—Friday, November 27th. At 8 p.m. At 34, Victoria Street, S.W. Paper on "A Model Drawing Office System," by Mr. C. E. Ford.

(Midland Section).—Tuesday, December 1st. At 8 p.m. At Imperial Hotel, Birmingham. Address by the President of the Section, Prof. F. C. Lea.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, November 27th. At 7.30 p.m. At Lecture Theatre of Literary and Philosophical Society, Westgate Road, Newcastle-on-Tyne. Discussion on paper "Industrial Locomotives," by Mr. J. W. Hobson. Paper on "The Remarkable Failure of a Consignment of Steel Plates," by Mr. W. J. B. Wilson.

Association of Mining Electrical Engineers (Lancashire, Cheshire and North Staffordshire Branch).—Saturday, November 28th. At 3.30 p.m. At Wigan Mining and Technical School. Joint meeting with the Colliery Managers' Association (Lancashire Branch).

Association of Supervising Electricians.—Saturday, November 28th. At 6.30 p.m. At London Tavern, Fenchurch Street, E.C. Inaugural Dinner.

Institution of Electrical Engineers (Newcastle Local Section).—Monday, November 30th. Paper on "Power Plant Testing," by Mr. W. M. Selvey.

(Manchester Local Section).—Tuesday, December 1st. At 7.30 p.m. At Engineers' Club, Albert Square. Paper on "Power Plant Testing," by Mr. W. M. Selvey.

(Yorkshire Local Section).—Wednesday, December 2nd. At 7 p.m. At Philosophical Hall, Leeds. Paper on "Power Plant Testing," by Mr. W. M. Selvey.

Illuminating Engineering Society.—Tuesday, December 1st. At 8 p.m. At the Royal Society of Arts, John Street, Adelphi. Discussion on "Illuminating Engineering in War Time: Some Lessons to be learned from the present Lighting of London," opened by Mr. Leon Gaster.

Rontgen Society.—Tuesday, December 1st. At 8.15 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Discussion on "Localisation of Foreign Bodies by X-Rays," opened by Dr. R. Knox.

Royal Society of Arts.—Wednesday, December 2nd. At 8 p.m. At John Street, Adelphi, W.C. Paper on "Britain and Germany in Relation to the Chemical Trade," by Dr. W. R. Ormandy.

Greenock Electrical Society.—Saturday, December 5th. Visit to Coplawhill Car Works and sub-station of the Glasgow Tramways.

Salford Technical and Engineering Association.—Saturday, December 5th. Annual meeting.

"Wicked War."—Sir A. Markham was but expressing the opinion of thousands of generally unemotional Englishmen when, in the House of Commons on Tuesday, he said that the "war was so wicked" that, although he had done very large business with Germany, he would never buy from, or sell to, a German again. It is the depth of such feelings that confirms the view already expressed that Germany has smashed her own foreign trade to atoms. But the existence of such a feeling places upon us, as British manufacturers, obligations to leave no stone unturned to make it possible for the purchaser to carry his feelings out in actual practice by making available for him the things he desires to buy.

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A MILITARY COOKING INSTALLATION.

Through the courtesy of the Westminster Electric Supply Corporation, Ltd., we are able to give some particulars of an interesting electric cooking installation which they put into service at very short notice about a month ago.

The Church Army have put up a "Hut," a large temporary building, in the centre of Grosvenor Square, which has been provided by the residents of the Square for the 9th County of London Territorials.

On a recent Friday evening they asked the Westminster Electric Supply Corporation to assist them in making provision for the cooking for 300 men who would require meals on the following Monday. The Corporation gallantly came to the rescue, and, despite the very short notice, the necessary distribution mains were laid, and five standard household electric cookers installed and wired up, together with the necessary electric lighting, so that the hut was available for the men on the Monday as required. The contractors for the installation work, which was necessarily carried on both day and night, were Messrs. Jackson and Boyce.

Electric Cooking at a Territorial Depôt.

The range of stoves, which we illustrate, consists of five of the ordinary household type, which the Corporation hires out as suitable for cooking for ten people, and which are built to its own specification by the Electric and Ordnance Accessories Co. These each have a total loading of 6 kw.; the oven has three heats of 800 watts each, and the grill one 1,500-watt heat. Two hot-plates are fitted; one with three heats—300, 900 and 1,200 watts, and the other for quicker heating, with three heats of 700, 1,000 and 1,600 watts.

The heater circuits are controlled through Diamond H switches and Zed fuses. The oven is provided with windows and a thermometer and internal lighting.

Electrical extension hot plates, each loaded with 1,000 watts are fitted in one or two cases, on either side of the top plate.

Two ovens are run on a pair of cut-outs, and the other three on another pair; each oven circuit is controlled by a Berry, Skinner Dreadnought switch, a type developed by the Corporation for its own use, and fitted with a red and green reflex, showing whether the switch is on or off. The armoured flexible connects the stove terminal in each case to the switch.

The installation has been in every way successful, and during the first week, in four days some 930 hot meals, consisting of beef, mutton, stew, curry, tapioca, macaroni and stewed fruits were prepared on these cookers, together with 780 teas, at a cost for energy of £3 13s. 4d., the tariff being 1d. per unit. In another five days 953 hot dinners and 550 teas were prepared at a cost of £3 16s. 10d. For water heating ordinary urns are being used on the hot-plates, and a temporary hot cupboard has been rigged up for plate warming.

On the first day, while all the stoves were in use, a pipe burst, covering the stoves with water, but no damage resulted, and the cooking was not interfered with.

The robust and simple construction of the electric stove makes it particularly suitable for such work as is here entailed; moreover, the electric cooker, as is well known, is especially suited on account of its safety for installation in a temporary building, and the cleanliness and absence of fumes associated with it are fully demonstrated in this case, where the whole of the cooking operations are carried out in a corner of the building where the food is consumed.

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HEATING AND LIGHTING APPLIANCES.

G.E.C. Lighting and Heating Fixtures.

Since the publication of our last issue we have paid a visit to the beautifully-appointed showrooms of the General Electric Co., Ltd., in Queen Victoria Street, E.C. All of our readers who have lately made the round of these premises will understand what we mean when we say that in days when darkened scenes outside are not calculated to promote buoyancy of spirits, it is a most enjoyable change to bask in brilliant sunshine and revel in glowing colour contemplating the achievements of designers and art-metal workers, whose great aim in life is to produce the beautiful and the aesthetic. One speedily catches the atmosphere of the place if one gives oneself up to the occupation, admiring the delicacy and charm of colour of each new fitting as switched on. Of the variety of electric light fittings that are on view, wired so that the caller may see them at their best, it is not possible to say much. We, however, select for illustration a few examples from the showroom display of the new electric light fixtures catalogue (fourteenth edition) that has just been issued, as we think that these will be considered somewhat out of the usual run. Fig. 1 is a novel but beautiful bracket finished in gilt colour with "Equiluxo," "Superlux" or "Perlux" hemisphere 10 in. in diameter; another bracket (two-light) finished in real bronze colour with "Perlux" glass bowls appears in fig. 2. The other illustrations show a couple of magnificent ceiling fixtures, which, we think, are departures along interesting lines. Fig. 4 has from one to three lights in the 16-in. "Perlux" glass bowl; it is in real bronze colour, and has six small lights hung round as shown; the same principle, but with different globes, is adopted for fig. 3, which has a 12-in. "Superlux" globe, with a high C.P. lamp in the centre, and three small globe lights hung with an 18-in. spread round. Turning to the catalogue itself, this consists of more than 300 pages of illustrations of fittings, with prices and reference numbers for each article. Over one hundred pages of new fixtures have been added, and many new designs appear on those pages which, in the past, were devoted to such accessories as "glassware," "silk shades," "signs" "ship fittings," "shop lanterns," "street lanterns," and "posts"; these have been eliminated and now appear in a separate catalogue. The pendant section now includes an exhaustive range of fixtures under the headings of indirect and semi-indirect lighting. There are many beautiful designs of the well-known G.E.C. "Dalite system" of illumination—giving a large variety of "reflector bowl" and "sphere fittings." Most of the fittings in these classes employ either "Superlux," "Equiluxo," "Perlux," or "Holophane" glassware.

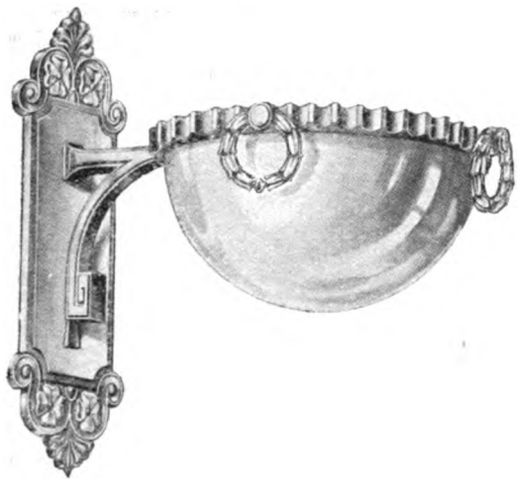
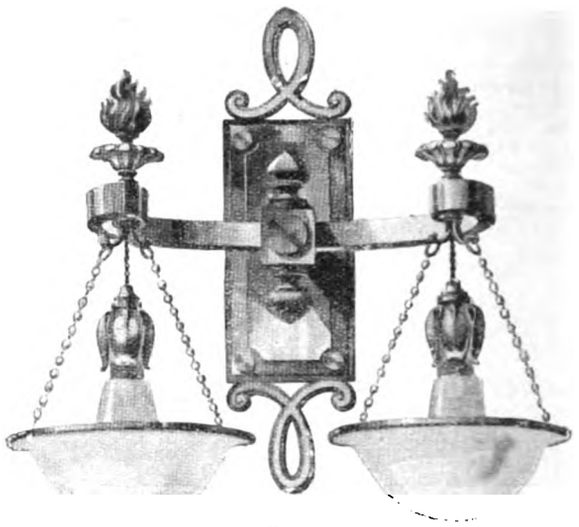


Fig. 1.



G.E.C. Lighting Fittings. Fig. 2.

The bracket section includes many new designs based on inverted lights in shades or bowls. The ceiling fixture and electrolier sections contain a number of new fittings based on a centre light in bowl or sphere, surrounded by a number of smaller units in globes or shades. Many new and original table standards have also been introduced. There is at the end of the catalogue an important section devoted to Crystal Fixtures reminiscent of the Bourbon Period. The designs are thoroughly representative and are specially suitable for apartments such as halls, dancing rooms, reception rooms, &c., where illumination is essentially an enrichment of the general decorative scheme in certain periods. The contents of the catalogue are arranged in a systematic manner; the fittings in these classes are from drawings and photographs made from the articles themselves and reproduced to scale. The strict sequence of the catalogue numbers will enable one to find any desired article thus avoiding the necessity of consulting

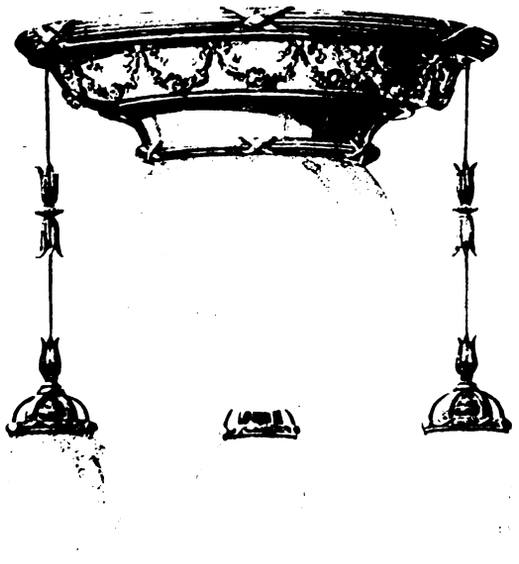
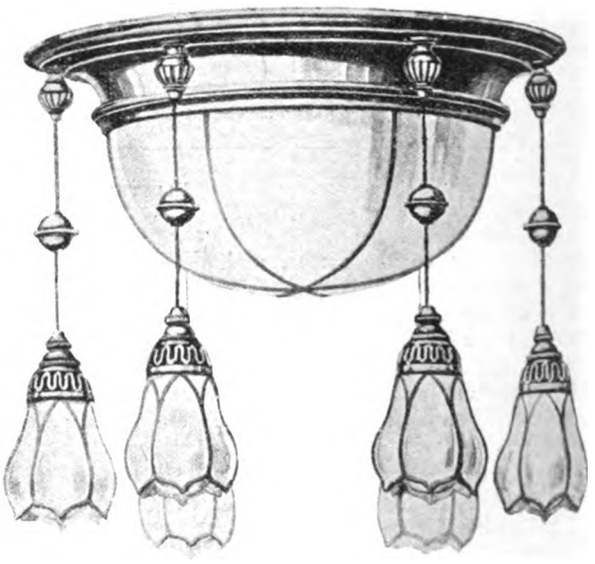


Fig. 3.



G.E.C. Ceiling Fixtures. Fig. 4.

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a numerical index. Every article has been given a distinctive name, so as to facilitate orders either by telephone, telegraph or cable. In addition to the catalogue number and price, the finish and the nature of the material employed with dimensions and other necessary particulars are concisely stated. This catalogue of "Electric Light Fixtures" supersedes all previous publications issued by the company. Although the catalogue was printed and nearly ready for distribution before the war, it is not subject to any advance in price.

The company has also just issued a new catalogue of electric heating and cooking apparatus. It consists of 36 pages of illustrated matter and prices relating to "Magnet" fires, lamp radiators, convectors, a considerable range of electric cooking utensils, portable ovens, domestic cookers, electric irons, glue pots and sundry heating apparatus which the company has to put before contractors and the trade generally for the present season.

We illustrate in figs. 5 and 6 the essential features of the "Magnet" panel type of fire, which the General Electric Co. assure us is proving a most successful line (an earlier pattern was described in our issue of May 8th). In the diagram, fig. 5, the curved heating element or panel is shown at A. At the back is an earthing screw B; the china terminal base C has a double opening at right angles to the entrance for the flexible leads, forming an efficient cord grip. The connections to the heaters D are of stiff solid copper wire.

Fig. 5.—Diagram showing Arrangement of "Magnet" Panel Fire.

The heating coils H are of spirally-wound high-resistance wire, and glow at a bright red; they are easily replaced at low cost if required. On the top of the frame slots F are provided for fixing a trivet, on which a kettle can be kept boiling.

Fig. 6.—G.E.C. Banbury Type "Magnet" Fire.

The switches I are of the double-pole quick-break type; the fire is raised from the ground, and the perforated base cover K permits of air passing under and through the panel elements.

Fig. 6 shows the Banbury fire, which incorporates the above features, and is built for loadings of 1,500, 2,000 and 3,000 watts.

Magnet fires are also supplied with "rod" elements.

"El Radio" Radiator.

Messrs. Haylock & Haslett, of 63, Queen Victoria Street, E.C., have recently introduced a neat and handy portable radiator, which we illustrate in fig 7. The device has a polished copper internal reflector behind the heating element, with polished nickelled feet and sides, and a dull black back; it takes 600 watts, and measures 10 × 12 × 12 in. The handle is heat

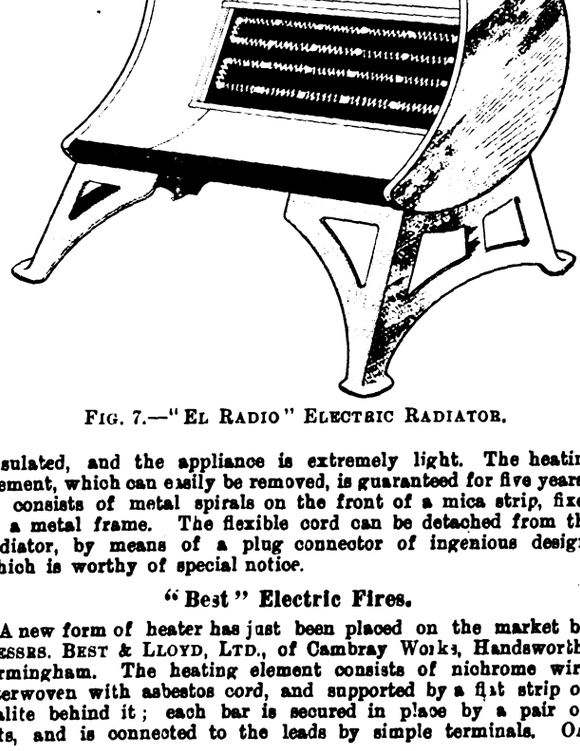

Fig. 7.—"El Radio" Electric Radiator.

insulated, and the appliance is extremely light. The heating element, which can easily be removed, is guaranteed for five years; it consists of metal spirals on the front of a mica strip, fixed in a metal frame. The flexible cord can be detached from the radiator, by means of a plug connector of ingenious design, which is worthy of special notice.

"Best" Electric Fires.

A new form of heater has just been placed on the market by Messrs. Best & Lloyd, Ltd., of Cambray Works, Handsworth, Birmingham. The heating element consists of nichrome wire interwoven with asbestos cord, and supported by a flat strip of uralite behind it; each bar is secured in place by a pair of nuts, and is connected to the leads by simple terminals. On

Fig. 8.—"Best" Electric Fire.

removing one nut, the back of the radiator, which carries the heating elements, can be lowered to a position in which the whole of the elements and connections are readily accessible; the back plate is of copper polished on the inside, and all nuts, &c., are concealed when the radiator is in use. The elements, when switched on, glow immediately, and as the whole of the wire is on the front of the uralite supports, the heat is radiated mainly forwards; there is no metal work above the heating bars, and, therefore, no discoloration of casings. These fires are guaranteed for two years; each element takes 500 watts, as the makers realise that if a radiator is to be effective, it is useless to under-power it. The "Best" electric fires are made in numerous patterns, one of which we illustrate above; they are fitted with from two to six elements, and are finished in several different styles.

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Glasmi Radiators.

Amongst the numerous British-made luminous radiators, Messrs. J. & W. B. Smith, of 15, Farringdon Road, E.C., provide a number of attractive designs. We illustrate in fig. 9 a 250-watt four-lamp radiator by this firm, consisting of a satin finished brass

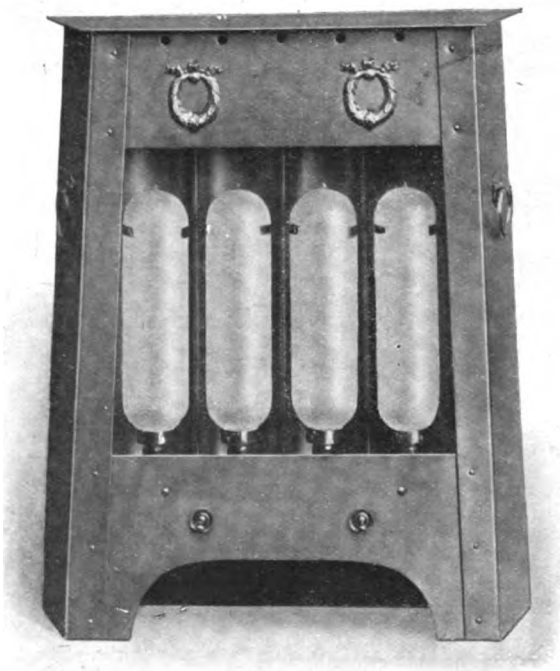

Fig. 9.—"Glasmi" Luminous Radiator.

frame with a polished coppered reflector, and this can, if desired, be supplied with lamps of 500 watts consumption, giving twice the amount of heat.

The firm also make electric radiators of the hot-bar type, with loadings up to 2,400 watts.

Credenda Electric Kettles.

The accompanying illustration shows the arrangement of new types of water-heating utensils which are being manufactured at the Star Works of Messrs. Credenda Conduits, Ltd., Chester Street, Birmingham. The construction of the base of the utensil

Fig. 10.—Credenda Electric Kettle.

marks an advance on existing types, in that the false bottom is stamped in a special manner which gives it strength, while the metal is comparatively thin, and can be quite easily turned up at the edge, whereas the thick brass bottoms usually applied do not permit of this. The soldering-in of the bottom can thus be made a good mechanical job. Brass bolts which serve to hold the strip elements in position pass through the stamped channels, being specially pressed in before soldering, as shown in fig. 11.

Fig. 11.—Section of Base of Kettle.

The elements are of this firm's new type, in which corrugated nickel-chrome heating ribbon is wound on a mica former; they can be quite easily replaced, the outer bottom of the article being removed for this purpose.

This patented arrangement is now used on all kettles, &c., which the company manufacture.

Messrs. Baxter & Caunter, of 219, Tottenham Court Road, W., are the selling agents for London.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

A Large Motor-Converter.

A motor-converter of 2,200-kw. capacity has recently been erected and put into commission at the Dickinson Street station of the Manchester Corporation electricity department, which is of particular interest in that it is the largest converting unit yet

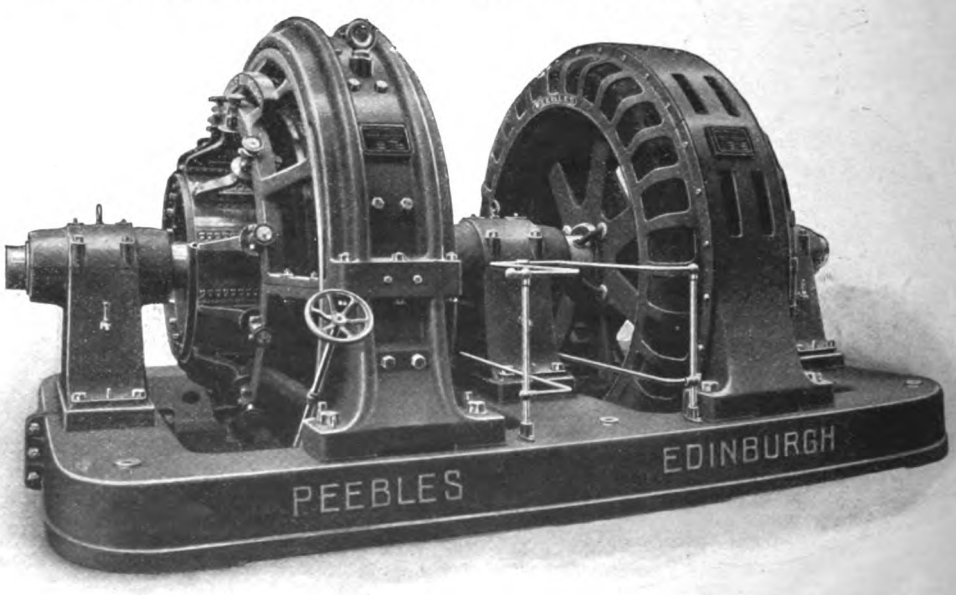

Fig. 1.—2,200-kw. Peebles Motor Converter.

installed in Great Britain. It is used for the conversion of the Corporation 6,600-volt, 50-cycle, three-phase supply into continuous current at a pressure of from 420 to 550 volts, and runs at a speed of 250 r.p.m.

It will be seen from our illustration that the machine is of the three-bearing type, the bed-plate, owing to its size, being made in two parts.

As is well known, the motor-converter occupies the minimum space for a given output, and the set has much the same general appearance as an induction motor-generator, embodying the simplicity of this type of plant without its disadvantages, and at the same time possessing valuable features peculiar to itself. The high-pressure current is taken direct to the stator, thus obviating the interposition of a transformer, while, of course, all rotating parts only carry low-voltage currents. The rotor of the A.C. end and the armature of the D.C. end are electrically connected by leads passing through the hollow portion of the shaft, as may be seen from the illustration, which also shows the massive construction of the D.C. brush gear. The field magnet frame is of cast-steel, fitted with 12 laminated main poles and 12 solid commutating

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poles, the windings being so arranged that the converter will operate equally well as a shunt machine at 420-460 volts, or as a compound set at 520-550 volts.

Provision is made for the converter to run as a three-wire balancer, this being obtained without complication by simply connecting the middle wire through a change-over switch (provided on the starter) to the star point of the A.C. rotor winding, the voltage regulation between the two sides of the system being exceedingly close even with large out-of-balance currents.

The power factor is practically unity at all loads, and requires no regulation. The starting and synchronising of the set is the simplest of operations, requiring no special skill or previous experience, while the entire absence of complicated switchgear, the small number of brushes (especially on the D.C. side) and proved reliability of performance are features which will appeal to the engineer who is responsible for the running of electrical plant.

The plant was manufactured by Messrs. Bruce Peebles and Co., Ltd., of Edinburgh, who hold the exclusive patent rights in Great Britain and the Colonies for this type of machine, which was built under the Peebles-la Cour patents.

New Plug Switch for Shipwork, &c.

Messrs. H. T. Boothroyd, Ltd., of Bootle, have recently introduced a new form of patent plug switch which has been specially designed for use in ships, factories, &c., and for heavy power circuits. The plug is so shaped that it is necessary to remove it before replacing it in either "on" or "off" position; by this means it is possible to arrange that the opening of the circuit ensures a clear wide break, and the contact being of rubbing or wiping action, ensures a clean good contact. The arrangement is shown in fig. 2: the view on the left-hand side shows the plug switch with the hinged cover open, and ready for withdrawing the plug, which can be rotated a quarter turn and replaced in the "off" position. The right-hand view shows the box closed and watertight; when the plug is not in use, the small plug on chain is inserted in the circular orifice, by which the plug is gripped when in service, thus making the box perfectly watertight, as required for ship work, washing of decks, &c. The service plug is protected by a fuse which runs through the centre of the plug body, spring clips being used for holding the fuse wire, so that the fuse can be inserted without undoing any screws; also the spring grip automatically adjusts itself for contraction and expansion, so that the fuse-wire ends cannot become loose.

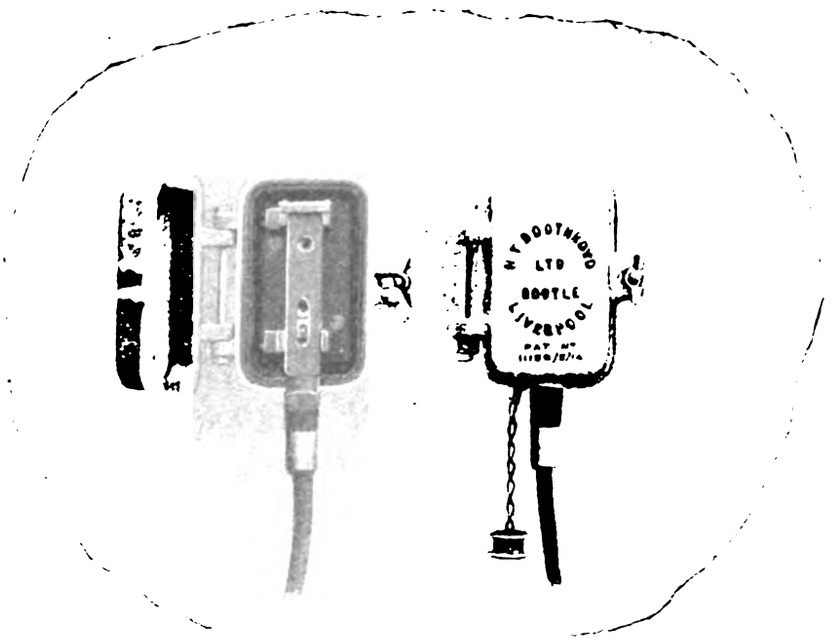

Fig. 2.—Boothroyd Plug Switch.

The plug itself has no projecting pins or contacts, and the polarity cannot be reversed, and therefore it is suitable for arc lamps and accumulator charging. When the switch-box cover is closed the switch cannot be interfered with. The plug contacts are so arranged that the plug is first forced longitudinally into the recess of one contact, and then transversely into the other, the latter contact having its recess open at the front. For this reason in order to change the position of the plug it is necessary to withdraw it completely from the contacts.

"Klip-On" Shade Holder.

An ingenious device recently introduced by the "Klip-On" Electric Lamp Shade Holder Co., of 28, Spencer Street, Birmingham, is intended to avoid the usual tedious method of holding up the shade on the fitting by means of a milled nut.

The "Klip-On" holder shown in fig. 3 consists of two collars—the bottom one containing the standard slots for carrying the lamp—united by a coil spring. Both the collars are split, the bottom one springing over and clipping the standard lamp socket while the coil spring lifts the top collar, which, sliding over the screwed portion of the fitting, holds the shade up in its correct position.

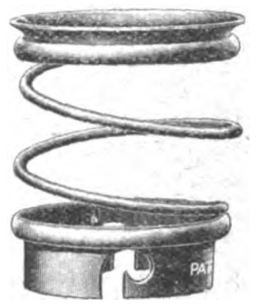

Fig. 3.—"Klip-On" Shade Holder, Full Size.

The split in the collars enables them to be sprung over all standard fittings in spite of slight variations in size. The new holder is inexpensive and is not seen when in position.

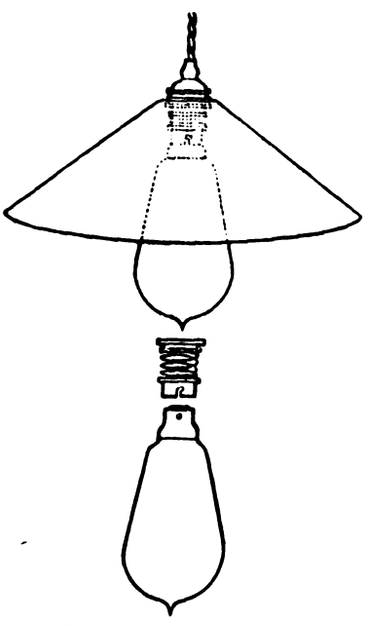

Fig. 4.—Method of Attachment of "Klip-On" Shade Holder.

Fig. 4 shows the holder just above its actual position on the lamp, also the lamp fixed in position and holding the lamp shade.

Emergency Generating Sets.

Following the Convention on "Safety of Life at Sea," emergency lighting sets are now recognised as essential for all passenger liners, and among the firms who have gone into the very special requirements involved in the production of a reliable installation for this purpose, Messrs Thornycroft & Co, Ltd., of Caxton House, Westminster, S.W., may be given a prominent position, as much for their reputation in the manufacture of oil motors, as for the large number of Thornycroft sets already supplied.

A typical set is shown in fig. 5, and one of these is fitted on the Canadian Pacific Railway Co.'s new steamers *Missanabie* and *Metagama*, the former of which recently left on her maiden voyage to Canada.

The motor is of the Thornycroft six-cylinder type, using paraffin fuel—not more than ·9 pint per B.H.P.-hour. This engine is capable of developing up to a maximum of 70 B.H.P., and as the generator is of 40 KW, it will be seen that a large reserve of power for "overload" is available. The lubrication is of Messrs. Thornycroft's standard type, which has proved eminently satisfactory in stationary and marine work, and is entirely visible and automatic. The vaporiser is of Thornycroft pattern, in which the temperature can be easily varied to suit different grades of fuel, &c., while the set may be started immediately on petrol and switched over to paraffin within 5 to 10 minutes, or started on paraffin by lamp. A special type of fuel filter is fitted, which can be cleaned without stopping the engine. The starting is effected by hand, half-compression cams being fitted to facilitate this; the ignition is by H.T. magneto, with adjustable timing. The cooling water is circulated by a rotary geared pump round a closed system, passing through a cooler in its course.

It may, at first sight, appear strange that the suction from the pump is not taken direct from the sea, and the water, after passing round the engine, passed overboard; but these sets being used for emergency purposes are installed on practically the highest part of the vessel, frequently 80 ft. above sea-level, and consequently this method cannot possibly be used.

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The cooler in question, which can be clearly seen in the illustration, consists of a drum, which is driven by the engine, dipping in the water. A current of cool air is blown over the surface of the drum by a fan which is also driven by the engine. In this way the water is cooled most efficiently, and any evaporation is made up by the addition of fresh water from time to time. Tests have proved that the loss of water after four hours' running is no more than 2½ gallons.

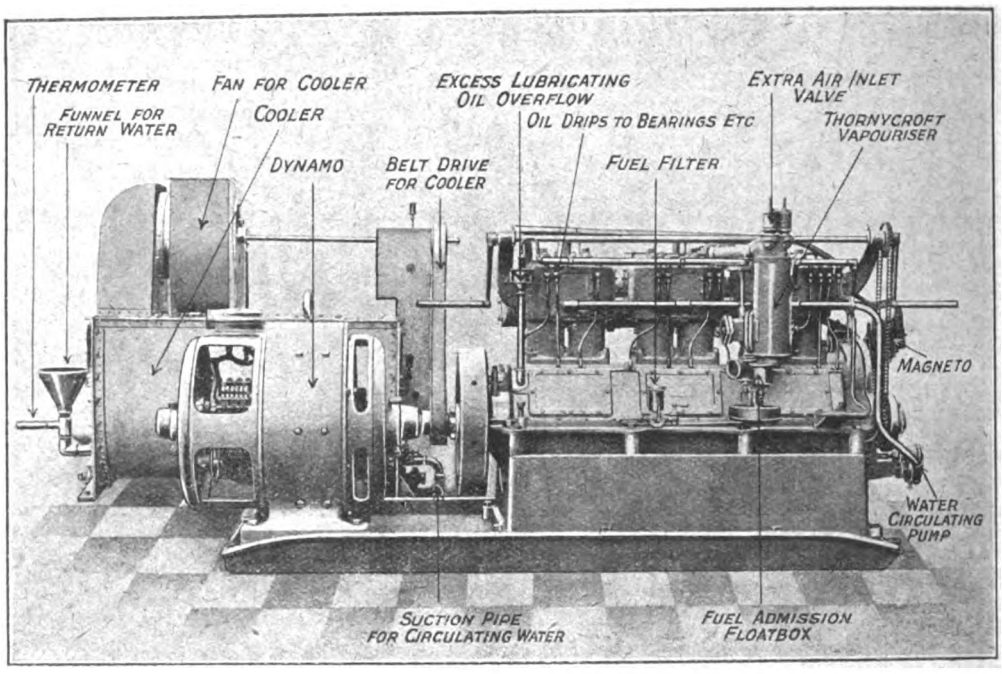

Fig. 5.—Thornycroft Emergency Generating Set for Ship's Use.

The generator is direct coupled to the engine fly-wheel, and is of the two-bearing pattern. The machine is of standard protected type, and is plain shunt wound. The voltage is 110, and the capacity as above mentioned is 40 KW.

The plant is installed in a steel compartment on the boat deck, and is entirely self-contained. The switchboard is also mounted on one wall of this compartment, so that all lights can be controlled from this spot.

The sets are manufactured in various sizes ranging from 3½ to 100 KW.

Vickers Motor Drives.

We illustrate herewith two Vickers motor drives; fig. 6 shows a small ½-H P. motor supplied by the Stepney Borough Council, running on a 480-volt circuit, driving a Linotype machine at the printing works of the *Jewish Times*, in the Whitechapel Road, E. The motor is installed in such a position that it is quite out of the way, takes up a very small amount of space, and is always ready for service, day or night.

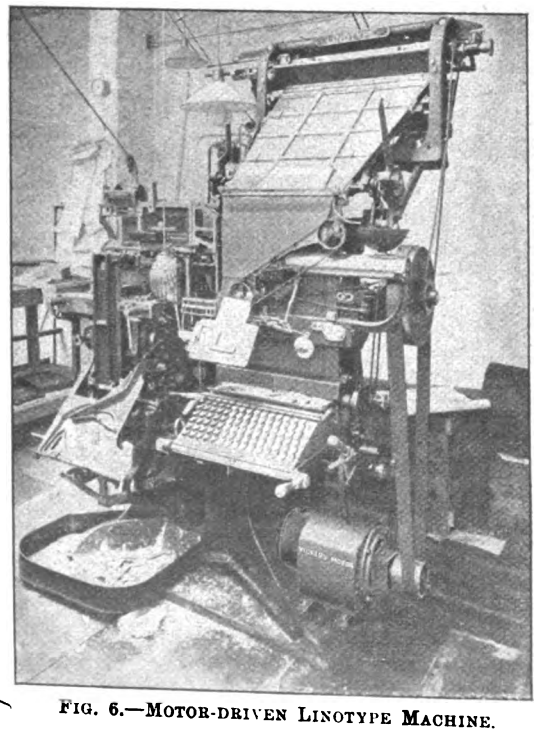

Fig. 6.—Motor-driven Linotype Machine.

Fig. 7 shows the application of a Vickers 3½-H.P. 500-volt shunt-wound motor to a blowing equipment built by Messrs. Henry Willis & Sons, of the Rotunda Organ Works, London. The motor and blowing equipment supply the air required for a large four manual organ at the Holy Trinity Church, Southport. This is a typical illustration of a number of Vickers motors which have already been supplied for the above purpose, many of which have been in service for a considerable period. These motors were supplied by the Electric and Ordnance Accessories Co., Ltd., Aston, Birmingham.

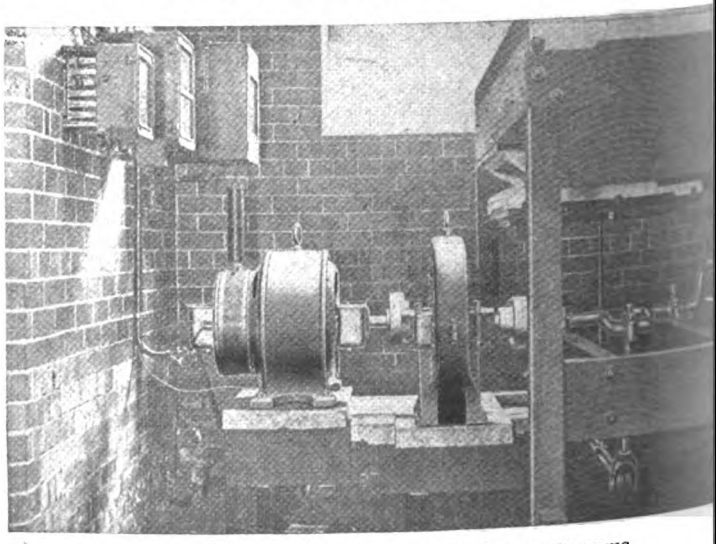

Fig. 7.—Motor used for Organ Blowing.

Rotary Well Boring.—Writing in the *Neftjannoje Djelo*, R. Titus claims that the rotary boring system, using a 30-H P. electric motor, will cheapen the present cost of oil borings at Baku by 80 per cent. or more. Using the Canadian system of boring, the present cost of a 2,000-2,300-ft. well amounts to £16,500 and, according to the author, practically swallows up any chance of profits. For rotary boring, the same gang may be used as for the Canadian process, viz., two boring masters, and six assistants; two engineers and two electricians; one smith and assistant; one carpenter; and seven or eight labourers. Under Roumanian conditions, the total wage bill will be £3 to £3 4s. per diem and the cost of electrical energy, at 2·85d. per H P.-hour, including oil, &c., amounts to £4 6s. per diem. Adding miscellaneous charges to the cost of boring tools, the expenditure will amount to £6 per diem. By careful administration the 2,000-ft. level can be reached in 40 or 50 days; allowing an equal time for shutting off water and 20 days for contingencies, such a well can be bored in four months at a cost of £750, to which must be added £960 for pipe; £680 for hydraulic engine, small motors and dwellings, &c. The total cost of a completed boring will thus, it is estimated, be about £2,300, *i.e.*, about one-tenth of the present corresponding total at Baku. Substitution of rotary boring for the Canadian system is practicable in the present stage of development of the former and should prove the salvation of the Baku industry.

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NOTES.

Belgian Refugees.—A suitable appointment is desired for a Belgian electrical engineer, whose work was cut short by the fall of Antwerp. He speaks and writes English well, and has had a technical training, as well as commercial experience. Replies may be addressed to the Editors of this Journal. A correspondent is willing to provide temporary employment in his office for a youth who can speak and write English, and a home for a Belgian girl of 15 to 18 years.

Copper.—Copper statistics at the present time are complicated by the fact that quantities which have been always included in such returns as European supplies are now unknown, and have to be estimated on a pre-war basis. Thus, stocks at Hamburg, Bremen and Havre, which amounted last July to 9,509 tons, or more than a quarter of the whole published supply, are now not accurately known, and therefore deductions made from figures can be of only relative value.

Messrs. H. R. Merton & Co.'s statistical circular for November 14th shows English stocks at 20,906 tons, hardly any less than for the end of last month. European stocks give 35,965 tons, including estimates, or a decrease of 601 tons on those for the end of October. Deliveries for the half-month are about the same as last. This figure may very easily have small bearing on the total for the month.

Marylebone Battery Arbitration.—In connection with the arbitration proceedings between the Marylebone Borough Council and the Electrical Power Storage Co., Ltd., the terms agreed (mentioned in our issue of November 13th) have since been slightly modified, and the complete terms of settlement, subject to the Council's approval, are as follows:—

1. Claim and counterclaim to be withdrawn. Each party shall pay half the arbitrator's costs and his own costs, including half costs of shorthand notes and other costs (such as use of courts) which are equally divisible.

2. Manchester Square to be put right by the Electrical Power Storage Co. by December 31st, 1914, or the extended time hereinafter mentioned, free of any cost to the Council.

3. Rathbone Place to be put right by the Electrical Power Storage Co. by December 31st, 1914, or the extended time hereinafter mentioned. On the battery being put right the Council shall pay £1,500 in respect thereof. Old lead to belong to the Electrical Power Storage Co.

4. Should it appear that the batteries or either of them cannot be put right without replacing the negative plates (or a substantial portion of them) the date December 31st, 1914, in Clauses 2 and 3 hereof may be extended by the arbitrator for such time as he may decide to be reasonable having regard to all the circumstances of the case (most of which are already within his knowledge).

5. To determine whether the batteries have been put right, *i.e.*, whether they possess the capacity on discharge specified by the maintenance agreements, the test conditions shall be determined by the general manager of the Council's electrical department and the chief engineer of the Electrical Power Storage Co., or, failing their agreement, by the arbitrator.

6. No maintenance shall be paid by the Council with regard to Rathbone Place in respect to the two quarters ending March 25th and June 24th, 1914. The maintenance payable as from June 24th, 1914, to December 31st, 1914, shall be paid in respect of each battery on its being put right, but not before, and no interest shall be payable.

7. As from December 31st, 1914, as regards Rathbone Place and as from the expiration of one month after the provision of a milking booster in the case of Manchester Square in case the batteries of either of them shall not have been put right by these respective dates, the maintenance payments or payment in respect of such batteries or battery shall be made in proportion only to the capacity obtainable from such batteries or battery until the same shall be put right. Provided that as from these respective dates until the batteries are put right, if and when the capacity of Rathbone Place shall be below 80 per cent. of the specified capacity or the capacity of Manchester Square shall be below 80 per cent. of the specified capacity, no maintenance shall be payable in respect of either battery the capacity obtainable from which is below such percentage.

The capacity obtainable at any given date shall be deemed to be that obtained at the previous test discharge. Such test discharge shall be made at any convenient time at the request of either party on seven days' notice.

8. The maintenance agreements to be renewed for another 10 years from the expiration of the present agreements, subject to the provisions contained in Clauses 9, 10 and 11 hereof, which shall have effect from the date of this agreement. Provided always that after the expiration of the original period of 10 years the batteries shall be required to give the specified output for only 90 per cent. of the periods of one hour, three hours, five hours, and 15 minutes respectively mentioned in the maintenance agreements.

And the maintenance remuneration payable in respect of Rathbone Place shall be reduced to £452 per annum, and in respect of Manchester Square to £354 per annum. And provided, also, that as from the expiration of such original period of 10 years during such periods as the capacity obtainable from the batteries, or either of them, shall be below 90 per cent. of such reduced capacity, no maintenance shall be payable in respect of either battery, the capacity obtainable from which is below such percentage, and for such purpose the capacity obtainable at any date shall be deemed to be that obtained at the previous test discharge, and a test discharge shall be made at any convenient time at the request of either party on seven days' notice.

9. The Electrical Power Storage Co. shall provide two battery attendants who shall attend the batteries under the supervision of the Electrical Power Storage Co. and do all that is necessary to keep the cells in order, and the Council shall pay 40s. a week towards the salaries of these attendants.

10. The Council shall provide a milking booster at Manchester Square, capable of giving 500 amps. on a fully charged cell.

11. The proper interpretation of the maintenance agreements *qua* the capacity of the batteries is hereby agreed to be that the capacity on discharge specified by the maintenance agreements shall never be exceeded. A curve connecting ampere-hours and rates of discharge, such rates to include the emergency discharge rate of 4,500 amperes, and also a method of calculating the capacity withdrawn during discharges of the batteries shall be agreed between the parties or, failing agreement, be settled by the arbitrator.

Private Arrangements.—Electrical Engineering and Motor Co., Ltd., Lowther Street, Carlisle.—A meeting of the creditors of the above was held recently at the offices of the company. The usual printed statement of affairs was not presented, but from figures read it appeared that the ranking liabilities amounted to £1,418, all of which were due to unsecured trade creditors. There was also a sum of £1,105 due on debentures. The assets were estimated to realise £1,588 8s., and after allowing for the debentures the net assets were reduced to £483, showing a deficiency of £935. The company was registered on May 28th, 1913, with a nominal capital of £3,000, divided into shares of £1 each. The company was formed to carry on the business of electrical and motor engineers, and to adopt an agreement with Messrs. C. A. & W. R. A. Lamb. The former was appointed managing director of the company. The assets taken over were valued at £2,093, and the company agreed to discharge liabilities of £1,290. The vendors were allowed 1,300 shares, but they received no cash. Debentures had been issued by the company, and on October 27th last a receiver and manager was appointed. It was further stated that there had been a total loss on the trading of the company of over £1,900. No dividend had ever been paid, and the company had been short of working capital. In addition, the volume of business done had not been sufficient for the expenses. Proper books of account had been kept, and those concerned with the management of the company had only drawn very small salaries. It was stated that business in Carlisle had been overdone, and that except with a good connection and nominal expenditure no concern could be carried on profitably. In answer to questions, it was stated that the Receiver intended to apply to the Court for permission to sell the assets of the company by tender.

Leyton Electricity Supply Staff with the Forces.—Mr. F. Harman-Lewis, the engineer and manager of the Leyton District Council electricity department, has a staff of which he is justly proud, for almost the whole of his unmarried men and a good number of the married ones have responded to the country's call, and out of 80 men no fewer than 23 are now serving in H.M. Forces. The following list will show that all grades are represented:—

Wright, A., meter inspector, Chief Petty Officer, R.N.R., now in barracks.
Marsh, W., meter inspector, Gunner, R.N.R., saved from H.M.S. *Aboukir*, now in barracks.
Stevens, A., cable jointer, A.B., R.N.R., saved from H.M.S. *Hogue*.
Creed, N., cable jointer, A.B., R.N.R., Sub. Depôt, Sheerness defences.
Martins, A., jointer's mate, leading seaman, R.N.R., H.M.S. *Minerva*.
Fullbrook, arc lamp mechanic, Chief Petty Officer, R.N.R., merchant cruiser *Orama*.
Fry, W., greaser, R.N.R., H.M.S. *Magnificent*.
Netting, J., storekeeper, Col.-Ser., R.M.L.I., Plymouth Battalion, was at Antwerp.
Neale, J., jointer's mate, R.M.L.I.
Brazier, J., lamplighter, 7th Dragoons, now somewhere in France.
May, A., jointer's mate, 7th Fusiliers, now somewhere in France.
Morrow, J., jointer's mate, 48rd Brigade, R.F.A., now somewhere in France.
Burden, E., switchboard attendant, Sapper, Royal Engineers' Signal Comp.
Ison, W., fitter's mate, Serg., 7th Essex Territorials.
Tyler, F., lamplighter, Trooper, 3rd Dragoons.
Besant, A., lamplighter, Kitchener's Army.
Anderson, J., greaser, Kitchener's Army.
Haywood, A., trimmer, Royal Garrison Artillery.
Butcher, W., labourer, 2nd Batt. Essex Regiment, wounded at Cambrai.
Quick, C. S., assistant foreman jointer, Oxford Light Infantry.
Gibbs, W., chauffeur, Oxford Light Infantry.
Gibbs, A., jointer's mate, Oxford Light Infantry.
Hardington, H., jointer's mate, Oxford Light Infantry.

Many of these men have seen active service, May, Morrow, Brazier and Butcher having been in the thick of it right from the commencement; the last-named was wounded at Cambrai in the retirement from Mons, and is now in England recuperating. Marsh and Stevens were in the North Sea disaster, and were saved after being in the water upwards of five hours, having the experience of being saved by H.M.S. *Cressy*, Marsh from H.M.S. *Aboukir*, and Stevens from H.M.S. *Hogue*, and then taking to the water again when she was torpedoed. Netting was at Antwerp, and was several days in the trenches. Wright was on Squadron Supply Ship *Inarani*, but was paid off from her before she was sunk by the *Emden*. These last five men have been home and tell some stirring tales. The men that are left are making weekly contributions to a fund from which they are supplying their comrades with tobacco, woollen clothing, &c.

Electric Heating in the Garage.—In a recent issue of *The Motor*, the advantages of electricity for preventing the freezing of the water in the radiator and engine jacket are pointed out. A heater consuming 80 watts suffices for the purpose. In the case of cars which must always be ready for instant use, such as, for instance, a doctor's car, the water cannot be drained off, and under these circumstances the electrical method is pre-eminently suitable.

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Belvedere Works Silver Band.—Our congratulations to the Belvedere Works Silver Band (Callender's Cable, &c., Co.), which won the Warwick Challenge Cup at the Wandsworth Contest on Saturday, November 21st. During the year the Band entered seven competitions—winning six first, and one third prizes.

Fatalities.—While engaged in loading iron girders at the Fife Electric Power Co.'s generating station at Townhill an aged labourer was crushed to death through the collapse of the crane and one of the girders.

A Manchester paper states that two men employed by the Postal Telegraph Department were killed while engaged in repairing wires over some premises in Dickenson Street, Manchester, on 20th inst. Some loose coping gave way, and the men fell 100 ft. and were killed instantly. A carman upon whom part of the coping fell was seriously injured.

At the inquest the jury returned a verdict of "Accidental Death," and expressed the opinion that the Post Office authorities ought to provide a safety line attached either to the standard or some other fixture in order to provide greater safety for the men when working at considerable heights from the ground.

An inquest was held last week into the death of an engineman named Ray, employed at the Enderley Mills at Newcastle, Staffs. Ray was killed by an electric lift falling upon him. It had been known that the ropes were unsafe, but no notice to that effect was put up, though the electrician had given instructions that no one must be allowed to travel in it. It had, however, been used for light goods. It was thought that the lift fell upon deceased while he was examining the ropes.

An inquest was held last week into the death of a young woman which occurred while she was attempting to board a moving train at the Piccadilly Circus Tube Station. Her body was found on the line. The jury added a rider to their verdict of "Accidental Death," to the effect that the gates of electric trains should be closed before the starting signal was given.

WOLVERHAMPTON.—An adjourned inquiry was held on Saturday concerning the cause of death of a Wolverhampton tramcar conductor named Simcox, who expired on his derailed car on the Willenhall Road on the 18th inst.

Mr. Thomas Black, house surgeon at the General Hospital, stated that Simcox was dead when admitted to the institution. Witness had made a post-mortem examination. The heart had a slightly abnormal deposit of fat, and there was a patch of roughened surface. There was no disease of the muscles or valves of the heart. The blood was abnormally dark and unclotted. All the other organs of the body were congested.

The Coroner: What did you conclude was the cause of death?—Witness: The evidence of the post-mortem was insufficient to enable me to form an opinion.

The unclotted condition of the blood is often found in cases of death from electricity?—Yes.

And it is quite possible electricity was the cause of death?—Yes.

You can't account for death in any other way?—No.

In reply to Mr. T. Haynes Duffell, who represented the insurance company concerned, witness said that Simcox might have been killed by shock without any marks being visible on his body and clothes. The condition of the blood and the general congestion were the only evidences which would lead to the belief that electric shock was the cause of death.

Questioned by the Coroner, the doctor said that post-mortem rigidity, which was present in this case, was often absent in cases of electric shock.

Arthur Millar Pitchford, tramcar conductor, of 260, Willenhall Road, said he was working a car on the Willenhall Road route on Wednesday, the 18th inst. At the loop opposite Hayward's works the car left the metals. They waited for a car to come from the other direction, and then connected a cable between the two cars. On Simcox's instructions, witness and Conductor Painter held another cable with one end on the car buffer and the other on the rail, to complete the circuit. Then Simcox mounted the control platform and started the car. Before it was on the rail again Painter disconnected his end of the cable from the buffer, and dropped it on the ground. In spite of this, the car was still under power, as it was illuminated. It was, however, stationary. Simcox was standing with one hand on the controller and the other on the hand-brake, when he began gradually to bend as though he were about to pick something up. He seemed to be held fast and unable to move further. Witness shouted, and Conductor Painter jumped on the car and cut off the power. Some brandy was administered to Simcox, who moaned, and witness then went to an adjoining house to obtain a candle. This he lit, and went into the car, where Simcox had been placed. An examination of him revealed no signs of life. The method employed, witness added, was the usual one, although he had never seen a cable connected from the buffer to the rail before. The usual way was to "earth" the car by means of a point-bar from the undercarriage to the rail. In this case the other method was employed because the point-bar would not hold.

Mr. A. Turton, who represented the widow of deceased, asked that the inquiry might be adjourned. He said it was a very technical matter, and he would like expert evidence to be called.

Mr. W. A. Luntley, the manager of the tramways, intimated that the car had not been touched electrically since the occurrence, and it could be inspected at the depot.

The inquiry was adjourned for a week.

Inquiries.—Makers of nichrome wire, and fire resisting materials used in the construction of electric radiators, are asked for.

The "Electrical Review" during War Time.—As announced in our issue of a fortnight ago, we shall be pleased to send the ELECTRICAL REVIEW gratuitously to any of our readers who may be serving with the naval or military forces and would like to keep themselves in touch with doings in the electrical world. This offer particularly relates to readers who have left these shores since the beginning of the war, either for active service in the fighting line in France and Belgium or in the Fleet, or for service in Egypt, India or other foreign parts. As the men concerned may not have an opportunity of seeing this notice, we shall be greatly obliged if their friends or acquaintances who know their whereabouts will let them know of our offer and ask them to communicate their names and addresses to the Manager, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. The matter will then have immediate attention.

Parliamentary Notices.—A number of applications which are being made to Parliament for electrical powers appear in the current issue of the *London Gazette*, and a few others have appeared in previous numbers. Three applications relate to London electricity supply—one by the L.C.C. and two on behalf of proposed companies. We shall refer to these applications in our usual form later.

Educational Notes.—UNIVERSITY OF LONDON.—Prof. W. W. Watts, of the Imperial College, Royal College of Science, has been elected Dean of the Faculty of Science, and Prof. Ernest Wilson, William Siemens Professor of Electrical Engineering, Dean of the Faculty of Engineering.

ROYAL TECHNICAL COLLEGE, GLASGOW.—The annual report for the past session has just been issued; it shows that there were 669 day students and 4,342 evening students, an increase of 103 over the previous year. Last year the College was affiliated to the University, and 41 matriculated engineering students were in attendance at the College. The revenue amounted to £37,147, of which students' fees were £7,481.

NORTHAMPTON POLYTECHNIC INSTITUTE.—The annual prize distribution, by Lord Moulton of Bank, takes place on Friday, December 11th.

Fire Protection of St. Paul's Cathedral.—A complete scheme for adequately safeguarding the Cathedral was carried out about two years ago, the contractors being Messrs. Merryweather & Sons, of Greenwich; the hydrants fitted at the main roof levels were supplied with water from rain-water collecting tanks on the stone gallery. Experts decided, however, that these tanks when filled with water constituted a danger to the fabric and should be removed. Messrs. Merryweather & Sons have, therefore, installed one of their well-known "Hatfield" pumps, driven by an electric motor, at the 60-ft. level. Power is transmitted from the motor to the pump through silent chain gearing, and the installation is practically noiseless in operation. The pump takes water from the Water Board's supply, and delivers into the ring main round the drum of the dome under the colonnade, hydrants being fitted on this main at various points. Each of the hydrants is equipped with hose and fittings, and a special feature of the installation lies in the fact that the pump starts automatically as soon as one of the hydrants is opened, so that a fire can be immediately attacked at the roof level without its being necessary to go near the pump. When the hydrant is closed the electric current is automatically cut off and the pump ceases to work.

The Trading with the Enemy Bill.—Since our leading article went to press, the House of Commons has further discussed the Trading with the Enemy Amendment Bill, and the Committee stage has been concluded. In reply to questions by Mr. Joynson Hicks on Wednesday evening, Mr. Runciman said that it was the intention of the Board of Trade to appoint supervisors in the case of every company in which more than 75 per cent. of the shares were held by alien enemies. Several members thanked the Attorney-General for the manner in which he had met their criticisms and desires.

Inquiries for British Traders.—Two agents in Norway are inquiring of the Board of Trade for United Kingdom manufacturers of (1) electric pocket lamps and batteries; (2) electric batteries for pocket lamps. A firm also asks for offers from United Kingdom manufacturers of V.R. insulated cable and wire of 1910 (Norwegian) standard, switches, ceiling roses, with porcelain fittings, motors (continuous and alternating current), metal-filament lamps and electrical appliances of all kinds. Communications should be sent to the British Vice-Consulate, Bergen.

A Melbourne agent, who has hitherto represented German firms, wishes to get into touch with United Kingdom manufacturers of electrical and engineering supplies, and more particularly wires, cables, electricity meters and instruments, electric fans and small motors. Communications to the office of H.M. Trade Commissioner for Australia, Commerce House, Melbourne.

An agent in Ontario desires to secure agencies of United Kingdom manufacturers of electric lighting fixtures and appliances, shades for electric lights, &c. Address H.M. Trade Commissioner for Canada, 3, Beaver Hall Square, Montreal. Names of the inquirers in all the above cases may be ascertained at the Board of Trade Commercial Intelligence Department, London.

Birmingham Electrical Volunteer Force.—At a meeting of men engaged in electrical work in Birmingham, it was decided to form an electrical volunteer force composed of men engaged in electrical work in Birmingham.

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Appointments Vacant.—Shift engineer (£150), for Birmingham electric supply department; shift engineer (£4), for Belfast Tramway and Electricity Committee: assistant electrical engineer (Rupees 450 per month), for East Indian Railway; canvasser (£2), public lighting foreman (£2), plumber jointer (£2), mechanic (£2), man to take charge of telephones, fuse pillars, boxes and draw boxes (35s.), for Wolverhampton electricity department; switchboard attendant for Borough of Torquay; wireman (35s.) for County Asylum, Rainhill, near Liverpool. Particulars are given in our advertisement pages.

Institution and Lecture Notes.—Institution of Electrical Engineers—The following items appear on the programme of the Newcastle Local Section for the 1914-15 session:—

November 30th.—"Power Plant Testing," by W. M. Selvey.
December 14th.—"Cables," by C. J. Beaver.
January 18th.—"Automatic Protective Switchgear for Alternating-Current Systems," by E. B. Wedmore.
May 3rd.—"Phantom Circuits in Telephony," by A. W. Martin.

At the meeting of the Birmingham Local Section on Wednesday last a paper was read by Mr. W. M. Selvey on "Power Plant Testing." The discussion was closed.

Association of Mining Electrical Engineers (West of Scotland Branch).—The syllabus of the above Association for this season includes:—

1914.—December 19th.—"Experiences of Surface Earthing in Scottish Mines," by P. S. Glover.
1915.—January 23rd.—Joint Meeting with the National Association of Colliery Managers. "Electricity at the Coal Face," by J. Bowman.
February 20th.—"Some Experiences in the Handling of Electricity," by A. Smellie.
March 19th.—"Use and Abuse of Oils," by T. C. Thomsen.
April 21st.—Annual Meeting. "Bearings of Electrical Machinery," by A. Gibson.

Association of Supervising Electricians.—The Inaugural Dinner will be held at the London Tavern, Fenchurch Street, E.C., to-morrow evening. The gathering bids fair to be a large one, as the Association already comprises over 70 members, although it has been in existence but a short time, and a considerable number of tickets have been taken by manufacturing firms, who are necessarily in close touch with the supervisors. The President, Mr. A. H. Dykes, will preside at the dinner, and take the chair at the concert which follows. Tickets may be obtained from the hon. secretary, Mr. C. J. Banister, 14, Pulborough Road, Southfields.

Professional Classes and War Relief.—The Maternity Nursing Home in connection with the Professional Classes War Relief Council is now ready to receive patients. The Home is primarily intended for the wives of professional men who are hard hit by the war, special preference being given to those recommended by the husband's professional society or institution. A small weekly charge is made to patients, which is inclusive of all expenses. The Home is situated at 14, Prince's Gate, S.W., and contains every comfort and requisite for good nursing. Full particulars can be had on application to Mrs. Chambers at the above address.

B.E.A.M.A.—The following firms have recently been elected members of the British Electrical and Allied Manufacturers' Association:—Ashworth & Parker; Greenwood & Batley, Ltd.; Sandycroft, Ltd. The Harland Engineering Co. has been elected an Associate.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. T. J. Robinson has been appointed to the position of charge engineer to the Neath Rural District Council.

The Lighting and Electricity Committee of the Croydon B.C. has, for about the seventeenth year, re-elected Alderman D. B. Miller as chairman; and Councillor H. W. Umney, A.M.Inst.C.E., M.Inst.M.E., is again vice-chairman. The Committee on Monday reported the resignation of Mr. J. W. Burr, assistant electrical engineer, upon being appointed borough electrical engineer at Swansea. He was in receipt of £375 a year. It was resolved to advertise the vacancy at a salary of £250, rising to £350.

Tramway Officials.—At Porth tramway depôt on November 1st, Mr. T. R. Evans, late assistant engineer and manager of the Rhondda electric tramways, was presented by the staff with a barometer.

General.—Councillor Walker has been re-elected chairman of the Rochdale Gas and Electricity Committee, and Alderman Taylor has been re-elected chairman of the Tramways Committee.

Alderman Griffiths has been appointed chairman, and Councillor Clayton vice-chairman, of the Southport Tramways Committee.

Councillor J. Priest, who is manager of the electrical department of Messrs. F. & C. Osler, of London and Birmingham, has been elected chairman of the Reigate Borough Council Electricity Committee.

Mr. Russell-Taylor has been appointed chairman of the Liverpool Tramways and Electric Power and Lighting Committee. Alderman F. Smith, the ex-chairman, was appointed deputy-chairman.

At Holy Trinity Church, Darlington, on November 11th, the marriage took place of Mr. J. W. Patterson, foreman electrical engineer at the Glasgow works of Sir Wm. Arrol, and Miss E. H. C. Smith, of Darlington.

The marriage has taken place of Mr. John Thomas Ellis Willey, electrical engineer, of Bradford, and Miss Edith Annie Lawton, second daughter of Mr. Henry Lawton, manager of the Idle Gasworks. Our correspondent who sends this information does not suggest that this is carrying the war into the enemy's camp. That the gasworks should be Idle is the most appropriate thing under the circumstances.

Mr. H. H. Gordon has resigned his membership of the L.C.C. Committee on London Electricity Supply.

Councillor Duncan Watson has been elected chairman of the Electric Supply Committee of the St. Marylebone Borough Council for the ensuing year.

Mr. Herbert H. Berry, of Messrs. Berry, Skinner & Co., who met with a serious accident in May last, and who has since had in consequence to undergo six operations, has practically recovered. It is confidently hoped that he will be able to resume his duties by the New Year.

Mr. F. Cusworth, of East Kirkby, on resigning the position of secretary to the Notts. and Derbyshire Branch of the Association of Mining Electrical Engineers, has been presented with a case of table cutlery and a combination armchair and writing table by the members.

At Preston, Alderman Ormrod has been appointed chairman, and Councillor Parkinson vice-chairman of the Tramways Committee.

Dr. Joseph and Councillor Wilkinson have been appointed chairman and vice-chairman respectively of the Warrington Electricity and Tramways Committee.

The Heywood Electricity Committee has reappointed Councillor J. Ashworth as chairman, and Alderman Popple as vice-chairman.

Alderman T. Perrin (Hyde) has been re-elected chairman of the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board for the ensuing year. Alderman Sykes (Mossley) has been re-elected deputy-chairman.

The Bury Tramways Committee has reappointed Alderman Collinge and Councillor Hargreaves chairman and deputy-chairman for the ensuing year, and the Electricity Committee has re-elected Councillor Jamieson and Councillor T. Holt chairman and deputy-chairman.

Councillor C. Hardman has been re-elected chairman of the Oldham Electricity Committee, and Alderman Ward vice-chairman. Alderman Isherwood continues as chairman of the Tramways Committee, with Councillor J. K. Cheetham as vice-chairman.

The following appointments of chairman and vice-chairman have been made at Salford:—Electricity Committee, Councillor Billington (chairman) and McDougall (deputy-chairman); Tramways, Alderman Lindsley and Councillor Barrett; Lighting and Cleansing, Alderman Hulton and Councillor Hopwood.

Obituary.—The *British Australasian* announces the death, which occurred on November 14th, at Bognor, of pneumonia, of Mr. William Churchward Langdon, for many years superintendent, Eastern Extension Telegraph Co., Chevalier de l'Ordre Royal du Cambodge, and J.P. of South Australia, aged 60.

Wills.—The late Mr. George Westinghouse left property to the value of £36,843 in the United Kingdom.

NEW COMPANIES REGISTERED.

Jersey Electric Lighting and Power Co., Ltd. (138,351).—Registered November 19th by Nordon & Drury, 56, Moorgate Street, E.C. Capital, £50,000 in £1 shares. Objects: To take over from Druce, Walker and Co., Ltd., a concession for the supply of electrical energy in the parish of St. Helier, Jersey, to carry out the terms of a contract dated April 15th, 1914, between the Assemblée des Principaux et Officiers of the said parish and the said company, to adopt an agreement with the said company and the Anglo-Colonial Engineering Co., Ltd., for the acquisition of the benefit of the said contract, to carry on the business of suppliers of electric light and power, electricians, mechanical engineers and manufacturers, &c. The signatories (with one preference share each) are:—P. J. White, Kingussie, Broomfield Road, Kew Gardens, managing director, Anglo-Colonial Engineering Co., Ltd.; H. Brittain, 13, City Road, E.C., engineer; A. J. Smith, 3, Burgoyne Road, Harringay, N., secretary; H. Kirby, Sutherland House, London Street, Hyde Park, W., chartered secretary; P. Boyd Stevenson, 17, Dover Mansions, Brixton, S.W., clerk; E. J. Walker, 10, Bush Lane, E.C., managing director, Druce, Walker & Co., Ltd.; S. N. Druce, 10, Bush Lane, E.C., managing director, Druce, Walker & Co., Ltd. Minimum cash subscription, 25 per cent. of the shares offered to the public; the first directors (to number not less than three or more than eight) are to be appointed by the signatories; qualification, £200; remuneration, £200 each per annum (chairman, £300). Registered office, 13, City Road, E.C.

Electrical Power Engineering Co. (Birmingham), Ltd. (138,377).—This company was registered on November 21st, with a capital of £5,000 in £1 shares, to take over as from June 30th, 1914, the business of a manufacturing electrical engineer and maker and factor of electrical appliances carried on by W. H. Heath, at Stechford, Birmingham, as the "Electrical Power Engineering Co." The subscribers (with one share each) are:—W. H. Heath, The Coppice, Bickenhill Road, Maraton Green, Birmingham, manufacturer; A. M. Willmore, Vermont, Victoria Road, Stechford, Birmingham, engineer. Private company. The number of directors is not to be less than two or more than five; the first are W. H. Heath (chairman), Mrs. A. M. Heath and A. M. Willmore; qualification, £250. Registered office, First Avenue, Stechford, Birmingham.

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Masham and District Electric Supply Co., Ltd. (138,306).—This company was registered on November 14th, with a capital of £2,000 in £1 shares (1,500 preference), to carry on the business of an electric light company at Masham, Yorks., or elsewhere. The subscribers (with one share each) are:—C. H. Best, 72, Market Street, Bradford, incorporated accountant; W. M. Lawson, The Square, Masham, Yorks., draper; C. Pullam, 80, King's Arcade, Bradford, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification, £25. Solicitors, Edmundson & Gowland, Ripon.

British African Agencies, Ltd. (9,270).—This company was registered in Edinburgh on November 18th, with a capital of £1,050 in 1,000 preference shares of £1 each and 1,000 ordinary shares of 1s. each, to carry on the business of a general commercial agency in South Africa; lighting, heating and power engineers, &c. The subscribers (with one preference share each) are:—G. V. Turnbull, Cape Town, South Africa, chartered accountant; C. Hill Scott, Lixmount Road, North Berwick, gentleman. Private company. The first directors are G. V. Turnbull and C. H. Scott. Registered office, 1, Howe Street, Edinburgh.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

J. Whitehouse, Ltd.—Particulars of £750 debentures, created November 9th, 1914, filed pursuant to Sec. 63 (3) of the Companies' (Consolidation) Act, 1908, the whole being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Topsham Electricity Supply Co., Ltd.—Debenture dated October 15th, 1914, to secure £100, charged on company's property, present and future, including uncalled capital. Holder: C. J. Gale, Fair View Topsham, Devon.

Pernambuco Tramways and Power Co., Ltd.—Issue on October 12th, 1914, of £22,425 debentures, part of a series of which particulars have already been filed.

Yale Electric Power Co., Ltd. (60,493).—Capital, £2,000 in 668 ord. shares of £25 each and 3,300 ord. shares of £1 each; return dated October 8th, 1914; 668 ord. and 800 pref. shares taken up; £25 per share called up on 600 ord. and £1 per share on 800 pref. shares; £15,800 paid; £1,700 considered as paid on 68 ord. shares. Mortgages and charges: £3,000.

St. Helens Cable and Rubber Co., Ltd.—A statement of the total amount outstanding on July 1st, 1908, in respect of mortgages and charges created prior to that date, and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Mortgage dated December 20th, 1906, securing £107,604 5s. 3d.

Yorkshire Incandescent Electric Lamp Co., Ltd.—Issue on November 7th, 1914, of £3,300 debentures, part of a series of which particulars have already been filed.

Enfield Electric Cable Manufacturing Co., Ltd.—Mortgage dated November 5th, 1914, to secure £15,000, charged on the freehold land with premises thereon, &c., at Brimsdown, Enfield. Holders: W. Bakewell, 28, Main Street, Handsworth, Sheffield; G. J. Andrews, 40, West Campbell Street, Glasgow; and F. Platte, Fontainbleau, Dacres Road, Forest Hill, S.E.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Trust deed dated November 10th, 1914, (supplemental to trust deed dated June 30th, 1909), to secure £167,000 deb. stock, ranking *pari passu* with £637,500 like stock issued under principal deed, charged on electrical undertakings of the company, freehold premises known as "Carville and Neptune Bank," leasehold premises at Dunston, and company's general assets except uncalled capital. Trustees: Rt. Hon. Viscount Ridley, of Blagdon, Northumberland, and W. Cunliffe, Headley Court, Epsom, Surrey.

Barbados Electric Supply Corporation, Ltd.—Issue on March 4th, of 1,500, and on March 27th, 1914, of £500 debentures, parts of a series of which particulars have already been filed.

CITY NOTES.

Lima Electric Power and Tramway Co.

Mr. M. P. Grece presided on November 18th, at Winchester House, E.C., over a meeting of the bondholders of the above company for the purpose of considering various resolutions dealing with the suspension of the sinking fund for the cancellation of debentures. There were two resolutions in the notice convening the meeting. The first proposed a modification of the trust deed to the effect that the sinking fund be suspended until the expiration of one year after peace is declared by all the Powers involved in the present European war subject to the following conditions:—

(1) That immediately after the expiration of the period of suspension the payment of the whole of the said sum of £44,449 shall be renewed and again paid in accordance with the provisions of the said clause, and (2) that no dividends shall be paid by the Company until after the said payments shall have been renewed.

The second resolution was at the request of the trustees for the debenture holders, and provided that for one year only the debenture holders agree not to take any steps in regard to the payment of the sinking fund, provided that no dividends on the share capital are in the meantime paid to the shareholders.

The Chairman said he occupied the position that day as the Chairman of the London Committee of the Board. It was obvious that the sinking fund would have to be suspended, as in Lima they had had their troubles owing to the war. They had met with enormous difficulties due to the banks drawing upon continental bankers and houses and having acceptance refused. The result was that the Government had to decree a moratorium, one condition of which, however, was that 15 per cent. of each debt was to be paid back every month. So far as the company was concerned, the result was that a great deal of the public and private lighting paid for in cash. Whilst the figures cumstances have been considered sati that they had not got the cash, althou With regard to the two resolutions the notice convening the meeting, the not consider that either of them wen proposed to suggest a different resoluti tion had not been submitted to the tru holders and they were not responsible the London Committee was organised ests of the debenture holders, and, aft had been successful in getting the di shares reduced from 6 per cent. to 4 p of improving the financial position of could now get the dividends suspended sidered it would still further improve t company. It was for the meeting to s would prefer. The Chairman then mo tions:—

"*Resolved*—(a) That the redemption of the provisions of Clause 30 of the trust deed and al postponed until the expiration of two years from accordingly that the company be permitted hen the trustees of so much of the sum of £44,449 as shall not be required for payment of the inte remuneration referred to in the said clause until the following conditions, namely:—*First*, that on the whole of the said sum of £44,449 shall be provisions of the said clause; *secondly*, that no company until after the said payment shall hav that the amount which would have been payabl the redemption of the debentures during the p 1914, to the 20th November, 1916, apart from t such instalments as the company may think fit within a period of five years next after the said tion to the payments to be then made pursuant applied by the trustees to the redemption of d clause.

"(b) That with a view to effecting the nece deed for giving effect to this resolution, the tr empowered to concur with the company in exec in the terms of the draft submitted to this meeti

Replying to questions, the Chairm interest would not be suspended, nor cancellation of the debentures be int

Mr. C. Loch, in seconding the moti revenue of the company came from way receipts were, of course, in cash lighting receipts that the moratorium that about 85 per cent. of the ligh were now received in paper, which revenue about 60 per cent. was bein agreed that the suspension of the sin quent non-payment of dividend for strengthen the company's financial

Sir Walpole Greenwell, as one of of the big debenture holders wanted the Chairman had said it did not seem one year.

The resolution proposed by the Ch unanimously.

Allgemeine Elektrizitats

The report of the directors for the ye 1914, states that the turnover and those in the preceding year, alth economic tension in general had alre and the development and business mitted of the distribution of the sam 1912-13 if a change in the situation about by the world-war. The many f in fact, completely at a standstill. being maintained to an inadequate ness was almost entirely languishin carried on in Argentina, Mexico, form of special companies. Depreci losses on debts owing at home and and the extent of these would onl further course of hostilities, althou it necessary to take such risks into as careful judgment would admit. following figures for the past two y

Share capital	
Gross profits	
General expenses	
Taxes	
Depreciation (ordinary)	
Net profits	
Net profits and balance forward	
Reserve fund	
Bonuses	
Pension fund	
Dividend	
Dividend, per cent.	
Carried forward	

The report proceeds to state that which receded from 70,162 in 191 declined further to 66,100 in the p comprising the smaller German wo works at Milan, Riga, and Vienna; called up for military service. The

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works in the Brunnenstrasse amounted to 123,162 machines and transformers of a total of 1,840,273 KW., these comparing with 122,452 and 1,973,987 KW. respectively in the previous year. The locomotive factory was transferred to new shops at Hennigsdorf. Two locomotives out of the 27 ordered by the Prussian State Railways were delivered, together with the motor equipment for the experimental train for the Berlin City Railway. The department commenced the production of railless electrical vehicles and of auto-cranes. The turnover of the turbine factory comprised turbo-dynamos of 564,000 KW. as contrasted with 599,908 KW. in 1912-13. The aviation department was actively employed during the year. In the case of the Frankfort works an increase took place in the turnover in searchlights; the signal factory was well employed and large orders were received for export. A new development was an automatic electric apparatus for passenger tickets, which was being tested at the main station at Essen. The copper requirements of the Oberspree cable factory amounted to 33,250 tons, or a quantity almost equal to the previous year's consumption of 33,800 tons. Extensions of the plant for the production of copper wire and brass rods and sheets were carried out, as also was an extension of the tube rolling mill in consequence of the greater needs of the navy and in connection with the construction of turbines. The demand for high-tension cables for the transmission of power over long distances, and the deliveries of telephone cables to foreign telegraph administrations, experienced an increase, whilst an expansion also occurred in the use of the patented telephone relay. An augmentation took place in the sales of wire lamps, and the efforts made to deal with lamps of low lighting powers were continued with success.

After referring to the motor-car department, which is carried on by a separate company in which the A.E.G. holds all the share capital, the report mentions that since the outbreak of the war this separate company has been employed almost exclusively on army contracts. During the year the constructional activity for mines and ironworks was slack and the orders were mostly those remaining over from the previous year's programmes of light and power installations, but the requirements for large dynamos, motors for pumping, ventilators and winding and rolling train machinery, cranes and other auxiliary machinery were scarcely less in extent than in 1912-13. Several of the electricity works and overland stations erected by the company in Germany were brought into operation or were still in progress. Abroad there were being carried out an extension of the Brakpan station for the Victoria Falls and Transvaal Power Co., the electrical equipment of the hydro-electric works of the Ebro Irrigation Co. of Barcelona, the extension of the Campina station (12,000 K W.) in Roumania, equipment for 10,000 KW. at Pruschkow, Russia, 15,000 KW. for Lisbon, 15,000 KW. for the new tramway power station at Petrograd, and 5,000 KW. for a power station at Malino. The tramway and light railway department yielded satisfactory results. Concerning the proposed high-speed railway between Gesundbrunnen and Neukolln, it is stated that work on one section of the line has already been put in hand, whilst the erection of overhead conductors and power station for the main line between Halle and Magdeburg and Lauban and Konigszelt is to be completed in the coming winter.

The balance sheet shows that the book value of all investments yielded a return of 9.079 per cent. as compared with 9.664 per cent. in 1912-13, the value of the investments having been increased from £2,145,000 to £2,827,000 in 1913-14. The credit held at the bankers amounted to £3,848,000 as compared with £3,879,000, and that granted to the Berlin Electricity Works reaches £530,000 as against £359,000, whilst the credit accorded to the company branches has declined from £1,549,000 to £1,112,000, and the credit in current account is £4,215,000 as contrasted with £3,995,000. The total of outstandings amounts to £9,841,000 as compared with £9,886,000 in 1912-13. The contracts in hand are computed at £1,675,000 as against £1,853,000, and finished manufactures stand at £1,013,000 as contrasted with £1,222,000. On the other hand, the current liabilities have risen from £2,939,000 in 1912-13 to £3,595,000 last year. The reserve fund is returned at £3,681,000 as compared with £3,683,000, apart from a special reserve of £982,000 as against £931,000 in 1912-13.

The Berlin Electrical Works. — The balance-sheet for 1913-14 has recently been published, and the gross profits are returned at £1,164,070, as compared with £1,152,300 for 1912. After the deduction of expenses there remains a net profit of £596,300, as against £584,300, out of which has been declared the same dividend as for 1912-13, viz., 12 per cent. on ordinary shares, while the preference shares are getting 4½ per cent., according to the company's by-laws. The consumption of energy during July this year showed an increase, but after the outbreak of the war it was considerably reduced in August, but subsequently it has risen again. The Berlin Electrical Works is a private company, which has a concession for a certain period. In the report it is stated that the magistrate of Berlin has now put forward the demand that the works are to be taken over by the city from October 1st, 1915, and the book value of the plant and other assets will form the basis of the purchase sum. At the present time the city derives a certain share of the profits apart from the dividend on the shares held by it, which for the last year amounted to £191,956, as compared with £196,000 for the year 1912-13.

Ruston Proctor & Co., Ltd.—The directors have decided that in consequence of the dislocation of the export business and the disturbed financial situation caused by the war, it is advisable not to pay an interim dividend on the ordinary shares.

R. Hornsby & Sons, Ltd.—The directors recommend a dividend at the rate of 2½ per cent. on the ordinary shares, carrying forward £13,859. Last year the dividend was 6½ per cent. and £4,570 was carried forward.

Provincial Tramways Co.—The directors have declared a final dividend of 10d. per share on the ordinary shares, making, with the interim dividend paid in June, 1s. 6d. per share, or 7½ per cent. per annum, for the year to September 30th. The directors have set aside £12,000 for reserve and depreciation, and £2,000 as a reserve for third-party insurance or for other purposes. £4,935 is to be carried forward.

Electric Construction Co., Ltd.—The directors have resolved to pay, on the 30th inst., an interim dividend at the rate of 7 per cent. per annum on the preference shares for the half-year ended September 30th.

Northern Light, Power and Coal Co.—The *Financier* states that a circular has been sent to the bondholders of this company, asking them to join in applying for the appointment of a receiver and manager, in which case, it is stated, the receiver must devote all proceeds and assets of the company to the bondholders, and not to the creditors.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended September 25th, 1914, amounted to 1,371,455, compared with 1,361,376 units in the corresponding four weeks of 1913.

STOCKS AND SHARES.

Tuesday Evening.

NOVEMBER 18th has come and gone, and this, which was to have been such a black-letter day for the Stock Exchange, turned out to be less terrifying than many an anxious settlement has been in what might be called normal times. There were a few firms who placed their books in the hands of the Stock Exchange Committee, because they were unable to meet their engagements; and it is possible enough, of course, that there may be others who will find themselves obliged to take this course of private liquidation. But the great majority of Stock Exchange members feel that they are out of the wood for the present, at all events; and the relief caused prices to advance sharply in a good many cases.

For the time being, investment attention is fixed upon the War Loan. One result of the issue of this stock is already seen in the renewed willingness of the capitalist to release his savings in order to employ them in directions more profitable than those afforded by his banker. He has been waiting for the long-promised War Loan, and has taken advantage of its issue to apply liberally. At the same time, the mere fact of having something to do, once more, with stocks and shares, has quickened his appreciation of other opportunities that are offering for the purchase of cheap stocks, and this is seen in the fact that a number of Stock Exchange investment markets have this week found such a continuous stream of inquiries for popular issues as not only surprised them, but left them short of stock.

Affairs in Brazil are progressing favourably, so that the rate of exchange has hardened, and a number of Brazilian securities are once more on the up grade. Brazil Tractions are the principal feature amongst these. The price has recovered smartly to 51½, with an active market in the shares. At the present rate of dividend, the yield on the money is practically 10 per cent., so that there is plenty of room for the Company to lower its distribution and still leave the investor with a handsome return on his capital. Rio Tramway Bonds have rallied to 85, and a parcel of substantial amount which had been hanging over the London market for some time past found a purchaser the other day, in Canada, at 84. It may be recalled that a few weeks ago we pointed out here that Bonds were on offer at 81, or a little cheaper, at which price they constituted a real bargain, having regard to the security offered by the Company.

Further attention has been paid to the 5 per cent. Debenture stock and the 6 per cent. Cumulative Preference shares of the Adelaide Electric Supply Company. The undertaking being situated in a country outside the war zone, is one of those of the kind which investors are now seeking, as we have pointed out before. The net profits have risen from £13,000 for the year ended August, 1908, to £46,000 for that ended August, 1913; and as the service of the Debenture stock calls for £11,000, the margin is obviously ample. The dividend on the Ordinary shares during the period quoted has risen from 3½ per cent. to 12 per cent. The 6 per cent. Preference shares are of the nominal value of £5 each, and are offered at £5 1s. 3d.; the interest on these calls for £12,000 per annum, so, here also, the dividend is covered by a substantial amount.

Demand, too, has sprung up within the past few days for City of Buenos Ayres Trams 5 per cent. Ordinary shares, the dividends

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on which are payable quarterly. This company has the guarantee of the Anglo-Argentine Tramways, and the dividend on its Ordinary shares takes precedence of the Debenture stock of the Anglo-Argentine Tramways—being, in fact, a rent-charge upon the undertaking of the latter company. The price is £5, and, as a permanent investment, these Ordinary shares are a good deal more secure than many Preference or bond issues.

Home Railway stocks maintain their values with firmness, but it has to be noticed that there is still comparatively little demand for them. In the Underground group, Metropolitans are steady at 30½, and there has been a little inquiry for Districts about 18¼. The uncertainty which is felt with regard to the amount of money to be handed over by the Government, in payment of dislocation of traffic through the movements of troops, is one of the reasons which scare people away from the Home Railway department. So far as the Underground lines are concerned, this timidity on the part of the people with reference to steam stocks happens to coincide with the check that has been imposed upon amusement traffic through the lowering of the lights of London. Coincidences, however, are fashionable just now; in which connection we may venture to wonder whether any of the readers of a certain weekly REVIEW noticed, a fortnight ago, two consecutive leaderettes of which the first was entitled "Copper," and the second, "The Special Constable."

There are not many changes to be recorded in the lists of stocks and shares restarted here last week. Eastern Extensions are ¼ harder, and Western Telegraphs at 12⅜ while nominally ⅛ down, are actually that amount higher, because the dividend of 5s. was deducted on account day. West India and Panama Telegraph shares are unaffected by the dividend of 1s. 3d. per share, already announced in these columns.

HOME ELECTRICITY SUPPLY COMPANIES.

Brompton Ordinary	8⅜	Kensington Ordinary	7⅞
do. 7 per cent. Pf.	8½	London Electric	1¼
Charing Cross Ordinary	4¼	do. do. 6 per cent. Pf.	5
do. do. do. 4½ Pf.	4¼	do. do. 4 Deb.	89½
do. do. City Pf.	4¼	Metropolitan	3
do. 4 Deb.	86½	do. 4½ per cent. Pf.	4¼
Chelsea	4⅜	do. 4½ Deb.	91⅜
do. 4½ Deb.	91½	do. 3½ Deb.	81½
City of London	15	St. James' and Pall Mall	9
do. do. 6 per cent. Pf.	18	do. do. 7 per cent. Pf.	6⅜
do. do. 5 Deb.	115	do. do. 3½ Deb.	88
do. do. 4½ Deb.	98	South London	3
County of London	11½	South Metropolitan Pf.	1⅛
do. do. 6 per cent. Pf.	11⅝	Westminster Ordinary	8½
do. do. 1st Deb.	99	do. 4½ Pf.	4⅜
do. do. 2nd Deb.	97		

MANUFACTURING COMPANIES.

Brit. West. Pf.	1½	Electric Construction	11s.
do. 4 Deb.	72	do. do. Pf.	1
do. 6 p. lien	98	Gen. Elec. Pf.	10
Callenders	11½	Henleys	14½
do. 5 Pf.	4¼	,, 4½ Pf.	4⅜
do. 4½ Deb.	97½	,, 4½ Deb.	97⅛
Edison & Swan, £3 pd.	5/6	Telegraph Con.	86½
do. do. fully pd.	1⅜	Castner-Kellner	2 1/16
do. do. 4 Deb.	60		
do. do. 2nd Deb.	63½		

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pf.	101½	Gt. Northern Tel.	29⅜
do. Def.	21	Indo-European	58
Chili Telephone	7	New York Tel. 4½	96½
Constantinople Tel.	4⅛	Oriental Tel. Ord.	2
Cuba Sub. Ord.	8⅛	do. Pf.	1 7/16
do. Pf.	15⅝	Tel. Egypt Deb.	97
Eastern Extension	11⅝	United R. Plate Tel.	6
do. 4 Deb.	94	do. Pf.	5
Eastern Tel. Ord.	122½	West India and Pan.	1 7/16
do. 3½ Pf.	74½	Western Telegraph	12⅜xd
do. 4 Deb.	95	,, 4 Deb.	96½
Globe Tel. and T. Ord.	10⅛		
do. Pf.	12⅜		

FOREIGN TRAMS, &c.

Anglo-Arg. Trams 1st Pf.	4½	Bombay Electric Pf.	11
do. 2nd Pf.	4½	do. 4½ Deb.	96
do. 4 Deb.	86½	Mexico Trams.	52½
do. 4½ Deb.	96½	do. 5 per cent. Bds.	72½
do. 5 Deb.	88½	do. 6 per cent. Bds.	72½
Brazil Tractions	51½	Adelaide Sup. 6 per cent. Pf.	5 1/16
		do. 5 Deb.	104⅜

The Marconi group shows a little more activity. The parent shares are being dealt in fairly largely on the basis of 30s.-31s. 6d. Americans have varied between 7s. and 8s., and Canadians, down to 3s. 3d. the other day, rallied a little to 3s. 9d. The result of the latest Marconi case, in which Mr. Godfrey Isaacs figured as successful defendant, aroused only academic interest.

The Electric Supply group remains lifeless. St. James's Preference are on offer at the moment, and the price of 6¾ shows a fall of 5s. on the week. There are a good many sellers about of the various London descriptions, and demand is still dormant. If a suggestion from an outsider might be permitted, an announcement on the subject of how much the electric light companies are losing by reason of the nightly obscurity would probably do good. No doubt the companies might find it difficult to give figures with any exactitude, but a rough estimate would be of service as a guide, not only to present proprietors, but also to other people who are watching the market with a view to taking an interest in the shares at the present low range of prices, but who are afraid to do so because they have no idea as to what is likely to be the result of the Admiralty's action in turning down the lights.

The Mexico Tramways vigorously protests against the action of the Mexican Government in giving all the Company's employées a rise of 25 per cent. and, at the same time, forbidding the remittance of money from the country until the rate of exchange improves—a proceeding so high-handed as might well arouse the envy of any Teutonic militarist. Shares are naturally on offer, but the dealers have made no alteration in the shares, which therefore stands at 52¼.

There is a reviving disposition to pick up a bonds of the Canadian companies. British Co way 4½ per cent. Debenture stock is wanted a Preferred stock is changing hands on the b the Deferred the nominal price is 103, tho going on in the stock. In the Home gro Traction 5 per cent. first Debenture stock within the past few days.

In the Rubber market, the changes are week. Both rubber and copper are reporte short supply in Germany, but this has had prices of the products in the London markets move scarcely at all. Nor is there any parti Armament shares. While everyone recognis must be doing amazingly well at the present naturally asked as to how long such prosper a query which gives rise to a good deal of c investors in the matter of making purchases

MARKET QUOTA

OWING to the war, the prices given belo or less nominal.

Wednesday, November

CHEMICALS, &c.

a Acid, Hydrochloric		per cwt.
a ,, Nitric		,,
a ,, Oxalic		per lb.
a ,, Sulphuric		per cwt.
a Ammoniac Sal		,,
a Ammonia, Muriate (large crystal)		per ton
a Bleaching powder		,,
a Bisulphide of Carbon		,,
a Borax		,,
a Copper Sulphate		,,
a Lead, Nitrate		,,
a ,, White Sugar		,,
a ,, Peroxide		,,
a Methylated Spirit		per gal.
a Potassium, Bichromate, in casks		per lb.
a Potash, Caustic (88/90 %)		per ton
a ,, Chlorate		per lb.
a ,, Perchlorate		,,
a Potassium, Cyanide (98/100 %) (for mining purposes only)		,,
a Shellac		per cwt.
a Sulphate of Magnesia		per ton
a Sulphur, Sublimed Flowers		,,
a ,, Recovered		,,
a ,, Lump		,,
a Soda, Caustic (white 70/72 %)		,,
a ,, Chlorate		per lb.
a ,, Crystals		per ton
a Sodium Bichromate, casks		per lb.

METALS, &c.

b Aluminium Ingots, in ton lots		per ton
b ,, Wire, in ton lots (1 to 14 S.W.G.)		,,
b ,, Sheet, in ton lots		,,
g Babbitt's metal ingots		,,
c Brass (rolled metal 2° to 12° basis)		per lb.
c ,, Tube (brazed)		,,
c ,, ,, (solid drawn)		,,
c ,, Wire, basis		,,
c Copper Tubes (brazed)		,,
c ,, ,, (solid drawn)		,,
g ,, Bars (best selected)		per ton
g ,, Sheet		,,
g ,, Rod		,,
d ,, (Electrolytic) Bars		,,
d ,, ,, Sheets		,,
d ,, ,, Rods		,,
d ,, ,, H.C. Wire		per lb.
f Ebonite Rod		,,
f ,, Sheet		,,
g German Silver Wire		,,
h Gutta-percha, fine		,,
h India-rubber, Para fine		,,
i Iron Pig (Cleveland warrants)		per ton
i ,, Wire, galv. No. 8, P.O. qual.		,,
g Lead, English Pig		,,
m Manganin Wire No. 28		per lb.
g Mercury		per bot.
e Mica (in original cases) small		per lb.
e ,, ,, ,, medium		,,
e ,, ,, ,, large		,,
e Nickel, sheet, wire, &c.		,,
g Phosphor Bronze, plain castings		,,
g ,, ,, rolled bars & rods		,,
g ,, ,, rolled strip & sheet		,,
e Platinum		per oz.
d Silicium Bronze Wire		per lb.
r Steel, Magnet, in bars		per ton
g Tin, Block (English)		,,
n ,, Wire, Nos. 1 to 16		per lb.
g White Anti-friction Metals		per ton
k Zinc, Sh's (Vieille Montagne bnd.)		,,

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bollin
k Morri
l Richa
m W. T
n P. Or
o Johns
p
r W. F.

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TRADE OF SOUTH AFRICA.

The report for the year 1913 on the trade of the Union of South Africa by His Majesty's Trade Commissioner has just been issued by the Board of Trade.*

The following is a summary of such portions of it as are of interest to the electrical manufacturer and contractor:—

General Trading Position.—During the past six years the actual excess of exports over imports amounted to £143,486,000. For 1913 itself there was a trade balance of £28,713,000. Out of this sum the country is well able to meet its obligations in respect of borrowed capital and other charges which include public debt, municipal borrowings, mining and industrial undertakings, financial corporations of all kinds, the purchase of Government stores, the excess of imports over exports in respect of specie, freight charges, etc.

Trade during 1913 reached the highest point yet attained. The total trade of the country increased by an amount of £39,741,000, or an advance of 57 per cent. in a period of five years. This astonishing rise comprises an increase of £17,314,000, or 68 per cent., in import trade, and of £22,427,000, or 50.7 per cent., in export trade. The following comparative figures show the expanding nature of the market for goods of interest to the electrical and allied trades:—

	1908. £	1912. £	1913. £
Mining material	1,607,000	1,692,000	1,800,000
Electrical material	478,000	917,000	984,000
Miscellaneous machinery and requisites therefor	1,052,000	1,757,000	1,950,000
Building and constructional material	1,031,000	1,911,000	2,170,000
Requirements for other local industries	2,290,000	4,219,000	4,324,000

In view of the severity of the drought, combined with the dislocation of trade and loss to industry caused by labour troubles, the advances shown in 1913 over 1912 are remarkable. One fact which is not the least important in discussing the recent growth of South Africa's trade, and in contemplating its future potentialities as a market for British goods is that the native is steadily emerging and acquiring habits of civilisation and industry.

A close examination of the trade returns for successive years reveals the fact that this great expansion synchronises exactly with the consummation of the political union of the four Colonies, a circumstance which suggests that the notable change in the constitutional arrangements of the country and the consolidation of its financial and economic interests inspired the community and the overseas investing public with greater confidence, which awakened a new spirit of enterprise and industrial development in South Africa.

Electrical Material.—In the total imports of this class there has been a slight net increase, amounting to £66,000. This amount is made up by an increase in cables and wires of £74,700, and in electrical machinery of £16,200. Against these figures must be set a decrease of £25,600 in fittings and posts. The following table of imports of electrical goods shows what an immense demand for this line has existed in South Africa during recent years:—

	£		£
1908	478,000	1911	1,031,000
1909	632,000	1912	917,000
1910	1,429,000	1913	984,000

In other words, the imports since 1908 amounted to nearly 5½ million pounds sterling. Of the total value of the above imports for the last six years, Germany enjoyed no less than 44.9 per cent. of the trade.

It has recently been brought to my notice that a great deal of German electrical plant, bought and delivered in the years 1910 and 1911, could not be put into operation until the end of 1913, owing to the fact that the necessary supply of motive power was not available. I am informed, further, that latterly trouble with some of the foreign-made plant has occurred to an alarming extent, and that the faults are due not only to an over-rating by the makers of the capacities of the various machines, but, in some cases, to bad design and manufacture. One of the most prominent electrical engineers of the Witwatersrand, who has had great experience with plants of all competing countries, has stated to me his opinion that "at the present time, I believe, we have one or two firms in England who can hold their own with any of the Continental houses, and, since we have agreed that quality and not price shall be our first consideration in placing orders, we have not had nearly so much trouble."

There is no doubt that British trade has made great advances in the production of larger electrical power units during recent years, though there is room for still further improvement. The keenness of foreign manufacturers makes a progressive policy imperative if we are to hold our own in this branch of trade.

Miscellaneous Machinery, etc.—The only items of importance showing a decline are: "Machinery" (not elsewhere mentioned), the imports of which fell by £26,700; anti-friction grease, £7,100; and tools, £8,700. On the other hand, the following increases occurred, viz.: Pumps, £14,000; traction engines, £10,000; power lorries, £18,700; tramway material, £38,000; railway material (not for Government), £79,000; bands and belting, £7,800; lubricating oils, £11,400; steam suction and conveying hose, £8,800; and iron and steel piping and fittings, £49,200.

The last item is one to which British manufacturers must continue to give very close attention. A comparison, by countries of origin, of the imports of pipes and fittings into the South African Union since 1910, discloses the fact that while we still remain the principal suppliers of iron and steel piping, our relative position as a competitor has suffered to the extent of practically 10 per cent., due to the increased activity of Germany and the United States.

Constructional Material.—With the exception of corrugated galvanised iron, and linseed oils, paints and colours, there has been a sensible expansion all round, *e.g.*, rises of £23,000 in cranes, elevators and lifts, £21,400 in angle-iron, girders, etc., and £10,700 in cement. The output of a local concern producing a high-grade cement has materially affected the position of oversea-made cement in the Transvaal Province. A second factory (an offshoot of a British company) is being erected in the Orange Free State, which will be able to compete with the imported article in almost any part of the Union. The imports of cement from oversea are likely therefore in the course of time to disappear almost entirely from the trade returns of the country.

United Kingdom's Share in General Trade.—Comparing 1913 with 1912, the value of imports from the United Kingdom increased by £119,000, in spite of adverse circumstances, whilst our relative percental position dropped to 54.6 from 58.03, a decline of 3.43 per cent. Comparing 1912 (when our position was a satisfactory one) with 1908, our imports show an increase in value of £7,538,000, and our relative percentage is 1.84 up. The fall in our percentage in 1913, which, of course, implies weakened comparative standing, is not as bad as appears on the surface. The causes producing this loss of ground are temporary, but 1914 will probably again be less favourable for British trade in South Africa; however, I am none the less confident that our relative position will, later on, return to the place it occupied in 1912, with reasonable prospects of further expansion.

Our chief competitors in the South African market are the United States and Germany, with Holland, Belgium and France in the second rank, while Italy, Austria, Switzerland, Sweden, Norway and Japan are also growing competitors in certain directions. Amongst items in which the United Kingdom does the major portion of the trade, but encounters keen or growing competition, may be mentioned:—Mining machinery, iron and steel piping, manufacturing machinery, electric fittings and posts, pumps, cranes, elevators and lifts (all from U.S.A. and Germany); bands and belting, tramway rolling stock (from U.S.A.); telegraph and telephone material (from Sweden); sheet iron and steel girders, beams and columns, and iron and steel fastenings (from U.S.A., Germany, and Belgium). Furthermore, electrical machinery, tramway and railway rails, lamps, are items in which the United Kingdom is actually behind her competitors (viz., Germany and the United States), and should increase her relative shares of the trade.

How to Increase It.—There is no doubt that the vigour of foreign competition arising from the steady expansion of industries in other countries, as well as the growth of nascent industries in the Union itself, is making the task of maintaining our position a more difficult one from year to year. This pressure calls for a more active policy on the part of British manufacturers in perfecting their selling arrangements in this market. An active selling-agent, or direct representative, not only of necessity extends the business of his principals, but his daily contact with the requirements of a market, and his acquired knowledge as to the methods and doings of his competitors, together contribute to keep his home principals alive and progressive.

Seeing that the centre of gravity of this market has to a great extent shifted from London to South Africa, I regard the proper selection and appointment of agents as one of the most vital necessities for strengthening the forces of British trade in its struggle against foreign competition.

* Wyman's, Price 4d.; CD. 7648.

INSTITUTION OF ELECTRICAL ENGINEERS.

The opening meeting of the I.E.E. Scottish Local Section took place in Glasgow on Tuesday, 10th November, when the new president, Mr. James Lowson, delivered his inaugural address, dealing mainly with electrical equipment on board ship. He stated that the use of electricity in steamers was at first confined mainly to electric lighting, electric bells and a few telephones. Ten or fifteen years ago very few motors were in use even on steamers of a fairly large size. A decided advance was made in 1907, when the two express Cunarders *Lusitania* and *Mauretania** were built. In these vessels electricity displaced steam engines for driving the forced draught fans, 16 motors of 50-h.p. being employed for this purpose. Considerations of space and absence of noise and vibration were the main factors in the decision to use electric motors in this case, but in other parts of the ship electric motors and

* **The electrical equipment of the *Mauretania* was described in the Electrical Review of April 3rd, 10th and 17th, 1908.**

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apparatus were used because, in addition to the other advantages, the supply cables could be installed without disfigurement to interior decorations and without risk of causing damage such as would occur at leaky joints in steam pipes.

In all there was on the *Mauretania* a total of 2,133-H.P. independent of the power for lighting. The lifeboat winches were operated electrically, but electricity was not used to any great extent for cooking and heating. In the application of electricity to cooking and heating on board ship, there was still a large field for further extensions, but it would only be overtaken and fruitfully covered by strenuous endeavour and enterprise on the part of the electrical industry. It was hardly surprising that the adoption of electricity for cooking had been comparatively slow. For a long time suitable apparatus was not available; and it had also to be borne in mind that as regarded cooking and heating, electricity had a formidable rival in the abundant supply of steam which was always readily obtainable on board ship. Here again, however, the disadvantages inseparable from steam heating and cooking told in favour of electricity. Where steam was the heating agent on board a large liner 30-H.P. of motors was in continuous use to drive fans for cooling the galleys. On the other hand, the initial cost for electric heating was undoubtedly higher than with rival systems. Over and above the heaters themselves, special cables and additional generating plant had to be provided. The low voltage common on board ship rendered it necessary to use heavier cables for heating circuits, and this meant extra expense. The running cost of electrical apparatus was also higher, as steam could be obtained at a low cost from the boilers, which, as a rule, were situated close to the cabins where the heat was most likely to be wanted. In spite of these objections, the prime considerations of comfort, convenience and æsthetic effect continued to extend the use of electricity for heating, and its universal adoption on board ship was only a matter of time. The steam engine was peculiarly suitable for use in connection with winches as it was able to stand rough usage, and even total immersion in sea water without harm to itself, and it would therefore be a difficult matter to oust it from its present position. The electric winch as at present designed had not the same qualities to recommend it, but it should not be impossible so to improve this winch as to make it preferable on all counts to the steam-driven one, in view of the fact that electric cables had many advantages over steam pipes on board ship. Moreover, on large passenger liners, where forced-draught fans were driven electrically when the ship was not in port, the load factor would be greatly improved by the use of electric power to operate winches, cranes, etc., at times when the forced-draught fans would not be in operation. The advent of motor-driven ships, of course, made the use of electric auxiliaries imperative, and at least one steam-propelled ship, the *Fauvet*, had recently been equipped with a complete set of electric cranes for discharging and loading cargo.

After a reference to the experiment in electric marine propulsion by an equipment on Mr. H. A. Mavor's system, which has been described in the REVIEW, Mr. Lowson went on to speak in detail of the electrical equipment of the *Aquitania*, in which his firm took part. He pointed out that electricity was used even in the preliminary operations of the construction of the vessel. Fourteen electric derrick cranes were erected along both sides of the building berth. These were supplied and erected by Sir Wm. Arrol & Co., Ltd., and were found most serviceable in the building of this leviathan. When the vessel came to be launched the same power was utilised for releasing the triggers of the launching gear, as well as the mechanism for breaking the ceremonial bottle of wine against the side of the ship. The overall dimensions of this vessel were 901 ft. × 97 ft. × 64 ft., and an enormous amount of electric power and appliances was provided in this space. Accommodation had been provided for 3,230 passengers and a crew of 973, making a total of 4,203.

The generators were made by the British Westinghouse Co., and consisted of four 400-KW. 1,500-r.p.m. 225-volt. D.C. turbo-generators with slip rings and static balancers for three-wire distribution. Each turbine was capable of dealing with all loads up to 25 per cent. overload when supplied with steam at 150 lb. per sq. in., and exhausting against a back pressure of 20 lb. per sq. in. absolute. The turbines were of the standard impulse type, having three rotating wheels, each carrying two rows of blades.

The generators were fitted with the Westinghouse radial commutator and ventilated brush-gear. To ventilate these generators air was conveyed in sheet steel ducts from the top deck. The three-wire system had been adopted, using 110 volts between neutral and outers. The main consideration which led to the adoption of this system, apart from the saving of copper on the feeders, was the reduction in the size of commutators in generators and motors; higher efficiency was thus rendered possible; the number of brushes required on each machine was approximately half the number necessary with 110-volt machines, and consequently less attention was required. With radial commutators and carbon brushes the friction was greatly reduced. As electric power-driving of auxiliaries increased, the tendency was towards 440 volts pressure, and with this voltage there should be no greater danger on board ship than there was in land installations if the wiring was of the highest grade and carefully fitted on insulators, as it was on the *Aquitania*.

The main switchboard was 44 ft. long, and was designed for the control of four generators, [illegible] balancers, 10 feeder circuits for li[illegible]cuits for power. For each generat[illegible] breakers of 3,000 amps. capacity, [illegible]ment on the overload release. One [illegible] was also fitted with an adjustable re[illegible]taneously with a reverse current [illegible] addition it could be opened or close[illegible] controlled switch placed on the inst[illegible] board. The breakers could also b[illegible] middle wire feeders were coupled d[illegible] through ammeter shunts, and eac[illegible] nected to its own central zero amm[illegible] coupled through a central zero am[illegible] ance and main switch to earth, an[illegible] parallel with this switch. Normall[illegible] and the installation was run with [illegible] a fault develop, the variable earth[illegible] the contactor was operated by mea[illegible] flexible cord. It was thus possible[illegible] feeder ammeter, make and break [illegible] observe any sudden movement in th[illegible] If the fault was not observed in th[illegible] way switches were changed over t[illegible] the operation was repeated. In [illegible] overloading of the balancers, the po[illegible] were coupled together by connectin[illegible] being tripped simultaneously.

Power was transmitted from th[illegible] number of 220-volt auxiliary switch[illegible] wire auxiliary switchboards for 110[illegible] were placed at different positions [illegible] sides and cross-connecting cables [illegible] event of one section failing the s[illegible] from the other side.

Approximately the total length [illegible] amounted to 135 miles, and of sta[illegible] miles, making in all some 200 miles[illegible] stem to stern. The gross weight o[illegible] tion, was estimated to be about 5[illegible] of copper about 25 tons. The larg[illegible] cross-section, and there were som[illegible] several lengths of .35, .3 and .25[illegible] 90,000 porcelain insulators and 10[illegible] in the work.

With a view to preventing the [illegible] trical causes special precautions h[illegible] mains, sub-mains and branch wir[illegible] woodwork of the ship had been m[illegible] wires and to give easy and rapi[illegible] care was taken to keep all posit[illegible] separate grooves. All main feede[illegible] fixed in small clamped insulators, [illegible] to this the cables were the highes[illegible] Messrs. Henley, and it was confid[illegible] would outlast the life of the vessel[illegible] small extent on the care with wh[illegible] ship were selected and the care ta[illegible] result could only be ensured by e[illegible] wiremen and a staff of trained su[illegible]

The following is a list of the m[illegible] which they are used:—

14	motors aggregating	700-H.P.	f[illegible]
30	,, ,,	479 ,,	[illegible]
17	,, ,,	333 ,,	[illegible]
52	,, ,,	182 ,,	[illegible]
36	,, ,,	205 ,,	[illegible]
5	,, ,,	42.5 ,,	[illegible]
2	,, ,,	60 ,,	[illegible]
4	,, ,,	46 ,,	[illegible]
2	,, ,,	30 ,,	[illegible]
3	,, ,,	22.5 ,,	[illegible]
2	,, ,,	2 ,,	[illegible]
1	,, ,,	8 ,,	[illegible]
1	,, ,,	1.5 ,,	[illegible]
1	,, ,,	131 ,,	[illegible]
1	,, ,,	2 ,,	[illegible]
1	,, ,,	10 ,,	[illegible]
1	,, ,,	7.5 ,,	[illegible]

There were also 10 shore winch[illegible] each. The cables for these motors [illegible] on insulators as previously descri[illegible] exceptions all motors were wound [illegible] to the outers of the three-wire syst[illegible] *Lusitania* and the *Mauretania* it [illegible] the forced-draught fans were few[illegible] siderable increase in H.P. fell to be[illegible] other items.

In regard to lighting, metal fila[illegible] throughout, except in the engin[illegible] stores, and for portable lamps and

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of lamps fitted was close upon 10,000 at 110 volts, the load being as nearly as possible balanced. In addition there were 10 lifeboat lamps placed along each side, lighting the boat deck, and when required these lamps could be inclined outwards to throw light down the ship's sides. These lights were operated by contactors, controlled by switches placed on the bridge. There were also four connections for searchlights of 100 amps. each.

Special attention had been given to the fittings throughout with a view to the rapid removal of glassware for cleaning and for renewal of lamps. The main entrance, writing room, dining saloon and foyer had been fitted with six-light fluted glass dishes, mounted on a novel bayonet fixture, and the glass dishes might be removed in a moment. The lounge had been lighted by "sunflower" fittings of special design together with about 200 linolite lamps around the base of the raised roof in the centre. The well in the dining saloon was lighted by four large dolphin motives in corners, four smaller fittings of similar make in the centre, and two large fittings at floor level, resembling a water fountain, but with an alabaster shell basin filled with lights instead of the ordinary basin and jet of water. These fittings were mainly designed to illuminate the paintings on the ceilings. The smoking-room had lamps of handsome appearance together with linolite lamps in domes. All the second-class rooms were fitted with glass fittings close to the ceiling, giving a very soft lighting effect, and the swimming bath had been fitted in the same manner. One hundred and twenty lanterns were fitted at all entrances, lavatories, offices, etc., and special mention might be made of a novel pattern fitting at all fire-hose boxes.

Many were the devices and appliances for the safety of the ship, and these were all more or less controlled by electricity. To detect any outbreak of fire, the cargo and other holds were fitted with the Rich marine fire-indicating and extinguishing system, and in the passenger accommodation 203 Pearson automatic alarms of the thermostat type and 77 break-glass pushes were fitted. An indicator for both these systems was placed on the bridge. There was an elaborate system of watertight compartments and all the bulkhead doors below and adjacent to the loadline, 44 in number, were of the sliding pattern, and were operated on the Stone-Lloyd system by means of which they could be closed in a few seconds from the bridge, where there was an electrically-controlled indicator. There was a similar indicator at the engine-room starting platform.

Another important fitting on the bridge was Martin's automatic indicator for the navigating lamps. This indicator controlled five lights, each consisting of a duplicate filament lamp, one filament being lighted normally. In the event of this filament failing, the armature of a small electro-magnet, which was in circuit, was released and fell against an auxiliary contact, which completed a circuit through the remaining lamp filament and through the indicator lamp corresponding to the light affected. Attention was also drawn to the occurrence by an electric bell attached to the indicator. The supply for an indicator was connected through a change-over system to either the port or starboard feeder system, thus guarding against a failure in the navigating lights. For communication with other vessels at night two Admiralty Morse signalling lamps had been fitted, one on the masthead and one on the flying bridge. Two electrically-controlled whistles were fitted on the funnels, and these whistles were equipped with an electric time-control on the Willett-Bruce system, whereby they were blown automatically at frequent intervals during foggy weather.

An Evershed patent electric helm indicator showed on the bridge every movement of the rudder and its angular position in degrees. The 2-H.P. motor used on the gyroscope was operated in connection with the instrument for recording oscillations of the ship. A submarine signalling apparatus was fitted, the receivers being placed in a small telephone cabinet on the bridge. Among other interesting appliances there was the Kelvin motor-driven sounding machine which indicated directly in view of the navigating officer the depth of water. In the engine-room there was a device for warning the engineer in case the turbines should revolve in a direction contrary to that ordered from the bridge. A bell rang and a red lamp was lighted if this contrary motion took place. There was also the Kilroy stoking indicator, which automatically notified the stoker by ringing a bell when the boilers were to be fired and indicated the number of the boiler. Nugent's water-level tell-tale was connected to the water tanks for the information of the engineers.

Electric clocks on the Pulsynetic system were fitted throughout the ship, all the dials being controlled by a master clock, placed in the chart room. The means provided in the master clock for automatically advancing and retarding the ship's time, according to the longitude, was substantial and of the simplest description. The battery which gave the propelling force was in duplicate.

Loud-speaking telephones of Messrs. Alfred Graham & Co.'s manufacture were installed throughout the vessel to facilitate the navigation of the ship and the control of main and auxiliary engines. The installation consisted of 18 telephones and was divided into three sections, providing for communication between the following positions:—

1. From upper and lower bridges to forecastle, crow's nest and after wheel-house, the latter position being provided with a two-way change-over switch to connect the after docking-bridge.

2. From upper and lower bridges to starting platform in the engine-room and steering gear and from the latter position to the chief engineer's office.

3. From main engine-room to the chief engineer's office, condenser room, dynamo room, pump room, refrigerator, and steering gear.

On the upper and after docking bridges each instrument was mounted within a polished metal hood secured to a brass pillar, the hood, which was of quite a new design, being arranged so that when open it formed an efficient wind-screen for the telephone. Each of the three systems was supplied with electric energy by a battery of six special large type cells, giving current at a pressure of 9 volts. Twenty-seven intercommunication telephones were installed for the use of the captain, chief engineer, purser, doctor, stewards' department and other officers. It would be remembered that on the *Mauretania* there was a telephone exchange, so that passengers could converse with one another, but owing to passengers not taking full advantage of the service an exchange had not been fitted on the *Aquitania*.

The electric bell system was of an unusual type, specially designed for this vessel by the contractors and manufactured by Messrs. Ross & Co., of Glasgow. The bell pushes numbered about 1,500, and the indicators, while being cockroach proof and embodying all the usual features, were recessed in the walls of the alley-ways and fitted almost flush, the replacement rods being brought up through the slotted oxidised silver plates at the side of the indicator. In the top section a buzzer and a relay were fitted and a two-way switch was fitted marked "Bell and light." When the switch was on the "bell" position the pressing of the push in a state-room dropped the shutter and rang the buzzer in the usual way, but when on the "light" position the current from the primary dropped the shutter and also passed through a relay and closed carbon tip contacts which were on the lighting circuit voltage. This action lighted a specially constructed lamp which was situated in the alley-way immediately opposite the indicator and notified the steward in his room. The lamp was designed with two red bulls' eyes which shone down the alley-way in each direction and indicated to the attendant which particular indicator had been operated, while a third lens in the lamp shone on the indicator and facilitated the location of the room requiring attention. By operating the replacement rod the light was switched off. The comfort and convenience of the passengers had thus been carefully studied so that they would not be disturbed by the ringing of bells during the night.

The emergency generating plant was another of the many precautions now taken to ensure safety. In this vessel a separate circuit of 700 lights was connected to the emergency set and these lights were distributed throughout public rooms and passages on ten decks, so that in the event of the main generating plant failing, sufficient light would be provided to enable passengers and crew to find their way about. The lifeboat lights and deck lights and the wireless apparatus were all connected to this source of supply at times of emergency. Under normal conditions current was supplied from the main generator, and when required from the emergency set by operating a change-over switch. The emergency plant was situated at the after-end of "A" deck, far above the waterline, and consisted of a 45 B.H.P. Diesel engine, manufactured by Messrs. Mirrlees, Bickerton & Day. The engine runs at 450 r.p.m., has three cylinders 8 in. in diar. × 9 in. stroke, and is coupled to a 30-KW. Westinghouse generator. A special switchboard is fitted alongside the plant.

The Marconi installation on the *Aquitania* was of the most powerful and latest type. The wireless station was situated on the boat deck amidships and was designed to provide a working range by day of 650 miles over open water when employed with an aerial having a mean height of 130 ft. The maximum range by night under favourable conditions would be at least twice that by day. The aerial consisted of four parallel wires evenly spaced on ash suspenders and stretched between the masts. The earth connections were of a special design and were of insulated copper connected to convenient points in the hull.

One other interesting innovation on board was two Thornycroft motor boats fitted with Marconi wireless installations by which they could communicate with other vessels when afloat—a valuable provision in time of emergency. The aerial wires were carried on two 25 ft. bamboo masts which could be lowered on to the decks when not in use. The receiving range for these boats was 300 miles.

International Engineering Congress, 1915.—A report having recently been circulated to the effect that the Congress was to be abandoned, the Committee of Management informs us that this is not correct; the Congress will be held in San Francisco as arranged, from September 20th to 25th, 1915. A large majority of the papers originally requested for presentation at the sessions of the Congress and publication in its Transactions will be handed in on time, and the Congress will be truly international in character. A detailed circular of information regarding the publications of the Congress will be sent upon application to the secretary, in the Foxcroft Building, San Francisco, California.

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CABLES.

By C. J. BEAVER, M.I.E.E.

(*Continued from page* 708.)

In fig. 5 the radii of the component parts are shown for cables having one and two inter-sheaths respectively. It will be noticed that the latter starts with an advantage as regards the "radius over the conductor," both being the most economical for the voltages across the first layers at the maximum stress chosen. This initial advantage is somewhat discounted by the radial thickness of the extra inter-sheath, the net result being that the total radius over the complete

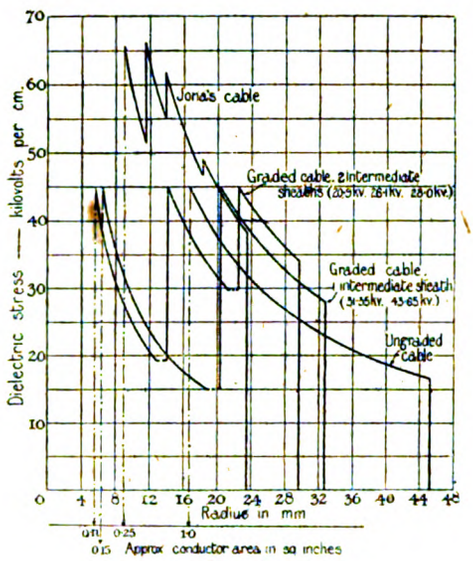


FIG. 5.

dielectric is only 3.2 mm. (⅛ in.) less in the cable having two inter-sheaths than in the cable having one.

The design of the cables with inter-sheaths follows Russell. It is based on a ratio (excluding the thickness of the inter-sheath) of $R/r = 5$, where R is the inner radius of the lead covering, and r is the outer radius of the conductor, and also on a division of the total radial thickness of the dielectric into two and three equal parts respectively for the cables with one or two inter-sheaths. When R/r is less than 5, the range of commercial usefulness of the inter-sheath method of grading begins to approach its limitations. Estimates of the cost of cables show that the lower limit of commercial advantage corresponds with working pressures in the neighbourhood of 50 kilovolts.

Fig. 5 was designed to show one or two other comparisons which may be of interest. The working pressure of 75 kilovolts was chosen because this would appear, from the maximum-stress point of view, to be the highest safe working pressure of the Jona cable. The comparison between Jona's cable and the inter-sheath graded cables is of course only general, owing to the basis of design being different. The further comparison available from the diagram is between these three cables—particularly the inter-sheath graded cables, the basis of design being the same—and an ungraded cable.

The most efficient design would probably be considered to be one inter-sheath for the conditions assumed. Commercial lengths of single cable with the hollow-core conductor previously described and with one intermediate sheath have been made and tested with satisfactory results. The single cables are designed as the members of a 3-phase line, for a working pressure of 100 kilovolts per phase and a breakdown pressure of 250 kilovolts per phase. The maximum stress in the dielectric at the working pressure is 52 kilovolts per cm. Details will be published at a later date. Fig. 6 shows a section of one of the single cables.

In the commercial manufacture of paper-insulated cables a breakdown stress of about 200 kilovolts* per cm. may be regarded as the maximum obtainable in the present state of the industry. For purposes of guaranteed tests, an average safe figure of, say, 120 to 150 kilovolts per cm. may be taken as representing good practice.

The original design of a cable, however, has rather more direct reference to the test pressures than to the working pressure for which it is ultimately to be used; and therefore, as test pressures specified for 50- to 100-kilovolt cables are likely to be of the order of 2½ to 3 times the working pressure, the maximum stress under working conditions will be 40 to 50 kilovolts per cm., or thereabouts. This is a fair practical working limit from another point of view also, namely, that heating due to dielectric hysteresis becomes appreciable at stresses of 60-70 kilovolts per cm. under continuous working conditions, and there are several points of view from which such heating is undesirable in important E.H.T. transmission cables.

The conditions which call for grading appear to be:—

(*a*) Working pressures exceeding 50 kilovolts.
(*b*) Maximum stresses above 60 kilovolts per cm.
(*c*) Where cable diameters would exceed, say, 3 in.

It cannot be too strongly emphasised that, as working pressures get higher and higher, electrostatic effects will be the most prolific source of trouble, and will accordingly have to receive the most minute attention. Reference has already been made to the effect of electrostatic discontinuity in a dielectric and the danger of local potential gradients thereby set up. Another source of trouble of similar character exists at cable ends, and the general principle of tapering off the electrostatic field has to be closely followed in practice in order to prevent deteriorating effects due to static discharges, such as the formation of ozone and oxides of nitrogen and the mechanical dispersion of impregnating media.

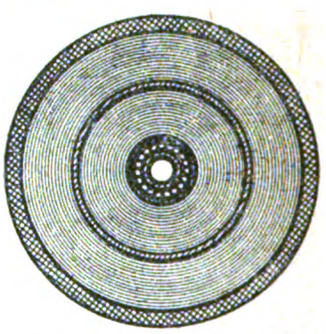
Fig. 7 shows a temporary method of dealing with this trouble during test periods in the cable factory.

The lead sheath is carefully and uniformly expanded radially and a metal tray is soldered on to it. Wax is then poured into the tray and moulded around the dielectric as shown in the illustration. Similar wax moulds are applied where the cores of multicore cables separate, the discharge at the fork being sufficiently intense in some cases to ignite the paper worming used to pad the cores into circular form. At the ends of the cores similar wax mouldings are applied as shown. They give sufficiently good results for the temporary purpose of testing.

For "straight" tests on factory lengths of 20-kilovolt cable (not short lengths or specially treated—heated or mechanically ill-used—samples), 2½ times the working pressure is found by experience to be sufficiently high to satisfy commercial purposes. In 50- to 100-kilovolt cables constructed under higher maximum-stress conditions, it will hardly be permissible for "straight" tests to exceed twice the working pressure.

Under other test conditions, now fairly well standardised for 20-kilovolt cables, which include breakdown tests on lengths of a few yards cut from factory lengths, either left unbent or subjected to mechanical ill-usage tests, or to heating by immersion in boiling water, the breakdown pressure for 20-kilovolt cables is specified to be as high as five times the working pressure. For 50-kilovolt cables the figure should hardly exceed say 3.5, and for 100-kilovolt cables say 2.5 times the working pressure.

The time element in these pressure tests assumes a considerable degree of importance where large thicknesses of dielectric are involved. English cable-practice has always been opposed to anything approaching the "flash test" which is made to serve in other countries, and the dissection of a



		Radial thickness.	Radius.
Conductor.—Inner lead tube—bore 0.27 in.	...	0.060 in.	0.195 in.
Copper wires 19/15 S.W.G.	...	0.072 ,,	0.267 ,,
Outer lead tube	...	0.050 ,,	0.317 ,,
Dielectric.—First paper layer	...	0.545 ,,	0.862 ,,
Lead inter-sheath	...	0.050 ,,	0.912 ,,
Second paper layer	...	0.565 ,,	1.477 ,,
Outer sheath.—Lead covering	...	0.160 ,,	1.637 ,,
Complete diameter	3.27 in.		

FIG. 6.

heavily insulated cable that has broken down under pressure cannot fail to impress on the observer the futility of anything less than, say, half an hour's application of any pressure designed to find weaknesses without overstraining a sound dielectric.

Cables sometimes break down under test near the expiration of the standard half-hour period, and as such breakdowns bear no relation to the dielectric strength of the insulating materials and cannot reasonably be supposed to be absolutely sudden and unpreceded by a development period (in fact, evidence of such development can almost invariably be found), the risk of interrupting the development in an incipient or early stage will be much greater in the case of a very thick dielectric. This is obviously an argument in favour of grading by intermediate sheaths.

In testing joints to destruction at pressures in the neighbourhood of 100 kilovolts, the author has frequently observed radial expansion of the lead sleeve several minutes before the electrostatic voltmeter gave any indication of failure; and in one or two cases the breakdown escaped detection entirely so far as voltmeter indications during the pressure test, and insulation resistance tests made subsequently, were concerned.

* R.M.S. values are referred to throughout the paper.

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It simply happened that the time was too short to complete the breakdown under the particular set of conditions obtaining. These are of course exaggerated cases, because there is a considerable tendency for faults in joints to seal up.

A point worthy of note in connection with the testing of cables having large thicknesses of paper dielectric is the difficulty of determining with certainty whether or not some water has entered through a flaw or damage in the lead covering. The hydraulic test at 100 lb. per square inch reduces the risk,

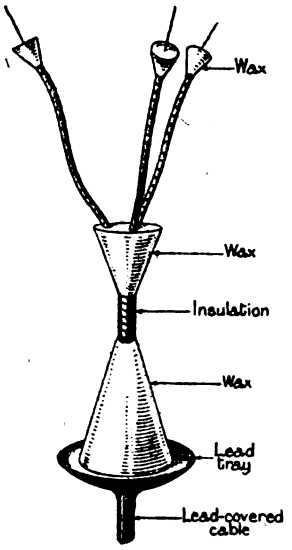

FIG. 7.

but the whole matter is one of degree. An amount of water that would ruin many yards of a low-tension cable will only be distributed among a few of the outer layers in a 500- or 600-mil dielectric, and its path of least resistance will be longitudinal rather than radially inwards. Under these conditions it is a matter of actual experience that electrical tests may entirely fail to indicate the presence of water, and yet it may exist in sufficient amount to cause trouble when it has had time to distribute itself, to say nothing of the possibilities of future breakdown consequent on a flaw escaping undetected in the lead covering.

To obviate this difficulty the author has suggested, and used in many cases during the past two years, a metallic "test sheath," underlying but sufficiently insulated from the lead covering to give an insulation resistance of the order of 50 megohms per mile. Insulation resistance tests between this sheath and the lead covering afford an absolutely reliable proof of the presence or absence of water so far as ingress through the lead sheath is concerned. The test sheath is also useful for maintenance tests, especially on subaqueous high-voltage power cables. Experience shows that immersion in boiling water for half an hour does not on the average appreciably reduce the breakdown voltage.

In the case of bending tests of ordinary severity it depends on the amount of displacement of the layers of paper under the effects of mechanical ill-usage. An average reduction of the breakdown voltage due to these causes may be taken as 15 to 20 per cent. for well-constructed E.H.T. cables.

PAPER-INSULATED CABLES.

The advantages due to the chemical stability of pure manila paper, and the durability resulting therefrom, are offset to some extent in practice by its hygroscopic properties, necessitating careful sealing wherever the dielectric is exposed. No degree of impregnation will render paper waterproof to the extent necessary to comply with the requirements of cables.

In connection with impregnation, there are one or two erroneous impressions which require correction. One is that paper may be "overdried" during cable-making operations; and another is that high insulation resistance is obtained by overheating the dielectric, or in other words is due to manufacturing accidents or imperfections. Even now one occasionally sees modern specifications which state that cables having an insulation resistance of over —— megohms per mile will not be accepted.

Paper contains hygroscopic moisture which can be easily expelled by heat, but not constitutional or chemically combined water, *i.e.*, its vegetable structure consists of celluloses, not cellulose hydrates. Therefore, while paper may be overheated it cannot be overdried. High insulation does not necessarily indicate overheating. It depends, in a well-made paper cable, on the specific insulation resistances of the components (dry paper and compound) and their relative proportions.

The method of impregnating the paper before the latter is applied to the cable not only renders overheating impossible, but ensures the maximum degree of uniformity in manufacture, and consequently in the electrical properties of the cable. Such uniformity has long been recognised to be of considerable moment. It is also important that under working conditions, into which heating of the dielectric will almost invariably enter, the impregnating medium should remain in its original position throughout the life of the cable. For these reasons the author prefers to impregnate the paper in sheet form, before its application to the cable, with a compound which is solid at the ordinary temperature, and at maximum working temperatures remains sufficiently viscous to stay in position, providing sufficient surplus of compound on one side of the paper to ensure ample flexibility in the wall of dielectric and also the filling of interstices between the edges of the convolutions of paper when wrapped on the conductor.

Assuming the use of the best materials, the necessary careful construction, and normal usage, it may be taken for granted that any appreciable deterioration of paper-insulated lead-covered cables will only be due to causes external to the cables themselves.

Troubles traceable to laying conditions are, generally speaking, not common when running conditions are such as correspond to the normal usage above-mentioned, but in the present rapidly expanding state of electricity supply, abnormal usage as regards the loading of cables is fairly common. The maximum safe working temperature of the cable is not the proper basis for determining the permissible loading of cables, and sooner or later expansion and contraction effects will take their toll. A great deal may be done by the provision of suitable arrangements at joints and ends which are fairly free to move; but beyond special procedure in laying bends, and organised methods of laying, comparatively little can be done to provide for these effects in the main parts of cable runs.

Apart from such physical effects as the foregoing, the natural rate of deterioration of insulating materials is appreciably increased by high-temperature conditions, much depending on the material and on the degree of heating. The effect of the type of insulation, form of cable, and method of laying, on the temperature rise in underground cables, has not until recent years been sufficiently appreciated.

In a contribution to the discussion on Messrs. Melsom & Booth's paper the author gave a set of curves showing the approximate relation between various types of insulation and methods of laying or fixing as regards the heating due to I^2R losses, with the object of illustrating the bearing of these variants on the final temperatures. It was shown that the temperature rise varied considerably (about 75° F.) according to the thermal properties of the materials forming, as it were, links in the chain between the conductor and the actual or virtual external boundary of the heated mass of cable, or cable plus conduit, etc., and according to the degree of contact between the components of the chain of materials concerned.

This is a matter of great practical importance, especially as it so happens that the greatest temperature rises—for a given cable—occur in systems of laying in which it is common to group cables closely; for example, in solid and draw-in systems.

The present Institution figures for current density, based on Messrs. Melsom & Booth's work, do not refer to underground cables or to thicknesses of dielectric other than low-tension, and they refer only to single cables. Single paper-insulated lead-covered cables used at considerably higher current densities than those given in the Institution Wiring Rules do not attain such high temperatures as would be found by extrapolation of data obtained at lower current densities.

On the other hand, moderately heavily insulated 3-core paper-insulated, lead-covered cables carry less current for a given temperature rise than would be indicated by calculations from formulæ.

Fig. 8 shows a comparison of the temperature rises obtained from actual tests at various current densities on a 0.1 sq. in. 3-core 30-kilovolt cable under two conditions of laying, with

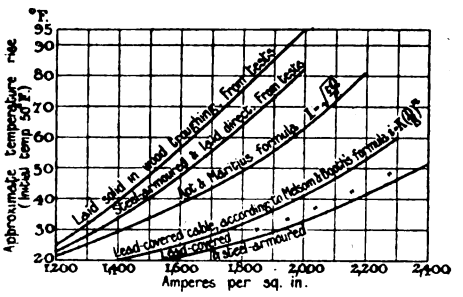

FIG. 8.—0·1-SQ. IN. 3-CORE 30-KILOVOLT CABLE AT VARIOUS CURRENT DENSITIES.

those calculated from the formula due to Apt and Maritius, $I = \sqrt{tQ/e}$ where I is the current in amperes, t the temperature rise in degrees Centigrade, Q the sectional area of the conductor in square millimetres, and e a constant depending on the form in which the cable is made up, namely, twin, 3-core, etc., and also with Messrs. Melsom & Booth's formula, $i = K(D/s)^n$ where i is the current density, D the diameter of the outside covering of the cable, S the sectional area of the total copper, K a constant depending on the temperature rise under consideration and the system of units adopted, and n a constant depending on the slope of the line connecting log i with log D/S.

The temperature rise in the case of the two upper curves

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was not contributed to by dielectric heating, open-circuit tests at the working pressure revealing no temperature rise whatsoever. The wide divergence between actual results and those obtained from the available means of approximately computing temperature rises illustrates the urgent necessity for the research now in progress.

Joints have always constituted the weak spots of networks, although of late years the standard of jointing work has greatly improved. Probably the best results have been obtained where the general principle of making the joint as much like a specially reinforced part of the cable as possible has been consistently followed. One good reason for this is that there is clearly a much better chance of making a lead-sleeve joint watertight on a lead-covered cable than by using a cast-iron box which in many cases depends solely on the compound used for filling it to exclude moisture. The apparently simple process of filling a joint box really contains sufficient pitfalls to make it wonderful that joint troubles are not much more frequent.

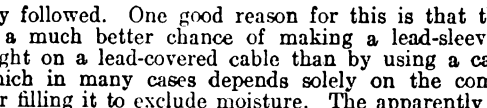

FIG. 9.

At pressures of 50 to 100 kilovolts the necessity for avoiding any concentration of stress and weak paths (or combinations of the two) becomes very marked, so much so that construction which affords an ample margin of safety at working pressures up to 11 kilovolts becomes no longer permissible. The above-mentioned pressures of 50 to 100 kilovolts may be taken for this purpose as representing the margin of safety required at working pressures of 20 to 30 kilovolts.

First, the conductor-jointing ferrules must be designed in bold curves, and they must accurately fit the conductor before sweating. They should be fitted and finished off as shown in fig. 9. The slightest excrescence of solder at the ends of the ferrule is a source of electrical weakness.

Wrappings of tape or paper for the purpose of insulating the copper joint are in the author's experience inadmissible, the chief reason being the risk of electrostatic discontinuity troubles or weak paths between the original insulation of the conductor and the applied wrappings. This risk may be minimised by suitable refinements of workmanship, but under even the best conditions of practical work there is a danger of a combination of electrostatic discontinuity and weak-path troubles. For this reason the author prefers to eliminate as far as possible the element of variable workmanship.

(To be continued.)

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

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22,199. "Electric signals." A. C. BROWN. November 9th.

22,209. "Means of holding diaphragms in gramophone sound boxes, telephone receivers, and the like." E. PATERSON. November 9th.

22,213. "Concentration and cooling of a circulating electrolyte and apparatus therefor." G. G. HEPBURN. November 9th.

22,228. "Time-lag devices for automatic electric switches and cut-outs." A. H. RAILING & A. E. ANGOLD. November 9th.

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22,248. "Transformers." O. IMRAY (Siemens Schuckertwerke G.m.b.H., Germany). November 9th. (Complete.)

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22,261. "Apparatus for electric riveting." F. P. KOBERT. November 9th. (Complete.)

22,265. "Telegraphy." MUIRHEAD & Co., LTD., and G. O. SQUIER. November 9th.

22,270. "Construction and arrangement of self-induction coils for use in duplex telephone systems operating on the Pupin principle." A. H. OLSSON and H. B. M. PLEIJEL. November 9th. (Convention date, November 11th, 1913, Sweden.) (Complete.)

22,280. "Miners' safety hand lamps." A. H. RAILING & A. E. ANGOLD. November 10th.

22,296. "Electric seat indicator." E. SUTTON. November 10th.

22,310. "Electric lamps." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) November 10th.

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22,437. "Arc incandescent lamps." E. A. GIMINGHAM. November 12th.

22,447. "Electric incandescent lamps and them in lamp casings or lantern bodies." H. Divided application on 20,015/14, September

22,456. "Instruments for speaking and BALER. November 13th.

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Vol. LXXV.] CONTENTS: December 4, 1914. [No. 1,932.

	Page
The Cost of the Electric Vehicle...	741
Censorship of Cable Telegrams	742
The Badge of Essential Industry	743
Copper	473
Over-Pressure Protective Gear for High-Tension Circuits, by K. Edgcumbe (*illus.*) (*continued*)	744
New Electrical Devices, Fittings and Plant (*illus.*)	746
Correspondence—	
Willesden Workhouse Supply	748
Trading with the Enemy	748
Re Notes on Modern Continuous-Current Motors ...	748
Legal	748
War Items	750
Business Notes	751
Hackney Electricity Works Extension (*illus.*)	755
Notes	762
City Notes	764
Stocks and Shares	766
Metal Market—Fluctuations in November	767
Institution of Electrical Engineers (*illus.*)	767
Cables, by C. J. Beaver (*illus.*) (*continued*)	768
Notes from Canada	771
Foreign and Colonial Tariffs on Electrical Goods	772
New Patents Applied For, 1914	772
Abstracts of Published Specifications	772
Contractors' Column ... ... Advertisement page xx	

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THE COST OF THE ELECTRIC VEHICLE.

AT the recent Annual Convention of the Electric Vehicle Association of America, judging from the abridged reports of the meetings, one point which cropped up rather persistently was the first cost of the electric vehicle. We have not previously noticed that our American friends have had much to say on the subject of high first cost, but this feature of the "electric" has by no means passed unnoticed here, where the limited demand up to the present for such vehicles may, to some extent, be said to have justified the prices charged.

President Smith—who is a central-station man—pointed out that a number of manufacturers had given serious thought to the development of a moderately priced delivery wagon, and one important manufacturer had exhibited at New York, in October, a 750-lb. delivery wagon to cost £175. He considered that there was unquestionably a great opportunity for a large volume of commercial vehicle business in the field occupied by the small buyer, and that this had not been developed to any extent, and should have the attention of all concerned. He held that the passenger "electric" was not necessarily in competition with the lower-priced motor vehicles of other types, and output was the controlling factor with which the manufacturer had to contend. This was due to the nature of the present popular type of electric vehicle—the enclosed coupé or brougham, with its battery, motor, controller, expensive body, &c.

The solution to the problem of introducing and successfully marketing a low-priced electric car was increased output, and if doubling or trebling the present output would produce costs which would permit of competition with lower-priced vehicles, there should be manufacturers both with capital and courage to seek these lower costs. There would always continue to be a market for the exclusive and luxurious car, and this field was well covered.

These remarks show that even in the States, where the electric vehicle business is in an advanced stage of development, and manufacturers are eager to take up immediately any proposition which will ultimately advance their interests, there has so far been no marked movement by vehicle makers to cater for low-priced vehicle users.

It is true that the demand for such a car has been recognised; there have, for instance, been various reports as to the appearance of a cheap Ford electric car, in the design of which Edison was to be associated, and it is now stated that a low-priced "Edison-Ford" vehicle, consisting of a modified Ford petrol chassis fitted with a new type of light Edison battery, will be on sale next year. But the remarks made in the discussions on the various papers clearly indicate that our American friends, who are in the best position to judge, hold very undecided opinions as to the feasibility of turning out a low-priced electric car which will be a practical success.

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One speaker pointed out that the average price paid for an electric vehicle was £520; another stated that the individual cost of 70 per cent. of the passenger gasoline cars was under £400, while the cost of 85 per cent. of the electric cars was in excess of that amount, and added the opinion that a car capable of running 50 miles on a charge and selling at about £140 was needed by the industry. Others denied that there was any demand for a car at this figure, on the ground that its low cost necessarily implied limited battery capacity and mileage, while it was further urged that talking of the low-priced "electric" created an impression that such a car would soon be available, and was harmful to the industry.

Mr. Geo. H. Kelly, who read a paper on "The Cost of Electric Vehicles," pointed out that the total electric vehicle sales were comparatively small, and that they fluctuated to such an extent that it was impossible to anticipate production, and for this reason it was difficult to produce a low-priced car, although, he added, passenger cars made to sell at £240 to £400 had never been a success. He considered that, contrary to the popular impression, the actual cost of selling electric cars was about half of that for selling petrol cars, so that the reasons for the high price of the electric passenger car were the high grade of material used and the expert workmanship necessary.

Mr. H. H. Doering, in a paper on electric vehicle manufacture, also had something to say on this subject. In his opinion, the time of cheap electric vehicles had come and gone, and manufacturers were meeting the demand of the public, which was for a heavy, luxurious, high-speed car. Quality set the price, and the "electric" was built to last, unlike the—presumably, American—petrol car. Mr. Doering pointed out that the largest manufacturer of electric passenger cars had an output of less than 1,500 cars a year, and the six next largest manufacturers had an output each of less than 1,000 cars a year, and this limited output rendered it impossible to lower the price. He added that the cheap "electric" failed because the battery capacity was insufficient, the speed too low, and the appearance objectionable, thus repeating opinions expressed by another speaker at an early stage of the meeting in an address entitled, "An Answer to Dr. Steinmetz," who, it may be remembered, recently advanced the view that the requirements of the future electric car were moderate speed and radius, and a price not exceeding £100 (see Elec. Rev., October 16th last, page 542).

Nevertheless, there were speakers who favoured the view that a moderately priced vehicle was wanted, and was within the scope of manufacturing to-day. On the whole, we should imagine that the arguments against the idea of a cheaper vehicle proved unconvincing to all except, possibly, vehicle manufacturers.

The suggestion, for instance, that the high price of the "electric" was due to the high grade of material used and expert workmanship necessary, cannot be reconciled with the fact that the far more complex petrol car, with its admittedly excellent workmanship and reliability, can be purchased for less money.

Even the argument as to limited output is lacking in effect, chassis building, battery construction, and motor and controller manufacture being all well developed businesses at the present time carried on by long established firms, whose experience and expert methods of production are available for the electric vehicle maker, and should by comparison with the earlier difficulties of automobile builders make his task really simple.

Indeed, amongst the talking points of the "electric" are its extreme simplicity and the fact that constructively it merely consists of parts which have been tried and tested on a large scale in other directions for years, and the average purchaser may be pardoned for failing to reconcile these features with high price.

In this connection our American friends may remember the saying of one of themselves that: "You can fool some of the people all of the time, and all of the people some of the time, but not all of the people all of the time."

Business men the world over are mostly of the hard-headed variety, and to some of them the admitted advantages of the electric vehicle are worth the price asked—to be more precise, the owners of less than 3 per cent. of the total registration in July, 1914, of vehicles in the States considered it worth while to pay the price, and this in the home of the "electric," where, according to President Smith, 98 per cent. of the automobile requirements can be taken care of by the electric vehicle absolutely.

No wonder that our American friends find the question of cheapening the first cost of the electric vehicle "some problem."

Censorship of Cable Telegrams.

In the last issue of the *Electrician* an extraordinary article appeared, in which we were made the subject of a bitter attack, couched in terms which transgressed the limits of good manners and verged upon abuse. The latter we shall pass over without further comment, but we cannot permit our contemporary's other remarks to remain unanswered.

The "short point" of the indictment brought against us is that in reproving the Commercial Cable Co. for objecting to the censorship of the U.S. Government we travelled beyond our "appointed field," and it is further suggested that in doing so we were endeavouring "to wipe off some old score." Regarding the innuendo thus conveyed, we may state at once and emphatically that we never had any "old score" to wipe off against the company, towards which we cherish no hostility whatever, and we are at a loss to imagine what gave rise to so unworthy a suggestion; moreover, we should scorn to permit our personal feelings to sway our judgment in such a matter. Our sole purpose in protesting against the action of the company was to serve the interests of our own country, which we considered likely to be prejudiced by such action. We are not concerned to justify our course in the eyes of our contemporary, which is welcome to its own opinion, but we are astonished that it should presume to define the limits of what it describes as our "appointed field." Harping on the phrase "electro-technical journal," our contemporary advances the proposition that such journals must confine their attention to matters of purely technical interest—apparently oblivious of the fact that its own columns exhibit numerous breaches of this novel regulation, and, in fact, the very next leaderette to the one we quote from treats of "Trading with the Enemy"!

We have never pretended to confine our attention to electrotechnical affairs, or to any other watertight compartment; we choose to survey the whole field of trade and industry associated with electrical engineering, and it is for us alone—with the good-will of our readers—to set bounds to that field.

We may add that we do not object to criticism, provided that it is sincere; but we do not accept as such that of our contemporary in this instance.

The relations of that journal to the telegraph companies are well known. We may point out that our leaderette was published on October 16th; 14 days afterwards we received a letter from the London manager of the company, which we published on November 6th, together with a note in reply, repeating our protest. The attack upon us in the *Electrician* appeared on November 27th—after an interval of three weeks.

The head office of the company is in New York, whence all important transactions are directed. The conclusion is obvious.

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The Badge of Essential Industry.

It is to be feared that the public do not as yet generally realise that it is necessary for large numbers of workmen to be retained at home in order to keep our factories running. Reports from all parts of the country go to show that notwithstanding Lord Kitchener's statements and attitude toward industry, such men are being taunted for not having answered the call for recruits. It is not unnatural that the workmen should resent such taunts, and there is a growing demand for some form of badge that may be worn in order to indicate that the wearer is serving his country in this critical time just as much as the man in uniform. That this is the view of those at the head of our Admiralty and War Offices is shown by the official letters that have been sent to all firms and companies engaged on the production of materials for those departments. Thus, from the War Office, Lord Kitchener has sent out a letter, in which he says :—

I wish you to impress upon those employed by your firm the importance of the Government work upon which they are engaged. I fully appreciate the efforts which the employés are making and the quality of the work turned out, and I trust that everything will be done to assist the military authorities by pushing on all orders as rapidly as possible. I should like all engaged by your firm to know that it is fully recognised that they, in carrying out the work of providing the Army with supplies and equipment, are doing their duty for the King and Country equally with those who have joined the Army for active service in the field.

On behalf of the Navy, also, Mr. Churchill, in the House of Commons the other day, stated that "the Admiralty had been aided by the energy and determination of the workmen, who had strained their strength to the utmost, and who had by so doing made themselves the comrades of their fellow citizens who were fighting in the trenches."

In some departments of the iron and steel, engineering and other industries which are of first importance to the nation at the present time, there is already a marked scarcity of skilled labour, and while demands are so heavy from our own and our Allies' Governments, we might at least exercise a little discrimination in levelling our taunts of indifference.

In order to meet the wishes of their employés, so that they may be in a position to produce evidence to rebut any taunts as to their non-enlistment, quite a number of firms connected with the engineering industries, including, we believe, some associated with electrical engineering, have gone to the extent of issuing cards bearing on the back a copy of Lord Kitchener's letter, and, on the front, a reproduction in colours of the British flag, the name of the firm, and the words :—"Mr. —— is serving his country by using his best endeavours and work in connection with the manufacture of —— for the British Government." While such cards are useful to a certain degree, they only partially meet the requirements of the case, and it is suggested to us that the War Office and the Admiralty should undertake the issue of an official badge which workmen employed on the production of material for the Government can wear on their coats or caps, and so give an outward sign to the general public that, although not wearing khaki, they are none the less serving their Country.

It would, of course, be a matter for the Government authorities to decide whether such a badge should be uniform for all branches of industry or whether a special one should be prepared for each particular trade. So great is the need of such outward sign of public service felt in many quarters, that several firms connected with the motor and aviation industries, have, we hear, in addition to cards of the kind alluded to above, issued badges to their employés on the lines suggested.

Since the foregoing was written we have read in an evening newspaper that in Newcastle something like 30,000 men employed in factories are wearing such badges as are referred to above, with the permission of the War Office.

Copper.

The last few weeks have witnessed something like a transformation scene in the Copper market, and whereas a little while ago the future appeared to be steeped in gloom, the tone has become strong with active buying, and prices have moved up regularly day after day. The demand for the metal certainly underwent a notable expansion on both sides of the Atlantic, and holders were able to exact considerably improved prices.

The reopening of the London Metal Exchange to normal trading was, undoubtedly, a highly important contributory factor in the restoration of more usual conditions in the speculative and consuming trades. As regards the former, it is really wonderful how well the standard market held itself together under the absence of all interest on the part of the Continent, which, in times of peace, has been the great stand-by of brokers. As it is, the practical elimination of speculation on the part of the Continent has been scarcely felt, and the entire business passing has been on account of the home and American trades. It speaks well for the market that things should have so far reassumed their normal appearance at a time when the nations of the world were still struggling for the death grip.

Germany will, of course, be smashed for a generation or more, and the opportunities thereby presented to the other European industrial nations will not be lost sight of. Already energetic efforts are being made to extend the trade of British manufacturers in all kinds of metal goods, and there is little doubt that these efforts will be crowned by success. Belgium will rise as a phœnix, too, from the ashes of Termonde, Louvain and the rest of the ruined cities, and the consumption of the metals necessary to repair the havoc will give such an impetus to industry as has never been known in the history of the world. It is no use being too bearish on metals. Intrinsically they are not dear at present prices, and the possibilities are great. America at last seems to have turned the corner, and it needs only a very moderate improvement across the Atlantic to put a different complexion upon the markets as a whole.

There are distinct signs of betterment in the United States, and if these extend further almost anything might happen in the metal market. It is most reassuring that railway electrification schemes in the United States have not been summarily suspended owing to the unfavourable financial and industrial conditions ruling lately. The St. Paul Railway, for instance, has just let a contract for two million dollars' worth of electrification work to the General Electric Co., and this is only a portion of a contract for a 15-million dollar job, covering the electrification of the 430 miles of main track over the Rocky Mountains and Bitter Root divisions of the railway. It is very evident that a keen look-out must be kept upon electrification developments across the Atlantic. As regards Europe, the war demands for copper are, of course, enormous, but so far as the United Kingdom is concerned, the authorities have a good deal of the metal on hand, in the shape of copper seized as contraband, at various ports, notably, Gibraltar and Ardrossan. This metal is quite enough to enable us to go on comfortably for a few months, while apart from this we have the resources of the world at our disposal, whereas Germany must do the best she can with old metal and with what can be produced by her domestic mines, which last year produced about 25,000 tons. This does not go far. While the tendency of the market has been very firm with continued buying, there has been a slackening of prices within the last few days, which is nothing more than a natural reaction following upon the supplying of consumers' needs. Fundamentally, the position is quite satisfactory, but prices should not advance far because production is restricted by about 50 per cent., and when the time is ripe mines and smelters will be set to work at an increased rate.

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OVER-PRESSURE PROTECTIVE GEAR FOR HIGH-TENSION CIRCUITS.

By KENELM EDGCUMBE, M.Inst.C.E.

(*Continued from page* 714.)

It is clear that neither the choking coil nor the condenser can alter the maximum value of the surge P.D. but only its form, and therefore a pressure limiting discharge gap (see next section) is essential. It is also advisable to take precautions as regards the insulation of the end turns of all machines and transformers connected to the line. If this is done, protection by means of discharge gaps and choking coils will be found to meet all possible requirements, and is almost exclusively used in the United States where the atmospheric conditions are exceptionally severe (see electrolytic arresters, below).

As to the best form of discharge gap to adopt, this question is more fully discussed when dealing with protective gear for internal disturbances and it is shown that, all things considered, the horn discharger probably best fulfils the requirements, so that for the moment it will be assumed that this is the form of gap adopted.

Limiting of Damping Resistances.

Since any gap has a negligibly small resistance when discharging, it thus represents nearly a dead earth on the system, and consequently it is essential to insert a resistance in series with it. Such resistances, which are often spoken of as damping resistances, may take any of the following forms:—

1. Wire resistance immersed in oil.
2. Liquid resistance.
3. The aluminium cell (electrolytic arrester).
4. Carborundum rod resistance.
5. Carbon or carborundum powder resistance.

The oil-cooled wire resistance is somewhat expensive, and it must be borne in mind that when subjected to discharges the oil is continually getting hotter, so that although such a resistance has a fairly large heat capacity, with a prolonged discharge the oil runs a very great risk of being ignited and so starting a serious conflagration. Attempts have been made to minimise this danger by fitting a fuse or thermal relay, so arranged that if the temperature of the oil rises above a certain value the circuit is broken. Apart from the complication of such an arrangement it is obvious that so long as a current is flowing through the resistance it is performing a useful function, and to cut it out of circuit at such a time is to leave the line unprotected at a critical moment. A discharge resistance to be satisfactory should be practically indestructible even under prolonged discharges.

The liquid resistance is superior in this respect but has numerous defects of its own. It is messy, requires considerable attention if it is to be kept in good order, and unless carefully looked after is a source of danger. Should impurities find their way into the solution the resistance falls enormously, and it is always indefinite. If the discharge is of long duration the liquid will boil, emitting steam, which is deleterious and eventually breaks the circuit. Solutions of sodium carbonate or hydroxide (caustic soda) are usually employed for such resistances.

The aluminium cell, or electrolytic arrester, as it is usually called, deserves more serious consideration since it is so largely used in America, although in this country and on the Continent it has found but little favour. Fig. 6 shows such an arrester in section. It consists of a number of aluminium cones threaded one over the other with a small space between each, on insulating rods, the whole being immersed in oil. Into each cone is poured a small quantity of electrolyte, so that the p
ber of aluminium cells connected
well know that if a plate of alumin
anode of an electrolytic cell a fi
will form and practically no current
sequently, if both anode and
aluminium and are subjected to ar
rent, the hydroxide will form on
only a very small current will pass
ever, as the voltage at the termina
exceeds a critical value of say 3
breaks down and the resistance fa
electrolyte alone. In practice the
is so chosen that at normal voltag
tial difference of about 300 volts
P.D., owing to abnormal circumsta
the critical value the film break
energy is discharged to earth.

Unfortunately for the simplicit
the continual passage of even t
taken at 300 volts per cell cau
gradual dissolution of the plates,
the circuit is essential, and for thi
gap is used. A further complic
the fact that when the cells are c
the line in this way the film gradu
and the cells become useless. To
necessary to " charge " them for
by connecting to the line. This i
short-circuiting the horn gap by a
tached to an insulator. This ch
must be performed daily, and altl
occupy much time it is nevertheles
tion in the case of a widely scatte

From what has been said it wi
soon as the film has broken down
the resistance to earth is extreme
fact only that of a comparatively
electrolyte. As a result, what a
a dead earth is thrown on the li
this may occasionally be justified
the disturbance to be dealt with, i
not, and the arrangement shown
sequently, employed. In this figu

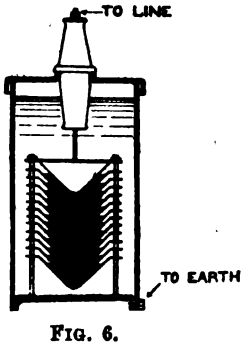

Fig. 6.

present horn gaps, H^1 being set
H^2. As soon as H^1 sparks ove
small current flows to earth th
undum rod resistance C.R. If
still, the gap H^2 breaks down a
earthed through the aluminium
danger with this arrangement is
ance (see below) is liable to br
warning and thereby to open-cir
horn, thus leaving the line u
against exceptionally severe ove
moreover, difficult to tell from a
rod that such a breakdown has o

An advantage claimed for the
is that it does not act merely as
ance but, itself, breaks the circui
in much the same way as does a
severe disturbance almost always
than this, however, the advanta
seem to be small. On the ve
transmissions which are commo

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aluminium arrester has performed useful service, and if well looked after it is valuable in such cases, but for any other purposes has less to recommend it.

The carbon or carborundum rod resistance which has already been alluded to was at one time largely used, particularly in America, but is useless for any except quite moderate discharges. Owing to its small heat capacity anything like a heavy discharge causes overheating and partial disintegration. This is followed by still further local overheating until in a short time the circuit is opened altogether. Unfortunately there is no external evidence to show that this has happened, so that no reliance can be placed on such resistances.

Carbon or carborundum powder resistances.—The powder used consists of carborundum or carbon mixed with some insulating material such as powdered fire-clay. As usually constructed, the powder is placed in a vertical stoneware pipe having contacts at top and bottom, the former being connected through a discharge gap to the line and the latter direct to earth. The drawback to such a resistance is that with continual heating and cooling due to discharges the weight of the powder causes it to settle down into a more or less compact mass. the ohmic resistance continually decreasing so that no definite value is adhered to.

In the *Brazil carbon powder resistance* on the other hand the vertical construction has been abandoned altogether, in favour of a horizontal fire-clay slab having a suitably shaped groove which is filled

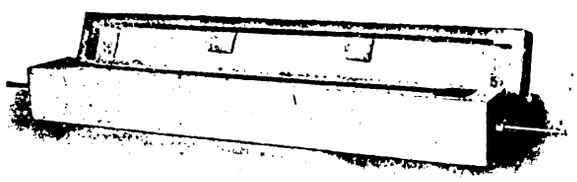

Fig. 8.

with the special carbon powder. Fig. 8 shows such a resistance. It consists of a long narrow fire-clay trough with carbon terminal blocks at each end into which are fixed connecting rods provided with clamping nuts. A cover, also of fire-proof material, protects the powder from disturbance.

Such resistances being constructed entirely of fire-resisting material will carry heavy or prolonged discharges without danger, and will, moreover, maintain a resistance which may be regarded as constant for all practical purposes. Fuller details of the Brazil resistances are given later in connection with resistances for dealing with internal over-pressure discharges.

Over-pressures due to Internal Disturbances.

The origin of such over-pressures was very fully dealt with by Mr. Duddell in his presidential address and a brief reference here will suffice. The main causes of these disturbances are:—

1. *Resonance.*—It can be shown that for resonance to occur in the case of an alternator feeding a cable the capacity current of the cable must be equal to the short-circuit current of the alternator. Since the latter will be some 2½ times that corresponding to full load, it will be seen that resonance in such a case is practically impossible. At the same time resonance with a 3rd or higher harmonic is shown by Mr. Duddell to be quite possible. Petersen has further pointed out (*E.T.Z.*, Vol. 25, p. 626, 1914) that if a 3-phase generator is shorted on one phase, harmonics are produced between the healthy phases, having amplitudes of sometimes as much as 50 per cent. of the fundamental, so that very serious resonance may occur even although the circuit is considerably "out of tune." An earth on one phase will have the same effect. Again, Mr. Duddell has shown that in the case of transformers or other plant fed through long cables resonance with the fundamental wave often occurs. Thus, even with the excellent wave forms given by modern machines, protective gear for dealing with resonance is essential.

2. *Switching operations, including sudden changes of load.*—A change in the load conditions at any point must inevitably be followed by a re-adjustment throughout the whole system. Whether this readjustment is attended by untoward results or not depends upon the magnitude of the change and the conditions under which it takes place, and Mr. Duddell has shown that there are a number of cases in which very dangerous pressure rises are caused in this way.

When, for example, an inductive circuit (*e.g.*, a transformer or motor) is suddenly switched in, a concentration of potential on the end turns occurs in precisely the same way as that described when dealing with overhead atmospheric surges, and much damage to transformers and generators has been caused in this way. If, on the other hand, an inductive circuit is suddenly broken it is well known that a very considerable rise of pressure occurs. When, again, a capacity is suddenly switched in a rise of pressure will follow owing to its being "over-charged." This has been the cause of many cable breakdowns, and is sometimes avoided by means of so-called cable charging resistances. A similar rise may occur on an overhead line where the wave is reflected by the open end of the line. In both cases the rise may be very much increased by a chattering of the switch contacts. In fact. should the second contact occur at the peak of the wave, a rise to nearly four times the normal may ensue.

A still more serious rise may occur when a circuit, consisting of capacity and self-induction in parallel, is broken. Such a circuit may be formed by the generator winding and the capacity of a cable, which is suddenly opened at the further end. Fig. 9 illustrates this, G.W. representing the winding of a generator (for simplicity assumed to be single phase), C the capacity of the cable, and B

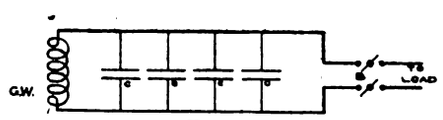

Fig. 9.

a breaker controlling the load. Should this breaker open while a heavy current is flowing the energy stored in the self-induction of the generator winding is transferred to the capacity of the cable. In order that the latter may absorb all the energy its terminal voltage must necessarily rise very considerably above the normal. The capacity having been charged in this way will again discharge through the self-induction, the process repeating itself until the energy has been dissipated in heat.

Still another cause of rises in pressure in an unloaded line is the Ferranti effect. In this case a wave travelling along a line is reflected at the open end, and sent back along the line, the length of which is such that it reaches the generator end exactly half a period later. At this instant the generator is ready to re-dispatch it, with changed sign, to the far end where it is again reflected and the process repeated, thus building up a pressure at the far end, the maximum value of which would be unlimited but for the losses involved.

3. *Faults* whether between lines or to earth give rise to over-pressures of a similar nature to those just mentioned, with this difference—that while in switching operations precautions can be taken to minimise the disturbances, in the case of a fault not only are no such measures possible but the magni-

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tude of the current to be dealt with is usually greater; moreover the arc which accompanies a fault has great instability, and by the suddenness with which the circuit is broken, enormously increases the severity of the resulting over-pressure. It was shown by Mr. Duddell that the instability of such an arc is much augmented if shunted by a capacity—a condition often fulfilled in practice owing to the capacity of the cable on either side of the fault.

The sudden breaking of the fault current in this way is almost the same in its effects as the sudden release of the "bound" atmospheric charge illustrated in figs. 1 and 3. That is to say, a steep-fronted wave rushes along the line in both directions with a velocity approaching that of light and is accompanied not only by a rise of pressure when reflected, but causes serious trouble through the breakdown of the end turns of windings in the manner already dealt with (see fig. 4).

Again, on an insulated system, an earth fault will for some time give a sparking earth with the result that oscillations accompanied by a serious rise of pressure will take place in the circuit formed by the capacity of the line and the self-induction of the generator or transformer feeding it.

(To be continued.)

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Ediswan Door Heater.

One of the most prolific sources of cold draughts is the space under the average door, from which a current of cold air usually sweeps across the floor.

A most ingenious patented arrangement has now been introduced by the Edison & Swan United Electric Light Co., of Ponder's End, Middlesex, which should go a long way to remedy this

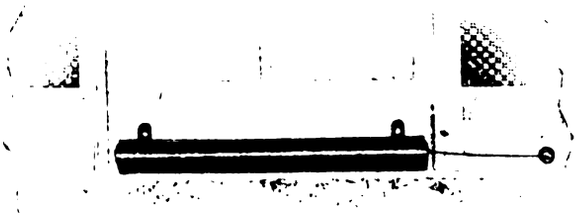

Fig. 1.—Heater attached to Door.

very usual trouble. It consists of an electric heater which is attached to the lower edge of the door, and thus warms up the air entering beneath the latter. The heater contains four Ediswan Quartzalite elements; these are coupled by flexible to an adjacent plug and socket on the wainscoting, and an automatic switch can

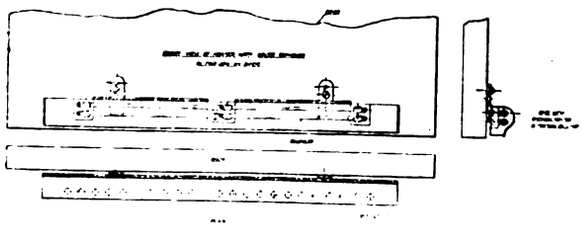

Fig. 2.—Details of Door Heater.

be provided to cut off the current when the door is opened. The heater is attached by two screws, and can be supplied for letting into the bottom of the door flush with the front surface. Fig. 2 explains the method of installation.

The "Linisher" Surface Grinder.

Messrs. Robt. H. Lash, of 31, Carburton Street, W., send us particulars of the "Linisher" patent surface grinding machine, which follows generally on the lines of one or two machines already described in these columns.

The "Linisher" consists of an endless grinding band driven by a pulley at one end and provided with a tension pulley underneath to take up slackness. Special bands are supplied woven in one continuous piece, and the upper half of the band runs over a

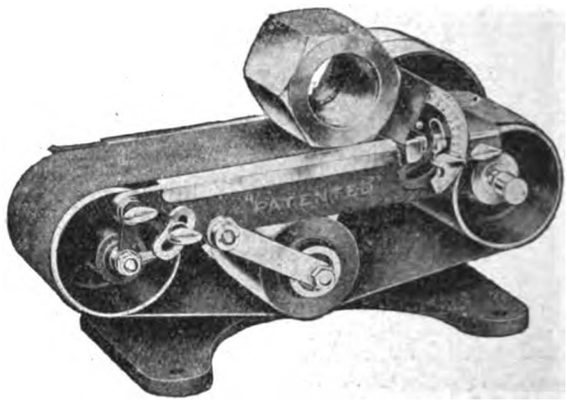

Fig. 3.—Linisher Surface Grinder.

machine ground table, which can be adjusted laterally while running, so that the band runs on the centre of the table or the extreme edge—the latter position being valuable for polishing up to corners.

Patent quadrants are fitted to enable the pulley centres to be adjusted to allow for unequal stretch of bands, and a graduated adjustable grinding rest (patented) is fitted to enable the unskilled operator to grind work accurately at any required angle. Fig. 3 illustrates the machine, type A, which is fitted with a table of about 10 in. × 5½ in., and weighs 56 lb. Large machines are also supplied.

Simplex Watertight Lampholder.

We illustrate in fig. 4 a galvanised watertight lampholder which has been introduced by Messrs. Simplex Conduits, Ltd., of 116, Charing Cross Road, W.C. The holder is substantially built and provided with a drainage lip which effectually carries the drip

Fig. 4.—Simplex Watertight Lampholder.

water clear of the lampholder shell; the length of thread has been increased to about ⅝ in., and on the shade-carrier pattern an improved method of attaching the shade has been incorporated. The figure shows the plain pattern. The holder is particularly adapted for use in exposed situations.

Belling Griller-Boiler.

Messrs. Belling & Co., of Derby Road, Edmonton, are introducing a new griller-boiler, which we illustrate in fig. 5. This is built up in cast-iron with hinged back and front doors to allow of easy cleaning, and is fitted with a drip tin and grid. The griller is heated by four standard Belling fire-bars (2-kw. loading)

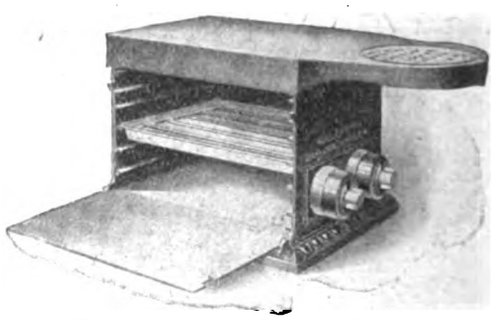

Fig. 5.—Belling Griller-Boiler.

with three-heat control, the "low" position being for use when the griller is closed up and used as an oven. The griller oven measures 12½ in. × 8½ in. × 7½ in. high.

The boiling ring is loaded with 1½ kw. with three heats; it is 6 in. in diameter and fitted with redhot elements. The apparatus is

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claimed to be a complete breakfast cooker—an electrical duplicate of a most successful gas appliance. It will boil the kettle on the ring, and heat plates, milk, porridge, &c., on the top of the grill while the bacon and toast are being cooked inside.

A New Mining Switch.

Messrs. Scholey & Co., Ltd., of 151, Queen Victoria Street, E.C., have lately put on the market the Scholey-Cantie gravity combined switch and fuse, which possesses some interesting features. It is simple and reliable, having no delicate or flimsy parts. The contacts are mounted on an insulated base which slides on two vertical rods; at the top and bottom of these rods are springs, the action being such that when the switch is opened the top springs accelerate the movement of the contacts as they fall by gravity to the off position, the two bottom springs acting as a buffer. The break and make are instantaneous. The handle operates the sliding contacts through a toggle joint, the action being rapid and positive. The switch is fool-proof, it being impossible to open the cover unless the switch is at the off position, or to close the cover if the switch is at the on position.

Fig. 6.—Scholey-Cantie Combined Switch and Fuse.

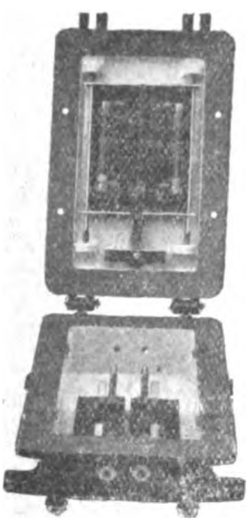

Fig. 7.—Switch Case Open; Switch in the "On" position.

Enclosed fuses are used; the leading-in cables pass straight to the terminals. The switch is enclosed in a flame-proof iron case with wide flanges.

Electric Cooking at the Brighton Royal Pavilion.

As many of our readers are aware, the celebrated Royal Pavilion, at Brighton, has been taken over by the War Office authorities for the accommodation of wounded soldiers, and already over a hundred of our Indian troops are being treated in the Dome, which has been converted into a temporary hospital.

The Royal Pavilion was erected by King George IV when Prince of Wales, between the years 1784 and 1787, and was used by him and his successors as a marine residence until 1850, when it was purchased by the Brighton Town Commissioners. It has since been the venue of numerous public and private functions.

The new plant which has been installed for the Corporation under the supervision of Mr. John Christie, the borough electrical engineer, was supplied by the Carron Company, of 15, Upper Thames Street, E.C., and consists of one range with two roasting and baking ovens, each 20 in. wide, and one 40 in. wide × 18 in. deep and 24 in. high inside; these are heat-insulated and lined with porcelain-enamelled steel sheets. Each oven is fitted with hinged shelf racks, grids, sheet-iron drip tray and meat hook, all removable for cleaning.

The heating elements fitted at top and bottom are mounted in cast-iron frames, removable by simply sliding out, the contact being automatically made at the back well away from the heat of the oven.

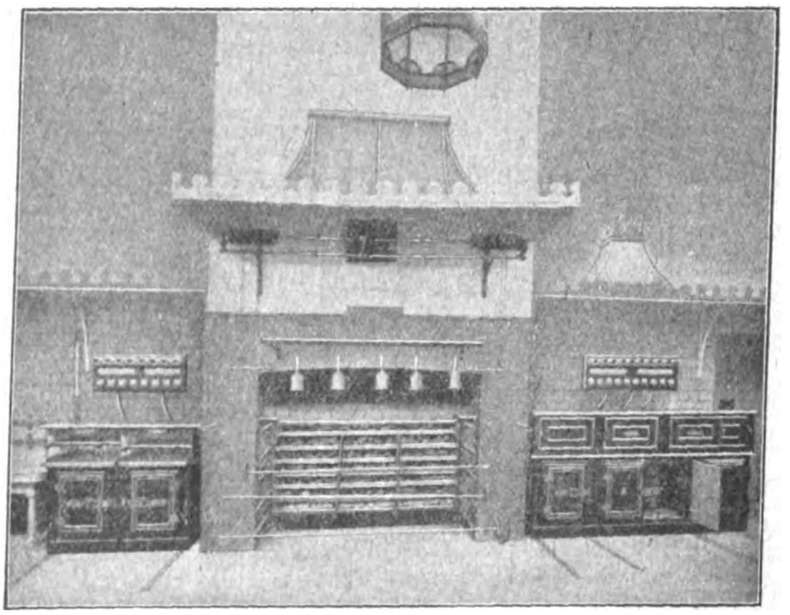

Fig. 8.—Carron Ovens, on either side of Coal Fire.

This type of element greatly facilitates cleaning, while the wiring is carried in cast-iron channels clear of the oven to main terminal boxes mounted on the back of the ovens. Each element (top and bottom) is wired for series-parallel control, so that the smaller oven has six ranges of current consumption and the larger one 12.

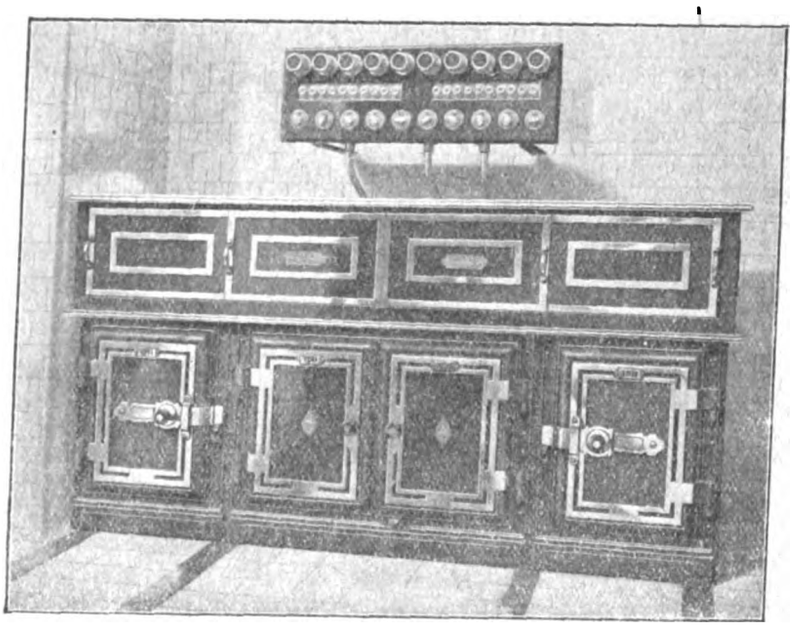

Fig. 9.—Range of Carron Ovens.

The top heat gives excellent results with pastry.

Over the oven is a hot closet with sliding doors, subdivided in the centre, and each half separately heated and wired for series-parallel control.

A switchboard is provided, fitted with indicating rotary series-parallel switches, Zed fuses to each pole and a pilot light to each circuit—a marked ruby disk showing which circuit is in use. The loading of each oven is 3,500 watts, and of each half of the hot closet 1,000 watts, giving a total of 16 kw. The approximate overall length of the range is 8 ft. 6 in., and its height 4 ft. 3 in.

Another range supplied contains two 20-in. wide ovens similar to those mentioned. Over them is mounted a double grill,

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white porcelain enamelled inside, supplied with a rod brander and tinned copper drip-tray shaped to drain to a deep well in front, ensuring the collection of fat away from the heat.

Each chamber is heated by standard Carron elements mounted on a cast-iron sliding frame, removable from the front. The wiring and switchboards are similar to those of the other range.

Each oven is loaded with 3,500 watts, and each half of the grill with 6,000 watts, making a total of 19 KW.

The apparatus is black enamelled, finished with ground facings, and earthing terminals are provided.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Willesden Workhouse Supply.

The report in your last issue relating to the supply of electrical energy to the Willesden workhouse may be very misleading to technical readers, and it may interest you to know a little more of the actual conditions.

For the last complete year preceding the contract with my Council for the supply to the Guardians, their own supply cost them, according to their own figures, £421 11s. 10d., and this after an allowance of ½d. per unit (on 44,701 units), for the value of the exhaust steam coming from the electrical plant which was used for heating purposes in the infirmary.

The figures for one complete year's supply by the Council are not at the moment available, but will not exceed £220, which is in round figures, £200 less than they admitted the cost to be during the previous year by their own plant.

Incidentally, the taking of the supply from the Council's mains avoided the recommended purchase of the new battery which would have incurred a total annual cost of approximately £150 when capital and maintenance charges with the units lost in the battery, based upon their own previous works cost, are included.

How the alleged loss of £363 is arrived at under these circumstances many would be interested to know. The only reason put forward by the Guardians is that they have lost the heat value of the exhaust steam which, according to their own figures two years ago, was worth ½d. per unit, while they are now endeavouring to claim a value of something like 2d. per unit, but doubtless the "more efficient" test they propose to make during the next 12 months will do something towards clearing up the mystery surrounding the alleged miraculous value of their exhaust steam.

A. W. Blake,
Electrical Engineer.

Willesden D.C. Electricity Department,
November 28th, 1914.

Trading with the Enemy.

Your leading article in the current issue is very interesting, and a few ideas have occurred to me which should receive careful consideration as affecting the electrical trade of this country generally.

Most electrical firms have gone through the usual quiet summer season, and profits or commissions have been comparatively small in consequence.

At the very time when we were all looking forward to the electrical season opening out, we were unavoidably plunged into the horrors of war, which seriously affected trade and finance for some weeks, and made headway difficult—our rents and debts have got behind owing to our inability to get money in to pay our own countrymen.

As soon as the moratorium has come to an end we are threatened with proceedings by "British firms" with alien shareholders; such proceedings have been taken, and judgments given in their favour. It is not right that these firms should be allowed to go into our Courts and obtain judgments and executions, and thus steal a march on our British firms who are allowing extended credit, and, in many cases, supplying further goods on credit, and, in fact, loyally helping their fellow countrymen all they possibly can; amongst my numerous trade friends I don't know of one that has been proceeded against by an English firm so far.

In conclusion, there is only one nation on which we can throw the onus of this deplorable fracture in trade and finance, and that is Germany: therefore is it not our duty to help those who are helping us first! The enemy should never have been allowed to hurl this new and powerful weapon at England through the medium of our Law Courts.

Fairplay.

Cardiff. *November 28th*, 1914.

Re Notes on Modern Continuous-Current Motors.

I waited for an abler pen than mine to comment on the above article, and even hoped that a designer might be found who would come forward and enlighten us on some of the points raised. I recently wrote upon the same subject ("The Modern Motor," ELEC. REV., April 10th, 1914,) and stated an opinion that I still hold, namely—that the designer suffers fr
ence. If these gentlemen had to run
should soon get machines much more
out any increase in price. Unfortun
been no medium excepting that of t
the designers, manufacturers and tho
operate electrical machinery could
one another. This has been overcome, I
formed "Association of Supervising E
amongst its members, ordinary and ho
men of the trade, both on the installa
It has already proved of value to
case, a well-known make of main
criticism and suggestions. As a res
market in a much improved form. A
new and better designs are necessary i
of foreign trade, an Association whe
into touch with those who have to h
the directions in which the aforesaid
should supply a much-felt want.

London, W.C., *November 30th*, 1914.

LEGAL

THE OSRAM LAMP WORKS, LTD., r.

AN application was made on No
Sargant, in the Chancery Division, th
stand over until after the termination
MR. MARK ROMER, K.C., who made
the defendants, said that the case was
cases for trial, and his application
application made on October 16th.
His LORDSHIP: Does anyone oppos
MR. WALTER, K.C., representing t
we do.
MR. ROMER said that the plaintiff
and were claiming an injunction, but
for was damages or profits as the
the patent had been given up, he
themselves, and the process alleged to
longer used by the defendants.
His LORDSHIP: Will the defendant
this process.
MR. ROMER said he was told so
about the matter. The action w
December 12th, 1912. The statem
early in 1913, and the defendants p
given in March, 1913. The plaintiff
inspection of the defendants' process
that inspection took place on three d
1914. Notice of trial was not give
days before the outbreak of the war.
expert evidence by Mr. Peter Saby, D
Wachsmuth. They had considered th
had come to a conclusion as to ho
ought to be presented at the trial.
gentleman, and were, therefore,
defendants' evidence must necessa
because the process which was
patented for the manufacture of
developed in Germany. The peo
it were the Germans. Large
£1,000 had been paid to those ex
about £1,000 had been spent in in
and their evidence was no longer
possible to obtain the necessary exper
would have to pay them large sum
expended would be thrown away, h
impossible to get them. It was rea
process for the use of tungsten as an
lamps, and they had no first-hand k
defendants' case could not be fairly
unless they could obtain the eviden
The process was that of obtaining a n
which has been superseded by a later i
wire process. The defendants had n
filaments for the last 18 months, and
His LORDSHIP asked whether th
undertaking to that effect.
MR. ROMER said yes. Even if th
witnesses in this country, they coul
some time, owing to the large range
had to be dealt with in the action.
acid was necessary. They had tri
America, but had not been able to do
MR. WALTER said this was nothin
application made and refused on O
evidence as then.
MR. JUSTICE SARGANT thought th
now than it was before.
MR. WALTER said that to postpone t
great hardship on the plaintiffs. Wi

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getting English witnesses, they could supply the defendants with the names of persons who knew more about the matter than any German, and with regard to their chief ground that they could not get the stuff, the plaintiffs had obtained it that morning at three places.

Mr. Justice Sargant pointed out that it would be very unfair to force the defendants to trial if they could not get proper evidence in the time, or to cause them to throw away the £2,000 they had already expended.

Mr. Walter said the plaintiffs had prepared for trial, and he had been in consultation with his learned friends, Mr. Colefax, K.C., and Mr. Gray, who appeared with him. The trial had been fixed not to come on before December 2nd, but he submitted it ought to come on as soon after that as possible.

Mr. Justice Sargant said that the defendants had evidence that none of the people from whom they had obtained it had any of this tungsten acid left—it was a special form of tungsten acid made in Germany; that they were unable to obtain expert evidence in this country; and that it would take an English expert, if found, several months to qualify to give evidence. Had the defendants any evidence to rebut that?

Mr. Walter said he had not come prepared with evidence of that kind, but there was no evidence that the defendants had approached any English experts at all.

Mr. Justice Sargant said he had to deal with the matter on the evidence.

Mr. Walter said then he would put in an affidavit that any number of persons could be found qualified to give evidence who had not been engaged by the plaintiffs. His Lordship was being asked to say that the plaintiffs should be deprived of their rights because the only persons who could give evidence in this case were Germans.

His Lordship said he must give the plaintiffs an opportunity of putting in evidence in answer to the application on the points he had mentioned, and for that purpose he would adjourn it for a week.

British Thomson-Houston Co., Ltd., *v.* Duram, Ltd.

Mr. Justice Neville, in the Chancery Division, on Friday, November 27th, heard a summons taken out by the defendants in this action, asking that the plaintiffs should be ordered to give them discovery of their books.

Mr. T. Terrell, K.C. (with him Mr. Courtnay Terrell), who appeared in support of the summons, said the patent in question was No. 21,513, of 1906, and related to the tungsten used in the manufacture of electric lamps. The plaintiffs were suing in respect of alleged infringement, and the defendants besides denying the validity of the patent and infringement had pleaded that the patented process was carried on mainly outside the United Kingdom, namely, by the General Electric Co., of New York, the Westinghouse Electrical and Manufacturing Co., of Hartford, Connecticut, the Franklin Electrical Co., the Allgemeine Elektricitäts Gesellschaft, of Berlin, the Siemens & Halske Aktien Ges., and by other companies in Holland and elsewhere. They had been called upon for particulars and had given full particulars of these matters. That being so, he did not see why an order for discovery should not go as a matter of course. They were the defendants in the action and were asking for discovery of the documents against the plaintiffs as part of their defence.

Mr. Walter, K.C., for the plaintiffs, said that what the defendants were really asking for was a full disclosure of the plaintiffs' trade. This was a new defence set up under Sec. 25 of the Patent Act, of 1907, and it incorporated a good deal of Sec. 27 about which there had been a good deal of discussion about the discovery of documents. The sections really related to an application for the revocation of a patent on the ground that the patented process was not worked wholly or mainly in the United Kingdom. His submission was that it was not the intention of the Legislature that the claimant for revocation should be given the right to go into the relations between the manufacturer here and all and sundry in every other place. A sort of Star Chamber was set up by the Comptroller, and on its being alleged that an article was manufactured mainly or exclusively abroad, the Comptroller called upon the patentee to give full particulars of all the competitors in his business. Such procedure would, however, be held to be absolutely contrary to the intention of the Act. Every application under this section had been made by Germans with the idea of contesting the patent so that they could import the article into this country. The section was open to great abuses, for the unfortunate patentee, when anyone pleaded the section, had to disclose his books to a person who was probably a competitor in his trade. He submitted that the present time was not the time for any such discovery as was sought in this case. The defendants really relied for their defence on the fact that the process of manufacture described and claimed in the patent was and had been since the date of the said letters patent, carried on mainly outside the United Kingdom, and in their particulars they mentioned several firms. But these firms were not agents for the British Thomson-Houston Co., who manufactured these lamps at Rugby. These foreign firms had nothing to do with the plaintiff company. It was quite easy for anybody, with or without accurate knowledge, to give the names of a number of persons abroad who manufactured these lamps. They could find them in the Directory. The plaintiffs had no business at all abroad, and the sole object of this order for discovery was to obtain the whole of the trade books of the plaintiffs with the number of lamps manufactured by them. In an ordinary patent action the Court never ordered a defendant to produce his books, and he submitted that in this case no order for discovery ought to be made.

His Lordship, in giving judgment, said that it was always hard on a litigant who in the end proved to be in the right, to have an investigation into his affairs which his opponents had no right to obtain by means of the litigation. That went to the root of discovery, but it was an inconvenience that they submitted to if they were to have discovery at all, which it was the practice of that Court to give. He thought if he were to refuse discovery of documents in this case, he would have to refuse all discovery in all cases where such matters were raised by a patentee. The order for discovery would therefore go, and costs of the summons would be costs in the action.

Mr. Walter said this was a very important matter, and he asked for leave to appeal.

Leave to appeal was granted.

Miller *v.* Telford, Grier & Mackay, Ltd.

Before Lord Dewar, in the Court of Session, the record was closed in an action at the instance of Charles Miller, Edinburgh, against defendants, electrical engineers, 222, Broomielaw, Glasgow. The pursuer, who claims £500 in respect of personal injuries, was in the employment of a firm of makers of lifts and cranes, and was in July last engaged in fitting up a lift in Aultmore House, where defenders were engaged in fitting up an electrical installation. While he was working in the shaft of the lift, pursuer says, some workmen in the employment of the defenders began work at the top of the shaft. He avers that the latter were warned to be careful in their operations, in the course of which they dropped down the shaft a brick, which fell upon the pursuer's head and seriously injured him. Pursuer attributes fault to the defenders, who deny liability and plead contributory negligence. They state that the pursuer was aware of the fact that their workmen were working at the top of the shaft, and also of the nature of the operations, and was thus advised of the danger he ran in continuing to work at the bottom of the shaft. Issues were ordered for the trial of the action by jury.

Telegraphists' Cramp.

In the City of London Court, on Monday, an interesting point was raised under the Workmen's Compensation Act when George Harrison, telegraphist, made a claim against the Associated Newspapers, Ltd., Carmelite House, as proprietors of the *Daily Mail*, to recover compensation for having sustained an attack of telegraphists' cramp while working for them. The respondents brought in W. C. Leng & Co., Ltd., as the proprietors of the *Sheffield Daily Telegraph*, as third parties, and claimed 25 per cent. contribution from them because Harrison came from them to the *Daily Mail*.

Mr. Pocock appeared for the applicant, and Mr. Ellis Hill for the Associated Newspapers, Ltd., and Mr. Berryman for W. C. Leng & Co., Ltd. Dr. Thompson, one of the Home Office medical referees, sat with Judge Rentoul, K.C.

Harrison's case was that he contracted the cramp while working on the *Daily Mail*, but he was not aware at the outset what he was suffering from. It was diagnosed first of all as muscular paralysis, and he received some benefits under the National Insurance Act. In December, 1913, he was advised that it was telegraphists' cramp, and that he should apply for compensation under the Workmen's Compensation Act, which he did. He was employed by the *Sheffield Daily Telegraph* as a telegraphist from May, 1910, to December, 1912, when he went to the *Daily Mail*, working for them until September, 1913, when he left as he could not work the telegraphic instruments. The *Daily Mail* had paid him £1 a week from September, 1913 to September 25th, 1914, and it was then stopped. His wages had been two guineas a week. He worked the Wheatstone perforator, the Gell perforator, and the Morse key at the *Daily Mail*. There were manifestations of the cramp before he left the *Sheffield Daily Telegraph*. He went there as a boy in 1904; but he did not work the Gell perforator there. He had done no work since he left the *Daily Mail* because they promised to find him other work, and they had not done so. He worked considerably harder for the *Daily Mail* than in his previous situation, though his hours were the same, but the previous salary was 30s. a week. He had been fit for any other than telegraphist's work since March. He expected the *Daily Mail* to bring it to him rather than he should go for it.

Dr. Cowen said that Harrison could not follow his occupation as a telegraphist. He, no doubt, suffered from the premonitory symptoms a long time before the actual cramp appeared. The Gell perforator would not produce the cramp by itself.

For the *Daily Mail*, Dr. T. Grainger Stuart, F.R.C.P., now serving as a captain with the New Army, said he had seen the instruments complained of worked by Harrison at the *Daily Mail* office. He soon became quite incapable of manipulating them. His condition must have been coming on for two or three years before he began working for the *Daily Mail*.

Dr. W. E. Lee, F.R.C.S., M.D. Lond., for the *Sheffield Daily Telegraph*, said that Harrison did not complain of feelings of cramp while working for that paper. His present condition was due to his more continuous work on the *Daily Mail* for nine months, as against his several years of less strenuous work on the *Sheffield Daily Telegraph*. There were more intervals of rest at the *Sheffield Daily Telegraph* than at the *Daily Mail*.

Mr. Alf. Inwood, London Editor of the *Sheffield Daily Telegraph*, said that Harrison never complained to anyone on the paper of cramp. He was engaged as a wooden slip puncher, and was a

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very good hand. Had he shown any signs of cramp when he left, the *Daily Mail* would not have taken him on. Any telegraphist could tell if a man was working properly or not. The Gell machine was a comparative innovation as far as newspapers were concerned. The field of Press telegraphists was so limited that they generally knew all about the workers.

Phillips, the chief telegraphic operator of the *Sheffield Daily Telegraph*, said that Harrison was one of the finest "punchers" in Fleet Street.

Mr. Berryman observed that the compensation was recoverable from the employer, who had employed the worker for the 12 months before the cramp was discovered. He had been brought there as a respondent as well as a third party.

Judge Rentoul held that Harrison was still incapacitated and must go on receiving the £1 a week, of which the *Daily Mail* was to pay three-quarters and the *Sheffield Telegraph* one-quarter. Those contributions would date back to the date of the accident, and the costs would be arranged in the same way as the compensation. If the *Daily Mail* could not get Harrison work it was certain he could not have got it for himself.

Moyle & Wing *v.* Adnil Electric Co., Ltd.

In the City of London Court, on Tuesday, before his Honour Judge Atherley-Jones, K.C., Mr. S. H. Moyle, 127, Endlesham Road, and Mr. R. W. F. Wing, Great Dover Street, Borough, formerly carrying on business in partnership, J. S. Moyle & Son, Ltd., and J. J. Windsor & Co., Ltd., Broadwall, Blackfriars, made a claim against the Adnil Electric Co., Ltd., Artillery Lane, electrical engineers and manufacturers, for £71, or the return of a 16-H.P. electric motor wrongfully detained by the defendants, valued at £65, and £6 damages for its detention.

Mr. Grey appeared for the plaintiffs, and Mr. Clements for the defendants.

Mr. Clements told the Court that the motor was sent to the plaintiffs for repair, and, in the ordinary course of business, defendants sent it to Berlin to the makers, for whom defendants were the agents in London. After the outbreak of war the motor was stopped on its way back, and defendants could not return it. They did not know where it was, although the Berlin firm had sent them the invoice. Plaintiffs knew defendants would have to send the motor to Berlin. They made an estimate to repair the motor in London for £21, but as it could be done in Berlin for £16 10s. they sent it there. It was an Adnil motor made in Berlin 12 years ago. Plaintiffs had bought it at auction.

Judge Athebley Jones, K.C., *observed it was a matter of common knowledge that with nearly all electrical work Germany had the monopoly.* [The italics are ours, of course. What bearing has this remark on the case? And where do judges get their *common* knowledge?—Eds. E.R.]

Mr. Clements: They are attempting to charge us £65 for an old motor when a new one can be supplied for £30.

Judge Athebley-Jones remarked that it was evidently the stress of war that prevented defendants from returning the motor.

Mr. Grey said that defendants had refused to supply them with another motor in substitution for the lost one. Plaintiffs did not know that the motor was to go to Germany. It ought not to have been sent there. Defendants must take the risk of that as war had broken out.

Ultimately the case was compromised by the defendants agreeing to give plaintiffs a new motor, no costs on either side.

Electro-Steel Foundries, Ltd.

A petition for the compulsory winding up of this company came before Mr. Justice Neville, sitting for the disposal of companies winding up business, on Tuesday, December 1st.

Mr. Bischoff, who appeared in support of the petition, which had been presented by Mr. A. E. Owen, a shareholder, said that it had been presented owing to a state of circumstances that had arisen through the war. The company was formed in June of this year for the purpose of foundering and carrying on, at Darlaston, an electric foundry in accordance with methods adopted in Germany. The original arrangements were made by one Englishman—the petitioner—and two Germans. An agreement was entered into on July 22nd, 1914, between the company, the two German gentlemen and Mr. Owen, under which a German company with which the German promoters were connected were to supply drawings and assistance for the carrying on of the foundry. They were to subscribe for £10,000 shares, which, according to the articles, were to confer the right of nominating four directors. Under that power two German gentlemen were nominated as the first directors. By the same agreement the petitioner Owen agreed to sell to the company the land upon which the foundry was to be built and to take up £20,000 of the shares, which were to confer upon him the right of nominating four directors. Under those powers he nominated himself and Mr. Borland, a Swiss. At a meeting held the same day the shares were allotted, and a call of 5s. per share was made, but was not payable until August 5th. In the meantime, war intervened and upset all the arrangements of the company. The two German gentlemen were in Germany, and the German company was, of course, unable to render any assistance. It was necessary, under these circumstances, that something should be done in England to protect Mr. Owen from liability. These Germans held shares properly allotted to them, but on which nothing had been paid, although a call of 5s. per share had been made. The petition had been served upon the company in accordance with the rules, and there was no opposition. Mr. Borland, who was appointed managing director on the same day that the agreement was executed, was entitled to a certain amount for salary, and had commenced an action in respect of it and obtained judgment. He, however, now appeared for Mr. Aston Cross and offered no opposition to the petition. The registered offices of the company were at Darlaston, and under the rules where the subscribed capital was under £10,000 winding up should be initiated and carried on at the local County Court. Counsel, however, submitted that as this case was likely to involve intricate questions of law as regards alien enemies, the petition was properly presented in the High Court and should be retained by the High Court.

His Lordship made the usual compulsory order, and directed that the winding up should be continued in the High Court.

WAR ITEMS.

Board of Trade Reports.—The following further information has been received at the Commercial Intelligence Branch of the Board of Trade:—

CANADA (New Brunswick).—The Imperial Trade Correspondent at St. Johns reports under date 2nd November that, generally speaking, trade conditions and prospects in the Province of New Brunswick are satisfactory. Wholesale merchants in various lines of business state that there is a good demand for general merchandise, and there is no difficulty in the collection of accounts. Industries have not been seriously affected by the war, and the outlook for farmers is excellent.

ITALY.—According to information received from H.M. Consul at Palermo, it is essential that British manufacturers and merchants desirous of capturing trade in Sicily hitherto in the hands of their German rivals should supply cheap goods, be content with small orders, and study thoroughly the requirements of the market. It is asserted that in many cases United Kingdom firms are unwilling to quote in Italian currency and metric weights and measures, to correspond in Italian, to grant credit, or to send out Italian-speaking travellers.

NICARAGUA.—H.M. Consul at Managua reports (3rd October) that owing to the disturbed financial condition of Nicaragua, British firms would be well advised to defer opening up trade in that country until the financial situation has improved. Although the present period of acute financial depression is not a favourable one for endeavouring to supplant German manufactures on the Nicaraguan market, H.M. Consul states that when commerce revives an effort might be made by United Kingdom manufacturers to obtain a firm footing in the supply of certain classes of goods in which German firms have captured the market with cheaper and more showy, but less durable, articles.

BRAZIL.—H.M. Consul at Sao Paulo reports under date 19th October that the British merchants in that town whom he has approached have not lost sight of the fact that the present state of affairs in Europe should facilitate the introduction of British goods at the expense of German manufactures. They point out, however, that owing to disturbed financial conditions in Brazil it would be unwise at present to undertake an active campaign with this object. Money is scarce, and merchants do not feel disposed to sell goods on long terms of payment. German firms have been successful largely because they have sold a cheap class of article, which is readily bought by the local merchants, and have granted easy terms of payment, 30, 60, 90 and 120 days, and even six months, being allowed.

No Connection. — We have received the following letter:—"Our notice has been called to the title of the Switchgear Construction Company, Limited, a new company which, we understand, has recently been formed to take over the switchgear business of the Union Electric Co., Ltd., and which is now in occupation of works used until recently by Messrs. Voight and Haeffner (England), Limited. As we consider the title in question so closely resembles that of our company as to be likely to cause confusion, we beg to inform you that we are in no way connected with the above mentioned company nor, in fact, with any other company or business concern. We have decided to circularise this letter as the only means of protecting ourselves, since there appears to be no remedy at law enabling us to restrain the company in question from using the word 'Switchgear' as part of its title.

"Our own title, 'Switchgear & Cowans, Limited,' was adopted with the object of retaining the identity of the Switchgear Company, Limited, and Cowans, Limited, when in 1911 we acquired and amalgamated those two old established companies for the purpose of continuing the business of manufacturing electrical switchgear.—Switchgear & Cowans, Ltd. (I. Sermon, Director and Secretary), Manchester. Nov. 28th, 1914."

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Iron and Steel Trades.—For the third time since the commencement of the war the price of steel in this country has been advanced, a rise of 5s. per ton having been instituted by the English Steel Makers' Syndicate a few days ago. . . Shipbuilders' requirements have been very heavy of late, and are likely to continue so. Activity in the iron and steel industry appears, indeed, to be assured, at least until next spring, while business is already being booked for dates further ahead. . . . There have been various indications of late of growing confidence in the future among iron and steel producing companies, and the fact that so many of them have recently declared interim dividends on the same scale as at this time last year, while in one case a first interim distribution has been announced for many years, renders it practically certain that for the current twelve months the total return on the capital of most of these companies will not be less than for 1913-14, and may be more. The point upon which iron and steelmasters lay most stress just now is that the recent elimination of German competition may be regarded as likely to remain operative for probably a decade. The only adverse development which seems likely to arise at present is a shortage of labour owing to the requirements of the army for precisely the class of man who is indispensable to mining and smelting operations.—"Financial Times."

German Contracts.—A correspondent of the "Financial Times" (Nov. 26th), writing with reference to the Trading with the Enemy Act (1914) Amendment Bill, says:—"Although attention has been drawn to the necessity of embodying clauses dealing with the question of existing contracts with the enemy, I do not think that it is widely realised that this is a point of immense importance. To my knowledge there are contracts of national importance which may be held up almost indefinitely unless proper covering clauses terminating these continuing contracts with German firms are embodied in the present Bill. To allow contracts to continue to be held up in this way will (failing such remedy) bring about untold inconvenience and confusion and be entirely against public interest. Incidentally, also, if these contracts can be now placed with English companies it will mean, besides bringing money into the pockets of English firms, very considerable employment of labour.—T. W. Cole, Moorgate Court, E.C." We wonder whether these contracts relate to machinery for an electric supply station?

Australian Trade.—In the course of an interview with the "Sunday Times" (Sydney), Mr. T. G. Milne, H.M. British Trade Commissioner in Australia, said:—"At the present moment I am engaged in taking out a whole lot of lines in which Germany has been increasing her trade with Australia in recent years. I will then get samples and details of cost, and bring the English buyer and seller together. The commercial war is going on all the time, but only now are we beginning to realise that it is the duty of patriots to take sides in the commercial war just as well as in the military war.

"I feel I should refer to the increasing American competition with British trade," said Mr. Milne. "When I arrived in Australia eighteen months ago, I ventured to predict that the opening of the Panama Canal would give American manufacturers in the Eastern States much readier access to Australian and New Zealand markets. That prediction is being verified. A vessel is at the present moment loading up in New York with American merchandise for this market. The European war will, of course, give the American manufacturers a great filip, providing they can get the shipping facilities. But our duty is to deal Imperially, and not to build up other nations, whether friendly or not. Remember to provide your country with the silver bullet!"

American and German Trade.—Mr. J. Rogers Flannery is in this country, at 64, Victoria Street, London, S.W., as the Chairman of the Foreign Trade Commission of Pittsburgh, Pa., U.S.A., for the purpose of inviting inquiries regarding materials and supplies hitherto obtained in markets not now accessible on account of the war. The principal materials for which Pittsburgh is known are steel and iron, machinery, electrical supplies of every description, tin-plate, glass, cork, etc.

Red Cross Almanack.—Messrs. Abdullah & Co., Ltd., have issued an almanack for 1915 with monthly sheets bearing reproductions of drawings of Empire and war interest by well-known artists. The proceeds of the sale of the first 20,000 copies at one shilling each are to be devoted to the funds of the British Red Cross Society.

What's in a Name?—"J.E.G." writes calling our attention to an advertisement in the "Times" for Nov. 10th, in which Major Stulpnagel announces that, with the leave of the Authorities, he has changed his name to that of "Swinton," and wonders if the gallant major would have chosen this particular name had he read Mr. Campbell Swinton's views on Teutons, as recently expressed in our columns.

The Eagerness of Burnley Tramwaymen.—The Burnley tramway manager having reported to his committee that 136 employés of the department have joined the forces, and that he has reached the minimum number with which he can work the service properly in the future, it has been decided that if any more employés desire to enlist they shall make application in the first instance to the manager, who will bring the applications before the committee.

Manchester Ball.—Among the contributions acknowledged for the Manchester Relief Fund on Saturday was one of £20 8s. 2d. from the Manchester Electrical Engineers' Ball.

Northampton Tramway Managership.—According to the "Northampton Mercury," there is a strong difference of opinion in the Tramways Committee concerning the filling of the post of manager vacant by the resignation of Mr. J. Gottschalk. A week ago a sub-committee was appointed to go into the whole of the matters pertaining to the management. The sub-committee made careful inquiries; they inspected every branch of the undertaking, and recommended to the full committee that the position should be advertised. This course, however, the full committee declined to adopt. A proposition that Mr. J. C. Cameron, the electrical engineer, be appointed manager for a period of six months was met by an amendment for the appointment of Mr. G. H. Margrave, the chief of the clerical department. There was a majority against Mr. Margrave, and the recommendation for the appointment of Mr. Cameron will therefore go forward to the Town Council.

Belgian Refugees' Free Rides.—The Halifax Tramways and Electricity Committee have decided to grant free passes on the tram cars to the Belgian refugees resident in Halifax until the 31st December next, and, subject to a satisfactory report from the traffic manager, to renew the privilege at the end of that period.

Blackpool Whist Drive.—Something like 2,000 persons attended the annual whist drive and dance held in the Empress Ballroom, Blackpool, on Nov. 25th, under the auspices of the Corporation Electricity and Tramways Employés' Institute. The proceeds were divided between the Belgian and local relief funds and the Employés' Institute.

Personal.—According to news received in Musselburgh, Mr. Fred S. Hayburn, his wife and child, have reached London safely from Brussels. Mr. Hayburn has been an inspector with the Marconi Co. in Brussels for seven years, and was at his post when the Germans occupied the city. It is interesting to note that Mr. Hayburn was shut up in Ladysmith during the siege as a Natal Government telegraphist, and was later a prisoner in the hands of the Boers.

Mr. E. W. Sleight, manager of Carlisle Tramways Co., has joined the Public School Battalion for the Royal Naval Brigade.

The St. Helens Cable & Rubber Co., Ltd., announce that their London representative for cables, ebonite and electrical goods, Lieut. F. E. Phillips, is now (though still in their employ) serving with H.M. Forces. Mr. R. W. Whitley will take over his work in the London district until his return.

Mr. Walter J. Cridge, who has many friends in the Birmingham and Sheffield districts, has joined the Queen's Westminster Rifles.

Our readers will be interested to learn that Mr. Rollo Appleyard, who is so well known in telegraph, engineering and other circles, has been granted a commission as Lieutenant, R.N.R.V., for special service, dating from Nov. 5th. He has been appointed to H.M.S. "President." Mr. Appleyard has long taken a very close interest in naval engineering matters, and his contributions to the Press on such subjects have been of considerable value. He has our congratulations and best wishes on his present appointment. Mr. Appleyard is a Justice of the Peace and a member of the Institution of Civil Engineers.

Roll of Honour.—Sergeant Alex. Evans, who was a conductor on the Potteries Electric Tramways, who went to the front on August 10th, has been killed in action since November 2nd, when he wrote home that he was having a rough time in the trenches.

Private Harry Hickling, of Salford, formerly employed at the Westinghouse Works, has died at Brighton from wounds received in the battle at Lille.

BUSINESS NOTES.

Dissolutions and Liquidations.—The Leitner Electrical Co., Ltd.—Under the failure of this company, which carried on business at Maybury, Woking, and Moscow, a statement of affairs has been lodged in the Court showing unsecured creditors, £25,739; other liabilities, £5,553, of which £5,350 is expected to rank for dividend; preferential creditors, £274; assets expected to produce £11,301, and a deficiency estimated at £42,263 with regard to contributories. The assets consist of cash, £3,960; stock-in-trade, £1,324 (estimated cost, £5,003); office furniture, &c., £91; good book debts, £3,187; and doubtful and bad debts together amounting to £5,470, and estimated to produce £2,739. The deficiency of £42,263 is accounted for as follows:—General expenditure in carrying on business from date of formation of company to date of appointment of provisional liquidator, viz., £21,919; directors' fees from date of formation, £407; losses and depreciation, written off in company's books, £2,398. Losses and depreciation now written off:—Bad debts, £2,631; stock, £4,009; machinery, &c., £11,849; furniture, fixtures, &c.

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£488; purchase of licence, patent fees, &c., £5,931; Russian agency, £8,931; patterns and tools, £1,211; goodwill, £1,100; claims for salary, &c., £5,350. Deduct:—Gross profit from date of formation of company, £16,104; royalties, £5,066; commissions, &c., £47; premium on issue of founders' shares, £2,745.

The report of Mr. W. J. Warley sets forth that the winding up order was made on October 13th, 1914, on the petition of a creditor presented July 18th, 1914. The Official Receiver had been already appointed provisional liquidator on July 28th, 1914, for the protection of the assets, and Albert William Wyon, chartered accountant (Messrs. Price, Waterhouse & Co.), a director of the company, was appointed special manager of the business, which has been continued by him to a limited extent under arrangements made with Henry Leitner, the owner of the patents worked by the company. The company was incorporated on September 19th, 1911, with a nominal capital of £27,500, divided into 25,000 preference shares and 2,500 founders' share of £1 each, to acquire from Leitner a licence to work his system of automatic electric lighting for trains and vehicles on a royalty basis. The Leitner system had previously been worked by Accumulator Industries, Ltd., which was unable to continue doing so owing to want of capital. The purchase price of £2,700, payable by the company to Leitner, was satisfied by the issue of 2,500 preference and 200 founders' shares fully paid up. The first directors were Viscount Templetown, Captain J. D. Walker and E. T. Sturdy. Leitner was appointed managing director on September 27th, 1911, at a salary of £600 a year, but subsequently a further agreement was entered into with him under which he received £1,000 a year for seven years from September 30th, 1913, and also a minimum yearly royalty of £1,000. On January 31st, 1912, A. R. Jenkins was appointed a director, but he resigned on May 8th, 1913. Viscount Templetown and Captain Walker resigned on October 2nd, 1913, when W. R. Preston and Major A. A. Armstrong took their seats on the board under an agreement with J. Stone and Co., Ltd. W. R. Preston resigned on June 24th, 1914, A. W. Wyon being appointed in his place. The original working capital was provided chiefly by E. T. Sturdy and his relatives, 7,783 preference and 362 founders' shares being subscribed for up to September, 1913. Other shares were subscribed for by J. Stone & Co., Ltd., under an agreement dated September 23rd, 1913, and in April, 1914, 6,000 preference shares were issued equally to E. T. Sturdy and J. Stone & Co., Ltd., for advances made in connection with the Russian business. At the date of the winding up, the issued and paid-up capital was £22,201, consisting of 20,001 preference and 2,200 founders' shares. The company's business was at first carried on at 7, Princes Street, Westminster, the apparatus for the electric lighting system being made for it by other firms. The users of the system included some of the leading railway and other transit companies. Considerable royalties were received from the Rotax Motor Accessories Co., who were appointed agents for the sale of the Leitner motor car lighting apparatus. Latterly, the business was carried on at Woking. In July, 1912, Leitner visited Russia to arrange for the opening of a branch there, and eventually works were equipped at Moscow, where work was executed for the Russian Government railways. On October 2nd, 1913, Henry A. Lehrs, of Moscow, was appointed commercial director of all the Russian business carried out by the company. A considerable number of lighting sets had already been delivered when the war broke out, and a sum of about £4,000 was payable to the company subject to satisfactory inspection. Having regard, however, to the amount reported to be required to satisfy the liabilities in Russia before this sum could be collected, instructions have been given to close the works. On May 8th, 1913, the company acquired an option to purchase the assets and business of the Accumulator Industries, Ltd., carried on at Maybury, Woking, which it did not exercise, but subsequently the arrangement to purchase the assets and business was embodied in the agreement referred to below. The company, however, worked the business under an agency agreement up to July, 1914. On September 23rd, 1913, a working agreement was entered into with J. Stone & Co., Ltd., who are makers of another system of electric lighting for trains, &c., under which the respective operations and spheres of influence were determined. The agreement provided, *inter alia*, for (1) the subscription for shares and the purchase of part of the interest of the existing shareholders, whereby a sum of £7,001 would be available for the company; (2) the issue of debentures for £14,000 by the company for the purchase of the freehold estate and factory at Woking belonging to Leitner, together with the assets of the Accumulator Industries, Ltd.; (3) the alteration of the articles of association, so that two directors (Preston and Armstrong) should be nominated by J. Stone & Co., Ltd., and two by the company, one of the former to be chairman, with a casting vote. Under the above agreement J. Stone & Co., Ltd., subscribed cash for 3,718 preference shares, and acquired from the other shareholders 3,283 preference shares at par; they thus held, after taking into account 2,500 vendor shares which had been issued, a majority of one preference share and a controlling interest. The proceeds of the sale of their 3,283 preference shares were used by the shareholders in paying for 538 founders' shares at varying premiums, the average being £5 2s. per share; the premium reserve of £2,745 created thereby was used in the business. As consideration for the agreement, J. Stone & Co., Ltd., were allotted 1,100 fully-paid founders' shares, their holding in founders' shares being then equal to the other shareholders. The alteration of the articles of association was duly carried out, and the first meeting of the new directorate, consisting of Preston, Armstrong, Sturdy and Leitner, took place on October 29th, 1913, when the question of erecting an electro-mechanical works at Woking was considered and sanctioned subject to a bank overdraft being obtained, which was afterwards arranged and guaranteed by J. Stone & Co., Ltd., up to an amou which E. T. Sturdy guaranteed £2,500 of the works and the purchase of the n was proceeded with at once in the ex property would be duly conveyed to t debentures. The works were comple the manufacture of the company's dyn The company's funds, however, were current expenses, and it was reported Leitner) on May 28th, 1914, that J. St any extension of the overdraft, which The company's position was considered 2nd, 1914, at which a scheme for di ject to voluntary liquidation was pr agreed to by J. Stone & Co., Ltd., who proposal, which also was not agreed tary liquidation was held on July 1 resolution was not passed, nor at a July 24th. Meanwhile, the company Woking had become critical owing to to Leitner under the agreement of Sep 25th, 1914, Leitner's mortgagee of th been satisfied out of the proposed issu Receiver, the company remaining as t it gave up possession on the property on the works of £11,849 is wri account, there being nothing realisab Leitner has given notice to the compa on the ground that the whole of t have not been paid as requested. among the company's assets. The c follows:—For the year ending Sep £2,427; for the year ending Septembe for half-year ending March 31st, 1914.

The company had apparently been stage. The sales were increasing, and more orders in hand than it could car £25,739, include the claim of J. St overdraft of £8,071 paid off by the £1,370 due to Leitner on royalty an the remaining claims are chiefly fo Woking works. "Other liabilities, £5,000 by Leitner for the unexpired managing director, but he has inti large claims against the company "Preferential creditors, £275," are c cash at bank, £3,948, has been c consists partly of loose plant stored been considered advisable to sell in t partly of stock used by the special business. Most of the good book d the doubtful and bad debts, £5,470, include an estimated sum £2,400 fr Railways, which is only payable co liabilities in Russia are not include and the total expenditure on the written off in the deficiency account. his appointment has carried out mo and the business is now practically trading has resulted in a substan failure of the company is attributed of co-operation between the director of the individual directors as have ma

MORDEY-FRICKER ELECTRICITY CORRECTION.—In the notice of this c issue, we announced a meeting December 23rd. The *London G* which our information was obtain *members*, and an inaccuracy occurr paragraph, which we regret. As a m no creditors, having sold its busines Insulated and Helsby Cables, Ltd. up voluntarily.

THE LLANELLY MOTOR AND EL LTD.—A meeting of creditors is 28, Baldwin Street, Bristol, by the liq

BRITISH METAL ENGRAVING CO., is called for December 2nd, at 3, War by the joint liquidators, Messr W. Reacher.

THE PREMIER LIGHTING AND meeting of creditors is called for Dec Station Chambers, Holborn, W.C., Goodwin.

THE JANDUS ARC LAMP (C ELECTRIC CO., LTD.—A meeting will be held at 46, Brown Street, M to hear an account of the winding A. A. Gillies.

THE CLIFTON ELECTRICAL ENGI Birmingham.—Messrs. W. A. Nelson partnership by mutual consent.

GREEN & SMITH, electrical and Lane, Leeds.—Messrs. J. D. Green an partnership. Mr. Green attends to to trade under the same name.

Private Arrangements.—A LEEK (trading as Hartley & Leek), e Road, Colne.—A meeting of the cre

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held on November 24th, when a statement of affairs was presented, showing liabilities amounting to £708, and assets estimated to produce £348, from which had to be deducted preferential claims of £19, leaving net assets of £329. It was reported that the business was started on September 1st, 1911, with a capital of £66. The partners attribute their present position to the fact that they have been charging too low prices, and have consequently been working too cheaply. The drawings of the partners have been on an average £1 8s. 8d. per week each. Neither of the partners has any separate estate. No offer was submitted, and it was decided that a letter of authority should be executed in favour of Mr. Hargreaves, accountant, Colne, and, should it be necessary, that the debtor be called upon to execute a deed of assignment. The following are creditors:—

Adams, Beardsall & Co.	£14	Siemens Bros. & Co.	£17
Baxendale & Co.	70	Ward & Goldstone	20
Frankenburgs, Ltd.	90	Baxendale Bros.	28
Falk, Stadelmann & Co.	34	Mudd, James	6
General Electric Co.	25	Whittaker, Wm.	6
Gratrix, Ltd.	156	Grimshaw, J., Ltd.	27
Scattergood & Johnson	14	Hyde, R., & Sons	6
Steel Tubes Co.	26	Watson, Benson	102
Stearn Electric Lamp Co.	28		

A Hard-Worked Motor.—The elasticity of the electric motor in dealing with its work under trying conditions is well illustrated by the record of a motor supplied by the General Electric Co., Ltd., to a large firm, whose factories the company had electrified. The motor was of 50 H.P., running at 200 R.P.M., and was driving a pair of heavy crushers. The firm's engineers noticed that at times the ammeter needle swung off the scale, and it was decided to ascertain the extent of the peaks, with suitable instruments. The result of the investigation was the discovery that overloads of 160 per cent. were attained. The purchaser reported that under this condition the commutation of the motor was beyond reproach, and, although the average load was above the rating of the motor, it showed no tendency to overheat.

Trade Announcements. — The Electric and Ordnance Accessories Co., Ltd., have made arrangements with Messrs. T. J. Grainger & Co, Edinburgh Life Building, 21, Mosley Street, Newcastle-on-Tyne (telephone, Central 3474; telegrams, Outshine, Newcastle-on-Tyne), to act as from December 1st as sole agents for their electrical apparatus covering "Vickers" switchgear, D.C. motors, lever switches, motor control panels, controllers, mining switchgear and motors, crane panels, fans, starters, electric lighting accessories, porcelains, heating and cooking apparatus, &c. Messrs. Grainger's area will be Newcastle and District, including Cumberland, Northumberland and Durham (excepting the Tees).

The business of the Clifton Electrical Engineering Co., of 3, New Street, Birmingham, has been taken over by Mr. John Lett South.

Catalogues and Lists.—National Boiler and General Insurance Co., Ltd., National Buildings, St. Mary's Parsonage, Manchester.—48-page illustrated catalogue of boiler fittings and other articles for steam-users and engineers. A separate list illustrates the National patent fusible plugs.

Messrs. John Line & Sons, Ltd., 63, Cornwall Street, Birmingham.—Lists relating to "Duresco" paint for rendering woodcasing fire-resisting, and other specialities for the protection of metal surfaces, &c.

The Benjamin Electric, Ltd., 1A, Rosebery Avenue, London, E.C.—New season's catalogue (L5) of 96 pages, containing illustrated particulars and prices of a wide collection of Benjamin wireless clusters and other lighting specialities, such as reflectors, "Dim-a-lite" attachments, half-watt reflector fittings, electric horns for motor and marine service, tools and accessories.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, E.—24-page illustrated list (No. 27) giving tabulated prices of gutta-percha, india-rubber, silk and cotton-covered wires for bell, telephone, winding coil, shot-firing and other service; also jointing tools, jointers' tents, rubber gloves, &c.

Messrs. H. Brunner & Co., 10, Philpot Lane, London, E.C.—Priced leaflet of new patent pole caps for wooden and steel poles.

Bankruptcy Proceedings.—Wm. Walker, formerly carrying on business as a dealer in electric lamps, at 2 and 3, Red Lion Court, Fleet Street, E.C., under the style of David Smith and Company.—At the London Bankruptcy Court on Tuesday, an application for an order of discharge was made to Mr. Registrar Linklater. Mr. Tindale Davis appeared for the Osram Lamp Works, Ltd. (petitioning creditors), in opposition to the application, and Mr. E. W. Hansell appeared for the bankrupt. Mr. Egerton S. Grey (Official Receiver), reported that the applicant failed last April with ranking liabilities £968, and no assets whatever. He came to this country from Wellington, in 1908, and in July, 1911, he commenced trading as above, with £28 of his own money, and £762 borrowed from a lady, who subsequently became his wife. The business was unsuccessful, and in December, 1912, the Osram Lamp Works, Ltd., obtained an injunction restraining him from selling certain lamps, on the ground that they were an infringement of their patent. In July, 1913, the company obtained judgment against the bankrupt for £176, the costs of the action. In December, 1912, the bankrupt closed the business in Red Lion Court, and in the following February he opened a similar business in Edgware Road, under the style of "The Imperial Engineering Co." He closed this business after two or three weeks, and in April, 1913, opened another at 6 and 7, Charing Cross Chambers, Adelphi, where he traded as "The Preston Engineering Co." The latter business was, in May, 1913, converted into a company, of which the bankrupt acted as managing director, at a salary of £2 15s. a week, which position he held when the Osram Lamp Works, Ltd., instituted these bankruptcy proceedings. The bankrupt attributed his failure to the costs of the litigation with the petitioning creditors, and to loss on the trading.

The only offences alleged by the Official Receiver were (1) insufficiency of assets to equal 10s. in the £ on the amount of the unsecured liabilities; and (2) imperfect book-keeping. Mr. Hansell asked for the discharge to be granted subject to a judgment for £52. He pointed out that the total liabilities did not exceed £967, and out of that £762 was due to the bankrupt's wife, who would make no claim if the applications were acceded to by his Honour. The amount of £52 would be sufficient to pay £25 to the petitioning creditors for the costs of the petition, and a dividend of 2s. 6d. on the liabilities, apart from that to Mrs. Walker. Mr. Tindall Davis opposed on the ground that the bankrupt's position was due solely and wholly to his having infringed the patent rights of the petitioning creditors. After considerable discussion, his Honour adjourned the hearing for a fortnight to allow the bankrupt's offer to be further considered.

Geo. E. Hipkins, electrical engineer, 48, Wolverhampton Street, Dudley.—Receiving order made November 24th on debtor's own petition.

W. H. Wood, electrical engineer, Birmingham.—First meeting, December 9th, at 191, Corporation Street. Public examination, December 16th, at Court House, Birmingham.

Trubie Moore, electrical engineer, Leeds.—First and final payment under scheme of arrangement of 7s. 4½d. in the £, on December 8th, at the Official Receiver's office, 24, Bond Street, Leeds.

W. R. Wedge, electrical engineer, Northampton. — Trustee, A. Ewen, Official Receiver, The Parade, Northampton, released November 12th.

Alfred J. Loader, medical electrician, 15, Carr Road, and late of 3, Forest Street, Nelson, Lancs.—Receiving order made November 26th on debtor's own petition.

Book Notices.—"The Physical Review." Vol. IV, No. 5. November, 1914. Lancaster, Pa.: The American Physical Society.

"Safety Rules to be Observed in the Operation and Maintenance of Electrical Equipment and Lines"; "The Testing of Potentiometers"; "The Emissivity of Metals and Oxides"; "Adjustments of the Thomson Bridge in the Measurement of very Low Resistances"; "*Bulletin* of the Bureau of Standards," Vol. 10, No. 4. Washington, U.S.A.: Government Publishing Office.

The P. & O. Diary and Almanac for 1915, issued by the P. & O. Steam Navigation Co. of 122, Leadenhall Street, London, E.C., contains particulars of the company's fleet and services, its directors, officials and agents, P. & O. mail tables, and a number of most serviceable maps, the flags of merchant vessels of different countries, and a calendar and daily diary space for 1915. It is a most handy pocket booklet for all business men who are interested in communications between this country and India, China, Egypt, Japan and Australia.

For Sale.—Tenders are invited by December 12th, for the sale of electrical and motor plant and stock of the Electrical Engineering and Motor Co. (Carlisle), Ltd. Particulars appear in our advertisement pages to-day.

The Neath Corporation Electrical Committee has for disposal two 10-KW. air-cooled transformers, 2,200 to 220 volts, 50 py. Particulars are given in our advertisement pages to-day.

Argentine.—A North American firm of electrical manufacturers, which has a capital of $30,000,000, has decided to open a branch in Buenos Ayres to which it will give a capital of $600,000 gold, and has already acquired the necessary premises.

A decree has been published approving the conditions of the call for tenders for electrical materials for the navy during 1915.—*Review of River Plate.*

Catalogues Wanted.—The Automobile and Electrical Equipment Co., of 2, Kingly Street, Regent Street, London, W., invites manufacturers and others to forward catalogues, &c.

Cinema Lighting. — The Tower Cinema Picture House, recently opened at Peckham, which is said to be the largest in London, is fitted throughout with "Pope Elasta" wire lamps, some 2,500 lamps being installed there.

LIGHTING and POWER NOTES.

Argentina.—The Special Committee of the Rosario City Council, which has had the question of electric lighting charges under consideration, has entered into an *ad referendum* contract with the Rosario Electricity Co., which provides for an 18 instead of the 40-year period in the old concession, and for a reduction in price of energy all round.

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The nine months' output of the Campania Alemana Transatlantica de Electricidad ended September, amounted to 49½ million units, as compared with 45 million units in the previous year.

The electricity supply at San Justo (Santa Fe) has just been inaugurated.—*Review of the River Plate.*

The following electric lighting concessions have been granted:—By the Government of Cordova, to Pedro Perla, of the Makenna Electric Works, to supply the Commune of Pueblo Torres, and to Messrs. Sigel & Co. to establish an electric station and supply a service of public and private lighting in the Commune of Capella del Monte. By the municipality of Monte Grande (Province of Buenos Ayres) to Zurchi Corti, to erect a station and supply current to Monte Grande. The municipality of Rauch (Buenos Ayres) has received the form of conditions of tender sanctioned by the Ministry of Public Works, and is now in a position to invite tenders for the concession to supply that town with electricity. The public service will need some 70 750-candle (8-ampere) arc lamps.

Australia.—At the present time the Adelaide Municipal Tramway Trust has power to supply electricity to the Government only, but in 1910 leave was obtained to amend the Bill of 1906, by which power would have been given the Trust to sell electricity to the Commonwealth and State Governments and the metropolitan municipal bodies. The amendment was, however, never introduced, but is now being considered by the Electric Light and Gas Services Commission in Adelaide, Mr. W. G. T. Goodman, chief engineer of the Trust, having been called to give evidence.—*Australian Mining Standard.*

The Northern Suburbs E.L. and P.S. Corporation has made an offer to supply the North Sydney Council with electricity, in view of the probable delay on the part of the Sydney City Council in giving a supply.

The shelving of the Greater Melbourne Bill will prevent the extension of the municipal electric lighting enterprise of the Melbourne City Council, which is at present limited to supplying its own residents. Suburban residents are largely supplied by private undertakings such as the Melbourne Electric Supply Co.

Blackpool.—EXHIBITION.—The second annual Trades Exhibition, arranged by the Blackpool tradesmen, is to open to-morrow (Saturday, December 5th) in the Winter Gardens. An electrical display is to be made by the Corporation, and demonstrations of cooking by electricity will be given.

PROPOSED LOAN.—It is proposed to apply for L.G.B. sanction to the borrowing of £24,000 for electricity works extensions.

Boston.—PROV. ORDER.—Mr. Robert Arthur Smith, of Palace Chambers, Bridge Street, Westminster, has applied for a prov. order for E.L. at Boston, Skirbeck, Skirbeck Quarter, Fishtoft, Freeston, Wyberton, Frampton and Kirton.

Bridlington.—I.M.E.A. BILL.—The Electricity Committee has received a letter from the I.M.E.A., stating that the Association did not contemplate taking any decisive action with respect to the Joint Bill this session.

Brighouse.—The Electricity Committee of the T.C. has decided that "a discount of 5 per cent. be allowed on such alternating current accounts as are now subject to discount where the consumption is not less than 6,000 units per month, and a further discount of 5 per cent. where the consumption is at least 9,000 units per month."

Burnley.—The new elementary schools in Cuthbert Street and Lionel Street are to be lighted by electricity.

Canada.—According to a financial statement by Sir Adam Beck on the municipalities supplied through the Hydro-Electric Commission, for the first nine months of the year, in every case a surplus is shown.

Canadian electrical plants are credited with producing last year 1,543,464,097 KW.-hours, of which 772,597,049 were exported and 770,867,048 were used at home. The largest producer was the Ontario Power Co., which generated 694,720,900 KW.-hours, and exported 282,123,004; the Canadian Niagara Power Co. produced 411,635,000, and exported 40,021,428; the Electric Development Co. was the third largest producer with 234,039,670, and 42,154,000 exported; the Western Canada Co. produced 62,553,130 KW.-hours, of which 23,213,891 were exported.

It will be seen that Canada exported more electricity than she consumed at home.

The third unit of the plant of the Canadian Western Power Co. will shortly be completed, increasing the plant capacity from 25,000 to 37,000 H.P., and next year four units are expected to be in operation, giving a total of 50,000 H.P.

It is proposed to construct a large hydro-electric plant, to have a capacity of 100,000 H.P., on the Speel River, 35 miles south of Juneau, Alaska.

Continental Note.—GERMANY.—According to the *Daily Express*, the petroleum famine in Berlin has induced the Berlin Electricity Co. to offer to light the houses of the poorer classes with electricity at less than the cost of oil, without making an installation charge.

Coventry.—PROPOSED LOAN.—The City Council on December 1st decided that application be made to the L.G.B. for sanction to a loan of £55,897 for the purpose of extensions of the buildings and plant of the electric light works. It was explained that they had nearly reached the maximum capacity of the works. It is proposed to install a new 3,000-KW. turbo-alternator and marine type boilers of an evaporative capacity of 30,000 lb. of steam per hour, upon the boilers now in use. T ceed with the preparation of pl the foundations will be carried o

Dover.—The War Office agreement with the T.C. for the poses, subject to certain modifica recommends that the charge o the terms of the agreement be buildings which might be f acquired, or leased within 60 ft maine.

Erith.—YEAR'S WORKIN Council's electricity undertakin profit of £10,071, an increase previous year; the net profit fo The units sold advanced from increase of 12½ per cent., which of only 3½ per cent. in the wor cost of coal). Reference is m further plant extensions at an e

Exeter.—PROPOSED LO services has been applied for by at present lighted by oil lamp

Fife.—Claims for reduct by the Fife Electric Power C Tramways Co. at a meeting of first-named company claimed a gross valuation, which is at pre Tramway Co. claims a deductio cent. as at present.

Greater London Elect (Kent) R.D.C. and East Barnet of the above scheme until aft protesting against the scheme. The Hornsey B.C. is calling a authorities, with a view to join

Hornsey.—LOAN SANCTI the borrowing by the Council The B.C. has decided to con of the appeal against the Ilford a defence fund of £200 is creat

Ilford.—In May last, t U.D.C. accepted the offer of Bo at the electricity works on trial to the reduction of the emissio reports that the action of th siderably the emission of smok the next meeting of the Electr of purchasing the apparatus wi

Kirkby Stephen.—PR recommended not to oppose the of Mr. C. H. Best, of Bradford, being signed, and to all pos approved by the Council's sur

Knaresborough.—The decided to oppose the Harrogat in Parliament a Bill authori electric lighting powers in the

Leek.—Two explosions Broad Street last week, stated t woman was thrown down and

Llanidloes.—LOAN SA the sanction of the L.G.B. to a taking of the Electric Light C

London.—ST. MARYL meeting of the Council a pro to the Works Committee for of the street lighting account, 43 per cent. of the lamps are Watson, chairman, E.L. Com mittee's contract was for the a certain fixed sum per annum. I for the last three or four ye contracted for had been give contract price this year was Ultimately the motion was wit The L.C.C. Finance Commi to sanction the borrowing b mains, £3,029 for transform £225 for meters, in connect undertaking.

Maidstone.—The T.C. at the electricity works to th for £700 each. A recomm towards the cost of the I. powers to local authorities, The L.G.B. has sanctioned a boiler house and offices at the

(*Continued*

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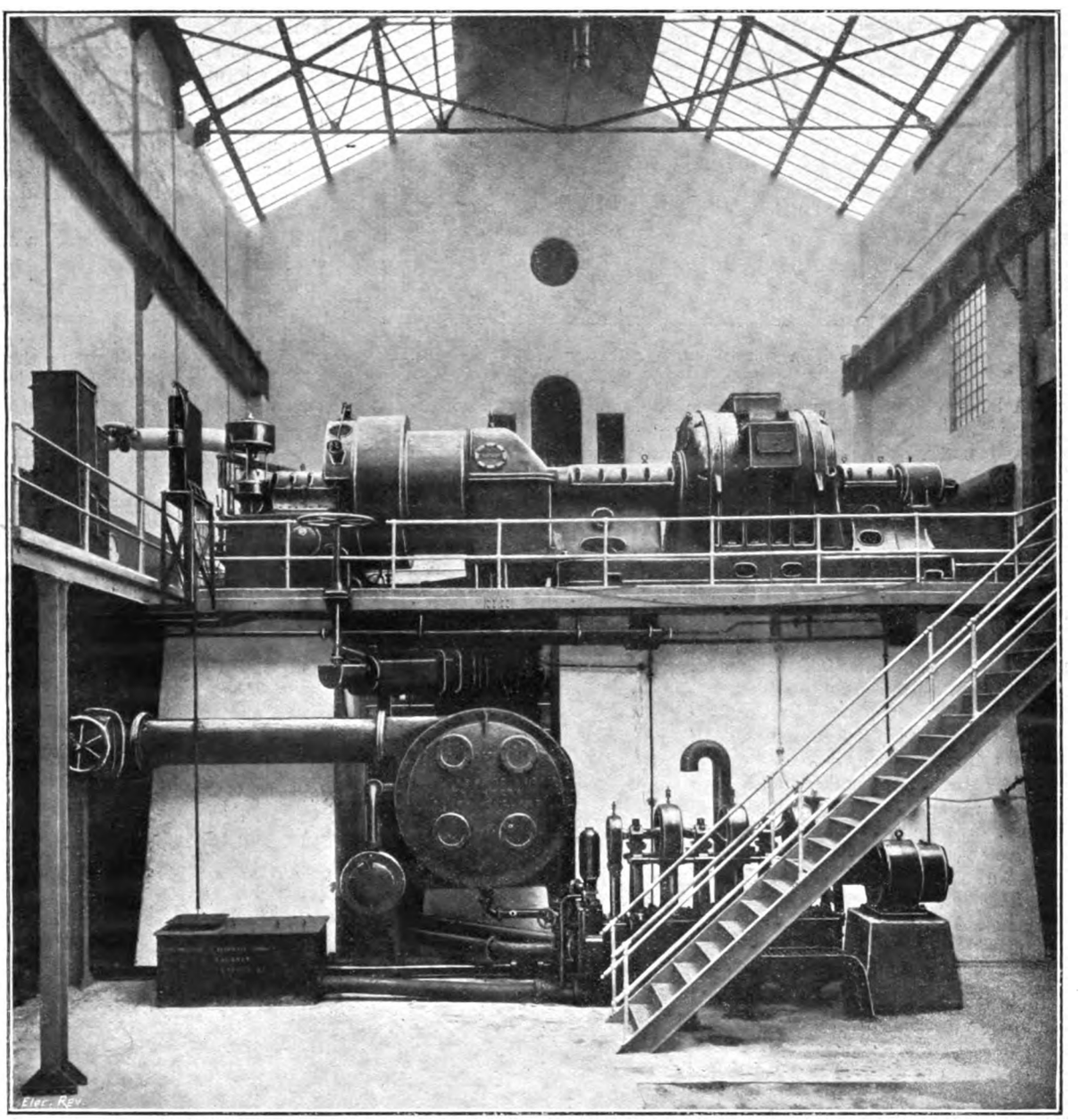
HACKNEY ELECTRICITY WORKS EXTENSION.

On Saturday last the new extensions of the municipal electricity works were the subject of an informal inspection by the chairman (Councillor T. A. Blane) and members of the Electricity Committee, under the guidance of the Borough Electrical Engineer, Mr. L. L. Robinson, M.Inst.C.E. It is just over 13 years since the undertaking was formally opened, and 10 years since we published a full description of the installation* ; even at that early date the station, which was designed by Mr. Robt. Hammond, had earned a reputation for economy in working, the total works costs at 1·03d. per unit being claimed to be the lowest in London. The plant was characterised especially by the use of steam-driven balancers and a large battery, both of which items have abundantly demonstrated their value in maintaining continuity of service under all conditions ; there has, in fact, never been a single interruption of the supply since the commencement.

The growth of the load—largely accelerated by the institution of a showroom some years ago—was met at first by additions to the direct-current plant and mains, the principal generating sets being two 1,500-kw. Westinghouse and Dick, Kerr dynamos driven by triple-expansion vertical Belliss engines, which have done excellent work and are still in first-class condition. In 1911, however, foreseeing a greatly increased demand, Mr. Robinson drew up a comprehensive scheme to meet the requirements of the future, with generation and transmission by three-phase current at 6,000 volts, 50 cycles, and distribution from sub-stations feeding the existing d.c. network, except in the case of very large consumers, who would be supplied directly from the extra-high-pressure mains.

On the advice of Messrs. Preece, Cardew & Snell, the Borough Council adopted the scheme, which provided for the installation of three 3,000-kw. generators ; but it has been found necessary to prepare for still larger demands, and while one 3,000-kw. machine has been installed, the second set, which is now on order, is of 5,000 kw. The new engine-room and boiler-house are built on to the older buildings, with the boiler-house between the engine-room and the River Lea, this arrangement permitting of the most convenient and direct handling of coal. The buildings are of steel frame construction, with concrete panelling, and cost about £25,000 ; they were erected to the general design of Mr. Robinson, under the supervision of the Council's architects, Messrs. Gordon & Gunton.



Willans-G.E.C. 3,000-kw. Turbo-Alternator and Condensing Plant.

* Elec. Review, March 11th and 18th, 1904.

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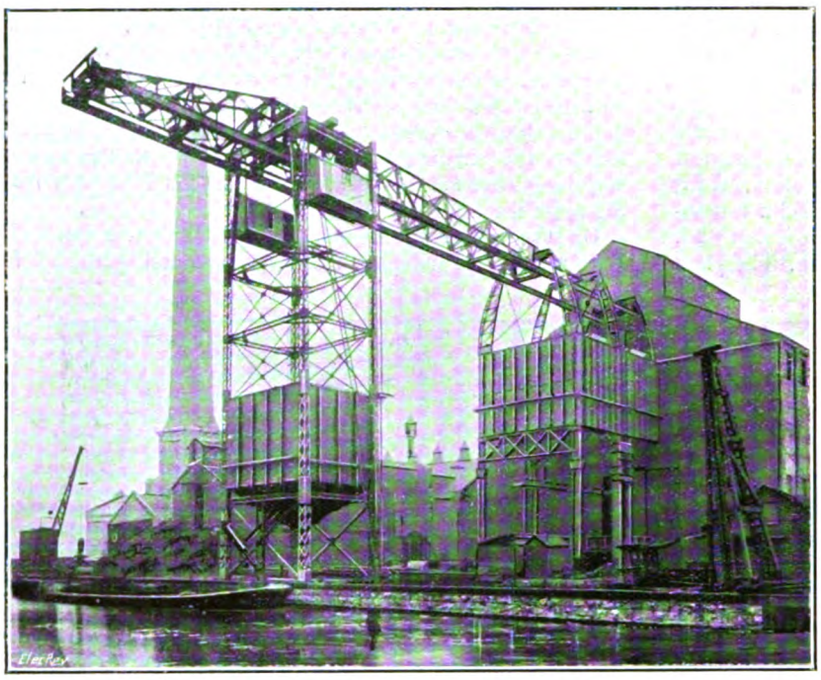
In addition to the 3,000-kw. set now installed, the engine-room provides accommodation for two 5,000-kw. sets, and a 1,500-kw. Peebles-La Cour motor-converter, which is already in position, and links together the D C. and A.C. systems. A lean-to building alongside of the engine-room houses the air filters and cables in the basement ; lavatory, messroom and E H.T. switchgear on the ground floor ; and the offices for the works superintendent and the engineer in charge, as well as the control switchboard, on the first floor, the switchroom affording a clear view of the engine-room, through a glazed partition.



Coal and Ash-Handling Telpher Railway.

The present boiler-house represents half of the complete scheme, affording accommodation for four boilers, of which two have been installed, each rated at 33,000 lb. of steam per hour. In the basement are the steam pipes, feed pumps, hot-well and ash railway, and above the boilers are the economisers and induced-draught plant ; one Green economiser of 520 pipes, and one ejector type steel chimney have been erected. The coaling plant runs in the roof over the coal bunkers. The end of the boiler-house is at present closed with galvanised iron.

A small building near the river accommodates the circulating water pumps.

The whole of the buildings are fireproof, and hydrants fixed to the bunkers provide against the danger of spontaneous combustion of coal.

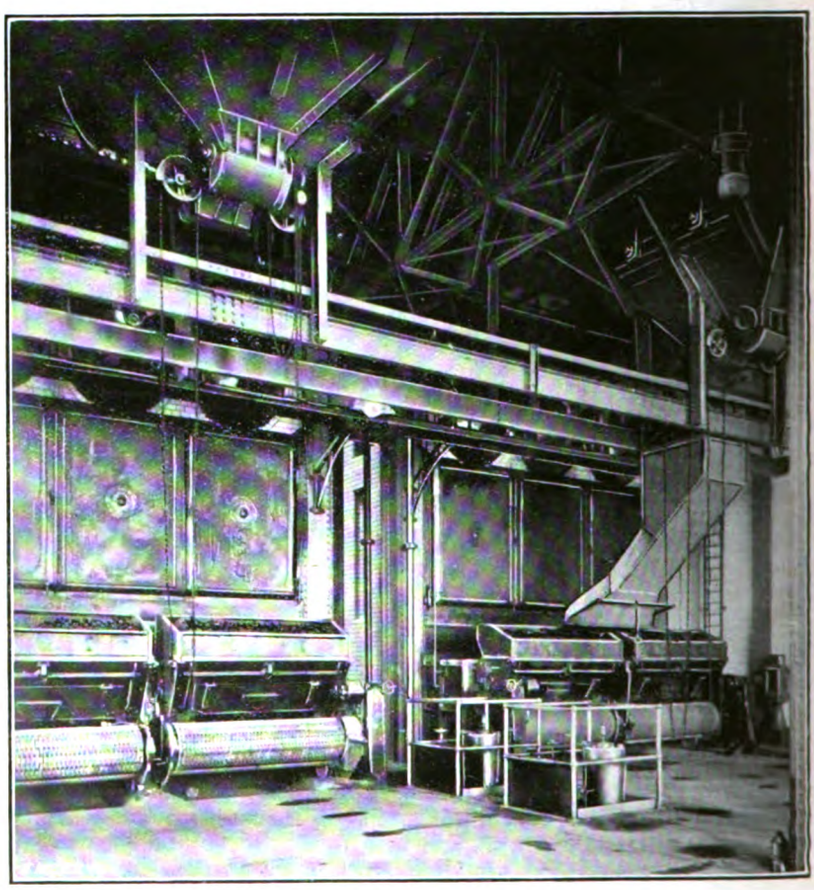
The coal-handling plant is of the telpher type, built by Messrs. W. J. Jenkins & Co., at a cost of £8,918 ; it is capable of handling 40 tons per hour, when both telphers are in operation. The telpher track extends the length of the boiler-house and beyond to the river, where it is supported by a steel girder and tower, the latter containing the ash bunker and the Avery weighing machines, which register the quantity of coal delivered by the contractors. The coal is raised by a grab from barges, and is deposited in the bunkers wherever desired ; the grab lifts 50 cb. ft., at 80 ft. per minute, and the telpher travels at 450 ft. per minute. The motors were made by the British Thomson-Houston Co., Ltd.

The bunkers have a total capacity of 1,300 tons ; their sloping sides are lined with granolithic concrete spread on expanded metal, and lead to double outlet valves, of which one set is at present in use. As the coal leaves the bunker it falls into a travelling shoot, being weighed again in the process ; the shoot serves both boilers, and can feed any of the four mechanical stokers from any of the four bunker outlet valves. When the other two boilers are erected, a second travelling shoot will be installed, utilising the other set of bunker outlet valves. The shoot runs on ball bearings, and can be traversed by hand with ease ; it has the advantage that if a run of inferior coal occurs in one hopper when a heavy load is on, a supply of coal can be obtained from any other part of the bunkers.

The ashes that pass over the dumping bars fall into hoppers, from which they are taken by tipping trucks running on a narrow-gauge railway to a pit, and eventually they are dealt with by the telpher grabs. The riddlings fall into ash-pans beneath the grates, and are put through the fire again.

Feed water is derived from an Artesian well, and is exceptionally soft ; it is pumped by two compound pumps, supplied by Messrs. J. P. Hall & Co., Ltd., either of which can feed three boilers at normal full load ; the steam cylinders are lubricated only with graphite, so that the exhaust steam can be passed directly into the hot-well through injectors.

The boilers, induced-draught plant and Green economiser



B. & W. Boilers and Travelling Shoot.

were supplied by Messrs. Babcock & Wilcox, Ltd. The boilers are of the land type, with double chain-grate stokers and superheaters, and each is capable of supplying 33,000 lb. of steam per hour at 200 lb. per sq. in., superheated to 600° F. The valves and fittings are Hopkinson's. The

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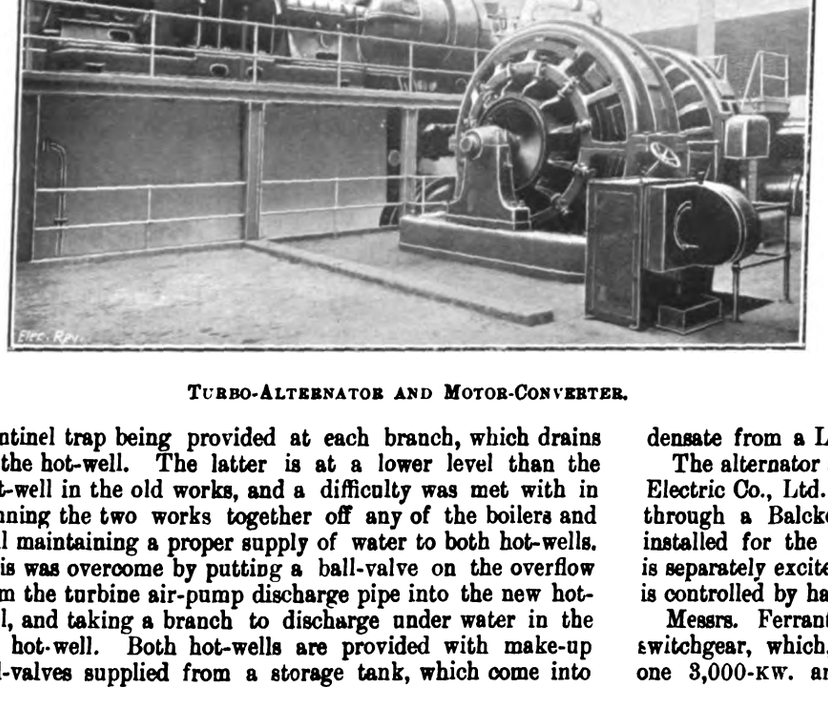
induced-draught fan was made by Messrs. Davidson & Co., and is driven by a Westinghouse motor, with a Brook, Hirst starter-controller, giving speeds from 490 to 700 R.P.M. The steel chimney was made by Messrs. Danks. The plant gives a draught of not less than 1 in. water gauge at the boiler dampers under any conditions of load.

A cast-iron conduit, with hoppers on the economiser floor and boiler floor, enables flue dust to be dropped directly to the ash railway in the basement.

The steam-piping is of lap-welded steel, and is carried through the boiler-house basement, a separator with a Sentinel trap being provided at each branch, which drains to the hot-well. The latter is at a lower level than the hot-well in the old works, and a difficulty was met with in running the two works together off any of the boilers and still maintaining a proper supply of water to both hot-wells. This was overcome by putting a ball-valve on the overflow from the turbine air-pump discharge pipe into the new hot-well, and taking a branch to discharge under water in the old hot-well. Both hot-wells are provided with make-up ball-valves supplied from a storage tank, which come into operation in case of emergency. The scheme has been completely successful, both hot-wells filling to a proper working level automatically, no matter how the load on the boilers and generators is changed about.

Circulating water is derived from the river, by way of two 36-in. intakes, with filter screens. At present there is a single 36-in. main to the engine-room, and a similar discharge; duplicates can be provided later. The circulating pump was supplied by the Rees Roturbo Co.; it has a vertical shaft, and is driven by a Laurence-Scott motor of 42 H.P., the pump being in the basement of the pump house below water level, and the motor on the ground floor. The plant delivers 3,600 gallons per minute against a head of 30 ft. at 700 R.P.M.

The engine-room is served by a 25-ton three-motor travelling crane supplied by the Chatteris Engineering Co., Ltd., and the pump house by a two-ton hand-operated crane by Messrs. Herbert Morris, Ltd.



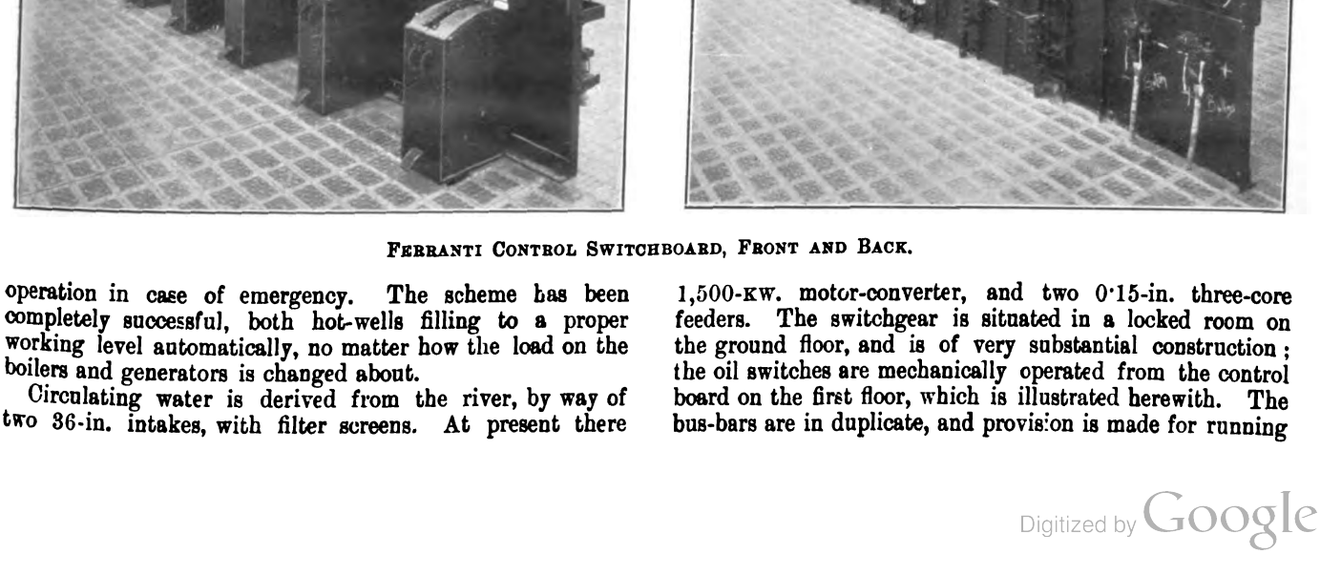
Turbo-Alternator and Motor-Converter.

The contractors for the turbo-alternator, condenser and air pump were Messrs. Willans & Robinson, Ltd.; the plant has an output of 3,000 KW., with a power factor of 0·85, at a speed of 1,500 R.P.M. The turbine is of the disk and drum type, and has a guaranteed steam consumption of 15·25 lb. per KW.-hour at half-load, 13·95 lb. at full-load, and 15·25 lb. at 1¼-load, including all accessories, but it is expected to give results 0·5 lb. better on test. The condenser is also of Messrs. Willans and Robinson's make, and is provided with a vacuum augmentor condenser.

The air pump, by the same makers, is of the Edwards type, driven by a British Thomson-Houston motor of 17 H.P. at 154 R.P.M., with a Brook, Hirst starter. It is connected with a force pump, which discharges the condensate from a Lea Recorder to the hot-well.

The alternator and exciter were supplied by the General Electric Co., Ltd. The generator is cooled with air drawn through a Balcke cloth filter, but wet air filters will be installed for the later machines. The field of the exciter is separately excited from the D.C. supply, and the pressure is controlled by hand or by a Taylor-Scotson regulator.

Messrs. Ferranti, Ltd., were the contractors for the switchgear, which, as at present installed, provides for one 3,000-KW. and one 5,000-KW. turbo-alternators, one 1,500-KW. motor-converter, and two 0·15-in. three-core feeders. The switchgear is situated in a locked room on the ground floor, and is of very substantial construction; the oil switches are mechanically operated from the control board on the first floor, which is illustrated herewith. The bus-bars are in duplicate, and provision is made for running



Ferranti Control Switchboard, Front and Back.

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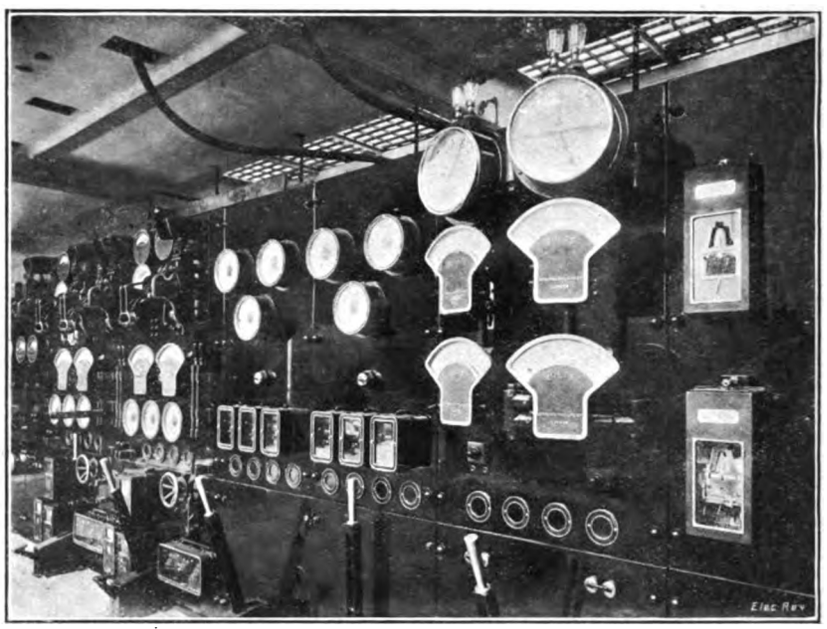
in conjunction with a supply from an external source, either in parallel or on separate districts. Merz-Price protection gear is provided for the feeders, and reverse power trips for the machines.

The excitation of the alternator exciters can be derived from either side of the battery, and an automatic change-over switch is fitted on the board, which cuts out the Taylor-Scotson regulator in the event of an accident to the booster, leaving the machines on hand regulation. The wiring of the control board is extremely simple and accessible, as shown by our view of the back of the board; pilot lamps show the position of each generator-switch, and to which set of bus-bars it is connected. Ammeters are provided in each phase, as well as power factor, power and energy meters for each machine, and the usual synchronising gear, &c.



Johnson & Phillips Switchboard at Dalston Lane Sub-Station.

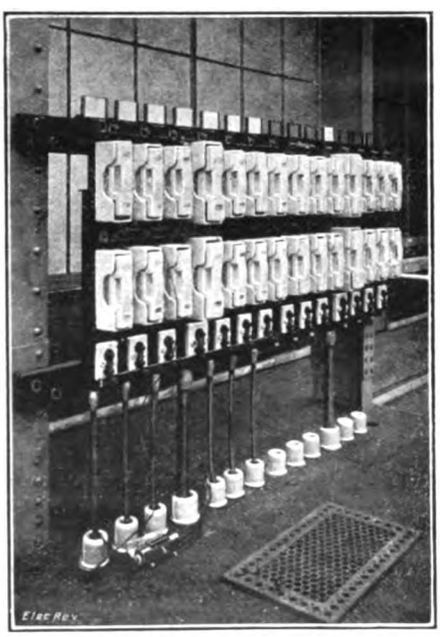
The Peebles-La Cour motor-converter in the power station is rated at 1,500 kw., 500-575 volts d.c., at 273 r.p.m., and has an efficiency of 92·25 per cent. at full load, 91·75 at three-quarter load, and 90·5 at half-load, when converting from a.c. to d.c. It is capable of carrying a much heavier load on occasion, and needs no adjustment at any load.

The e.h.t. feeders are laid out as ring mains, feeding three sub-stations; the old works will eventually become a fourth sub-station. The total length of conduit line is about 10,000 yards; six ducts are provided round the northern half of the ring, and nine round the south, and when these are filled, the capacity of the system can be doubled by laying mains across the middle of the ring. The ducts are of fibre, supplied by the Key Engineering Co., Ltd., 4 in. in diameter, and were laid in concrete by Messrs. Foote & Milne, Ltd., the total cost being £15,500.

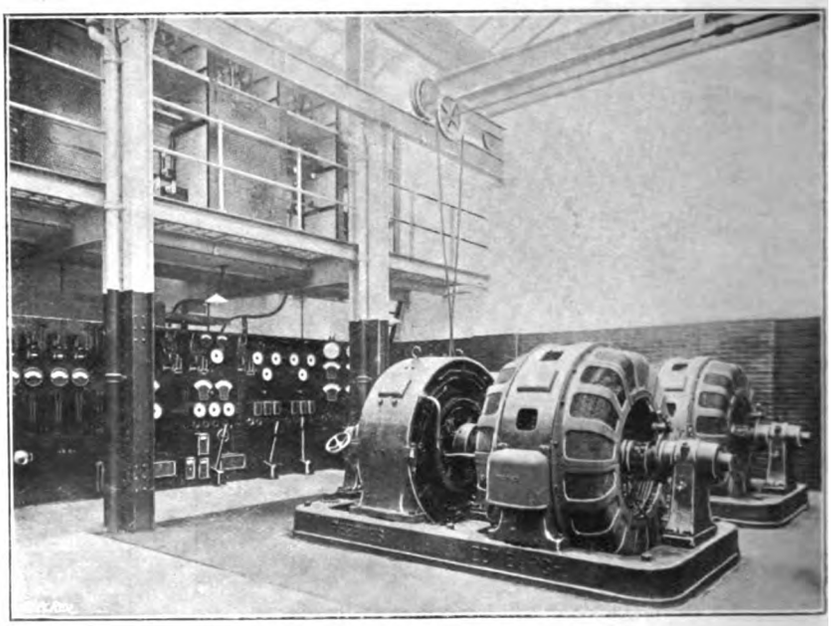
The feeder ring at present installed consists of one 0·15-in. three-core, paper-insulated, copper-shielded, lead-covered cable, made by the British Insulated & Helsby Cables, Ltd.; it is suitable for 11,000 volts working pressure, and was laid by the works staff. A three-core pilot cable, paper-insulated and lead-covered, for use in connection with the Merz-Price protection gear, and a six-pair signal cable, have also been drawn in.

Each of the sub-stations has at present a capacity of 1,000 kw., the plant consisting of six 500-kw. La Cour converters, having a full-load efficiency of 91·5 per cent. The switchgear was supplied by Messrs. Johnson & Phillips, Ltd., and is of their standard construction, the extra-high-pressure cells being on a gallery and the control and low-pressure feeder board on the ground floor, as shown in the view below. The oil switches are operated by levers and rods. Spark-gaps and Brazil earthing resistances are installed to deal with surges. The switchgear and measuring apparatus is, in general, similar to that at the power station, with duplicate bus-bars. The isolating switches are provided with triggers to prevent them from opening in the event of a short circuit. The d.c. change-over switches are fitted with double knife blades, so that a machine can be changed over without interrupting the circuit. At the right-hand end of the board is a panel for recording the pressure at a large number of feeding points.

A 10-ton hand-operated travelling crane by Messrs. Herbert Morris, Ltd., is provided in each sub-station.



Power Station Distribution Board.



Dalston Lane Sub-Station.

The low-pressure feeders, consisting of concentric and triple-concentric cables, paper-insulated and lead-covered, were supplied by the British Insulated and Helsby Cables, Ltd., and laid by the works staff, either armoured and direct in the ground, or on the solid system in earthenware troughs. The old feeders from the power station are being cut and looped in to the sub-stations, and by this means their carrying capacity will be increased nearly six-fold.

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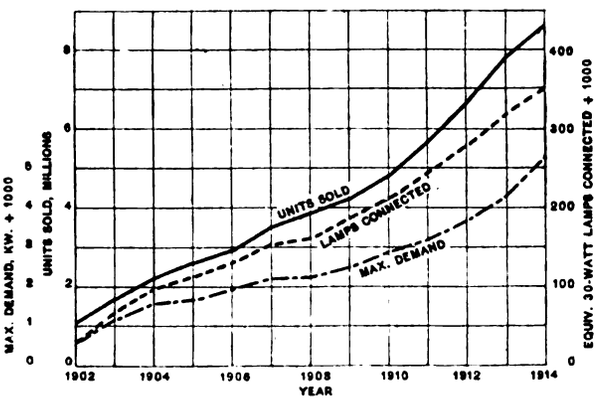
The total cost of the scheme, so far as it can be at present ascertained, amounts to £124,262, of which £63,926 was expended on the power station buildings and plant, and £60,336 on the transmission and distributing system. A 5,000-KW. turbo-alternator and condensing plant, by the same makers as the present set, will shortly be installed, at a cost of £15,750.

Much delay has been incurred in carrying out the scheme, mainly due to contracting difficulties, the lock-out in the building trades, the war, and the necessity of diverting one of the L.C.C. main sewers. The final result, however, reflects credit on all concerned, and the new system will ensure an adequate and economical supply of electrical energy to the borough, which has a population of nearly a quarter of a million.



In 1904 we published charts showing the progress made by the undertaking in the two previous years; we now give a diagram showing its growth during the whole period of its existence. The load has been largely lighting, and the load factor has remained fairly steady between 18 and 21 per cent. for many years; but power, heating and cooking have made remarkable progress of late, and a cold morning means a difference of 500 to 1,000 KW. to the demand, showing plainly that the number of radiators installed must be considerable. The Council also hires out B. & K. cookers, at 5s. or 7s. 6d. a quarter; these are going off well, and we have seen a letter from a very satisfied consumer who is enthusiastic in the praise of his electric cooker. Motors aggregating 6,842 H.P. are connected to the mains. The prices charged for lighting are 6d. and 1d. on the maximum demand system, or 3½d. per unit on the flat rate; for power £1 per quarter per KW. of max. demand, and ½d. per unit, or a flat rate of 1½d. per unit. A domestic rate of £2 per KW. per quarter in advance, and 1d. per unit, is also offered.

The Council undertakes electrical contracts and maintains a sales department, upon which a profit is shown. The cost of production for the last complete year was 0·70d. per unit, and the cost including loan charges, &c., was 1·34d.; the average price obtained was 1·55d., and a net surplus of £6,644 was recorded.

Our thanks are due to the Borough Electrical Engineer, Mr. L. L. Robinson, for facilities to photograph the works and for assistance in the preparation of this article; to which we add our congratulations upon the continued success of the undertaking under his control.

LIGHTING and POWER NOTES.

(*Concluded from page* 754.)

Manchester.—Loan Application.—The City Council is recommended to make application to the L.G.B. for sanction to borrow £543,000 for the establishment of an electricity generating station at Barton. The approximate cost of the scheme £1,775,000, is put forward by the Electricity Committee with reservation, as it is impossible, it says, to forecast electrical engineering developments for any length of time. It is, however, the scheme of which the present application forms a part.

Mayo.—Asylum Lighting Scheme.—The Mayo County Council has been informed that the Board of Public Works was not prepared to recommend the granting of a loan at the present time for installing electric light at Castlebar District Asylum, as the matter was not sufficiently urgent. It was resolved to postpone the scheme until after the war.

Newport (Mon.).—Loan Sanction.—The L.G.B. has sanctioned the application of the Corporation to borrow £16,150 for mains, services and plant, without deduction. No public inquiry was held.

Oldham.—L.G.B. Inquiry.—An inquiry was held on November 26th into the application of the Corporation to borrow £40,000 for turbo-generators, boilers, cooling towers, &c., at the Greenhill electricity station. The additional plant includes two 3,000-KW. turbo-alternators to supplement the existing 2,000-KW. A.C. supply, and is to meet the growing factory demand, some 12 contracts for A.C. supply, totalling 4,395 KW., having been entered into. There was considerable opposition to the proposal to add further cooling towers on the part of local property owners.

Perth.—Proposed Destructor.—The question of the introduction of a refuse destructor is being considered by the Corporation. A report to the T.C. states that assuming that it is most economical to work the destructor along with the electricity station, the cost of a modern installation should not exceed from £6,500 to £7,000. It is estimated that the total value of the destructor to the electricity department might be put at £1,055.

Salford.—New Plant Started.—The new 5,000-KW. turbo-generator, supplied by the British Westinghouse Co., was formally started last week. The set was manufactured and installed in 19 weeks, and it is proposed to add a similar unit later.

The Electricity Committee has entered into agreements with the Industrial Chemical Syndicate, the Bradford Dyers' Association, Ltd., and the Prestwich U.D.C. for the supply of energy.

Selby.—Prov. Order.—The U.D.C. has decided to oppose the application of the Yorkshire Power Co. for a prov. order to supply electricity in the district, and to apply for an order itself.

Southampton.—Prov. Order.—The Corporation has decided to apply for a prov. order to supply electricity within the parish of Bitterne.

The Electricity Committee has had under consideration the recommendations contained in the experts' report upon the Council's electricity undertaking, and has decided (1) to build up and maintain a reserve fund of £15,000, and to transfer the unappropriated balance at the end of March 31st, 1914, viz., £5,137, to depreciation and renewals fund; (2) to reduce by one-eighth of a 1d. per unit the charge for tramway current for power purposes, commencing with the next financial year.

Stanley.—Prov. Order.—The Electrical Distribution of Yorkshire, Ltd., intends to apply to the B. of T. for a prov. order to supply electricity for lighting purposes within the urban district.

Stoke-on-Trent.—L.G.B. Inquiry.—Mr. H. Ross Hooper conducted an inquiry on Wednesday, last week, into an application by the Borough Council to borrow £44,000 for electricity purposes, including £8,000 for supplying Fenton, £2,800 for supplying three-phase current from the new station to Goldendale, £14,056 in connection with the new central power house scheme. About £19,920 of the total represented over-expenditure, chiefly upon the central power house scheme. The remainder is made up of provision for future expenditure on mains and services and extensions, which will ensure every district of the borough having a supply of electrical energy. Goldendale is a manufacturing district in the northern part of the borough, from which applications have been received for motive power purposes.

At the inquiry it was arranged that the central power house should be the generating station for the county borough, and that the four old stations should be regarded and used as sub-stations for the supply of their respective districts.

As from April 1st last there will be only one set of accounts for the undertaking.

Tunbridge Wells.—Plant Extensions.—The T.C. has decided on the recommendation of the Electricity Committee to install a battery of two water-tube boilers complete with mechanical stokers, economisers, superheaters and induced draught plant, also a reservoir and cooling tower. Application is to be made to the L.G.B. for sanction to a loan to carry out the foregoing work as recommended by Mr. R. N. Torpy, the electrical engineer.

The T.C. has adopted the recommendation for additional heating at the Sanatorium, and this is to be carried out by the "Hestia" type of electric radiators, amounting in all to 24 KW.

Uxbridge.—Sewage Pumping.—The U.D.C. has under consideration the question of installing additional electric motors to drive the pumps at the sewage works.

Warrington.—Cottage Lighting.—The cottage homes of the Salford B. of G. at Culcheth are to have an electric lighting installation.

Whitehaven.—The B. of G. has referred to the Finance Committee for consideration and report the question of having the E.L. installed at the Union offices, which are at present supplied with gas.

Wimbledon.—The Electricity Committee recommends the Council to approve of the erection of a transformer station in Coombe Lane, at a cost of £195, also that the I.M.E.A. be informed that the Council is not prepared to incur the expense of complying with the provisions of the Borough Funds Acts in order to join in the promotion of the Association's Joint Private Bill.

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The Council has informed the Epsom R.D.C. that it intends to apply to the B. of T. for permission to supply electricity to premises in Great Avenue, Cleveland Road, Royal Avenue, Grafton Road, and Church Road, Worcester Park, and asking for the Council's consent to the supply being given. The electrical engineer reports that the cost of extending the mains from Malden to the roads mentioned, and of connecting 50 premises, would be £1,040.

TRAMWAY and RAILWAY NOTES.

Argentina.—A decree has been granted authorising the Empresa del Ferrocarril Oeste de Buenos Aires to proceed with the electrification of its services between the port of Buenos Ayres and the station Once de Septiembre, and between that station and Moreno.

The Anglo-Argentine Tramways Co. has deposited the plans with the municipality for the projected section of underground tramway between the Retiro station and the Plaza Constitucion, in Buenos Ayres. Construction is to be begun at several points at the same time, and the line is expected to be completed within a year from its commencement.

Australia.—ADELAIDE TRAMWAY TRUST ACCOUNTS.—The total operating expenditure for the year ended July 31st, 1914, amounted to £202,503; the net revenue accounts show that the excess of income over expenditure was £125,365, which, with interests and discounts, made a total of £126,306 carried forward for appropriation. The total revenue was £328,809, and the percentage of total operating expenses to total revenue was 61·5 per cent., as against 66·8 per cent. in the previous year. Interest paid to the Government absorbed some £60,000; third-party reserve, £3,467; reserve for renewals, £19,136; and sinking fund, £45,158. During the year over 43¾ million passengers were carried, and 5,325,660 car-miles were run. The total operating cost per car-mile was 9·12d., and the total revenue per car-mile 14·8d. The total route mileage in use was 51·8. Some 12½ million units were generated at the power station, and 9,838,000 were used for traction and car lighting. The maximum ½-hour load on the station was 3,600 KW., and the coal consumed per unit generated was 3·26 lb.

The annual report of the Freemantle municipal tramways for the year ended August 31st shows a credit balance of £14,000, and a net profit, after paying interest, &c., of £8,000.

Barnsley.—TRAMWAY ACCIDENT.—Owing to a car running away on a steep gradient, and subsequently leaving the track and colliding with a building, seven people were injured on Wednesday evening.

Canada.—The Ottawa Electric Railway Co. has been compelled to put up an auxiliary steam plant to augment its power owing to the unprecedented low water in the Ottawa River.

Chile.—ANTI-GERMAN RIOTS.—Due to an increase in the tramway fares at Valparaiso by the German-owned tramway company, serious disturbances have occurred, the cars and various buildings being stoned by the populace.

Continental.—PORTUGAL.—A decree has been issued by the "Ministério do Fomento," approving a contract entered into between the Portuguese Government and the Companhia dos Caminhos de Ferro Portuguese for the electrification and working of the existing steam railway between Lisbon and Cascais. The concession is for a maximum period of 50 years.

Croydon.—The T.C. has decided to have plans and estimates prepared for the reconstruction of the tramways in the diverted portion of Cherry Orchard Road.

Devonport.—TRAMWAY ACCIDENT.—On Friday, last week, a tramcar which had left the Dockyard and was proceeding down a steep incline, got out of control, jumped the rails and overturned. One man was killed and 20 injured, and one of the latter has since died.

Erith.—YEAR'S WORKING.—The annual report of the Council's tramway undertaking for the past year shows a gross profit of £4,644, an increase of £488. After paying all interest on loans, sinking fund and other charges, there was a deficit of £1,672, an improvement on the previous year of £470.

Edinburgh.—The Corporation has decided to give up the service of motor-'buses on certain routes. Various 'buses were taken by the Government, and the chassis of the remaining three have now been sold to the Scottish Motor Traction Co. The 'buses were petrol-electric driven and cost £807 each: the service was only inaugurated this year, and during the three months the 'buses were running the loss was £785 on working expenses. Edinburgh is served by cable cars and one short electric car line, and the motor-'buses were purchased this year to traverse routes off the cable line.

Halifax.—The revenue of the Corporation tramways from April 1st to the present week shows an increase over the takings during the like period of last year. The revenue to date has been £76,586, as against £73,800, an increase of £2,785.

Manchester.—B. of T. sanction has been received to the proposed laying of a double line of tramway in lieu of the existing lines in Queen's Road, Lamb Lane, Hulme Hall Lane, Pottery Lane, Gorton Lane, Belle Vue Street, North Road, and Stanley Grove.

Newcastle-on-Tyne.—S
annual meeting of the Corpo
November 26th, Alderman J.
working of the tramways for
gross receipts from traffic ha
£13,852; they had carried 31,0
six months, an increase of 3,014
of last year; and the total rec
£14,132. The total expendit
£6,912. The gross surplus was
this to £63,540, which was app
the half-year, £17,550; redemp
£2,755; turbine installation, £
the total to £46,018, against £
on the half-year of £17,522, co
half-year they had contributed
in the corresponding half-year,
£8,522. The present surplus
£100,000 again; but they were
by the end of the financial ye
something like £20,000 or £3
out of that fund. It would
half-year to make up the reserv

TELEGRAPH and

Baltic Cables.—The dir
vice has been interrupted, the c
and Libau, and Fredericia and
damaged, probably between Bo
that they have been cut by
between Russia and England
holm.—*Morning Post.*

Cutting Telegraph W
was on Saturday sentenced to
labour, for cutting and destro
Central Railway which connect
Harrow.—*Standard.*

France.—The French
installation of telegraphic con
Africa, at a total cost of 760,0

German Communicati
the German Colonial Office on
Colonies, contains references to
munication by cable and by
stations at Yap, Naru, Tasi
Pomerania), were destroyed b
Kamina in Togoland was de
and September. Communicat
August 25th. Most of the
sources external to Germany, i

New Telegram Rule.—
inland telegram will be require
before the telegram can b
requirement will be regarded
tered telegraphic address of th
of the message.

Post Office Telegraphs
General, issued this week, st
grams were transmitted, sho
revenue was £2,820,817, a d
diminished use of the telegr
competition with the telep
57,252, as compared with 51,1
for wireless stations numbered
licences were cancelled or laps
in existence on March 31st wa
previous year. At the same d
comprised 774,821 stations,
The number of effective calls d
increase of about 5 per cent.
fully in a later issue.

Secret Wireless Stat
Daily Mail states that, some
three men who posed as mi
Lower California, with an elec
be intended for locating under
their plant at Alamo, in Mexic
altitude of over 4,000 ft., and
telephone and telegraph lines
Ensenada made inquiries and
was a powerful wireless instal
40-H.P. generating plant, and
authorities, who arrested all
possession of the station. Th
trial, are reported to have
September at San Francisco.

The German steamer *Prens*
port, was found to have a se
the antenna being concealed
and the commander put unde

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A private German wireless station at Callao has been discovered, and the Allied Governments have protested to the Peruvian Government.

The Uruguayan Government has issued a decree prohibiting the installation and working of wireless telegraphs on shore as well as on vessels flying the Uruguayan flag unless permission has been obtained from the Government.—*Review of the River Plate.*

Submarine Signalling Apparatus.—In the Prize Court, on Monday, when the case of the *Schlesien* was considered, the Submarine Signal Co., an American firm, claimed that their signalling apparatus was only leased to the owners of the vessel, and, being neutral property, should not be condemned. The Court, however, found that the apparatus, not being merchandise, did not come under the Declaration of Paris; it was part of the ship, and the matter must be dealt with by the Executive.

Turkey.—The offices of the Eastern Telegraph Co. at Constantinople have been seized by the Porte and the staff dismissed. The English manager was arrested, but was liberated a few hours later.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—Corporation Electricity Department. Materials, including cast-iron work, wrought-iron, tubes and fittings, for one year. Mr. J. A. Bell, City Electrical Engineer.

Atherton.—The D.C. is to obtain revised tenders for a 500-KW. set of transformers in substitution for the 400-KW. set previously asked for.

Australia.—BRISBANE.—January 6th, 1915. Copper wire and accessories, paper-insulated lead-covered cable, for P.M.G. See "Official Notices" November 27th.

SYDNEY.—February 15th, 1915. Potentiometer, for the Municipal Council. Specifications (10s. 6d.) from the City Electrical Engineer, Town Hall.—*A. Mining Standard.*

Bacup.—T.C. One 100-KW. and one 50-KW. transformer. Manager, electricity works.

Colchester.—December 10th. Electrical sundries for three months, for Severalls Asylum. Mr. R. Overend, Clerk, the Asylum.

Dundalk.—December 7th. Steel towers for carrying cables, for G. N. Railway Co. (Ireland). Specifications, &c. (£1 1s.), from Engineer's Offices at Dublin or Belfast.

December 8th. Wiring for electric light installations in the artisans' dwellings at St. Brigid's Terrace, St. Patrick's Terrace and Cuchullain Terrace, for the U.D.C. Forms of tender from the Clerk's office, Town Hall.

December 21st. G.N. Railway (Ireland). Electric motors and accessories, sub-station switchboard, hard-drawn copper wire, bitumen wires. See "Official Notices" to-day.

Glasgow.—December 12th. The Corporation invites offers for the installation of electric lighting, telephones, bells and fire-alarms, required at Robroyston Hospital. Mr. W. W. Lackie, Electrical Engineer, 75, Waterloo Street.

Grimsby.—December 12th. 11,000 tons of fine slack coal, for the Electricity Department. Mr. W. A. Vignoles, Borough Electrical Engineer.

Hornsey.—December 29th. E.H.T. switchgear and E.H.T. three-core cable, for the Borough Electricity Works. See "Official Notices" to-day.

Johannesburg.—January 5th, 1915. Materials, renewals, &c., for tramway equipments, for Municipal Council.

London.—L.C.C. December 8th. (*a*) H.T. and L.T. switchgear, (*b*) gravity bucket ash conveyor, in connection with the tramways. See "Official Notices" November 13th.

December 9th. Installation, 160 wiring points, 210 lights, at Star Lane Elementary School, Fulham. See "Official Notices" November 27th.

H.M. OFFICE OF WORKS.—December 7th. Twelve months' supply of cable and wire. See "Official Notices" November 27th.

PORT OF LONDON AUTHORITY.—December 8th. Twelve months' supply of arc lamp carbons. Forms of tender from the Stores Superintendent, 106, Fenchurch Street, E.C.

Manchester.—December 16th. Corporation. Ten 50,000-lb. water-tube boilers complete; two 15,000-KW. turbo-alternators complete. See "Official Notices" November 13th.

December 21st. Corporation. Three reactance coils, for generating station. See "Official Notices" to-day.

Preston.—December 21st. Tenders are invited by the T.C. for the erection of new tramway offices, extension of car sheds, &c., in Deepdale Road. Forms of tender, &c. (£2 2s., returnable), from the office of the Borough Surveyor, Town Hall.

Spain.—Tenders have recently been invited by the municipal authorities of Oliva for the concession for the electric lighting of the town during a period of 10 years; by the municipal authorities of Campillo de Albobuey (province of Cuenca) for a period of 10 years; by the authorities of the town of Aldea del Rey (province of Segovia) for a period of four years; and by the authorities of the town of Olivares de Duero (province of Valladolid) for a period of six years.

December 13th. Tenders are being invited by the municipal authorities of Lillo (province of Toledo) for the concession for the electric lighting of the town during a period of 12 years.

Teddington.—December 7th. Electric lighting at the Council's sewage disposal and refuse destructor works. See "Official Notices" November 27th.

Walsall.—December 8th. Corporation. Six 250-KW. and one 500-KW. rotary-converter equipments. See "Official Notices" November 20th.

Walthamstow.—December 23rd. U.D.C. 1,500-KW. turbo-alternator, 600-KW. triple-expansion engine and dynamo, 1,000-KW. rotary or motor-converter. See "Official Notices" to-day.

West Ham.—December 10th. B. of G. Three months' supply of electrical fittings. Forms of tender from Mr. J. Smith, Clerk, Union Road, Leytonstone, N.E.

Winchester.—December 17th. Corporation. One 500-KW. D.C. turbo-generator, with condensing plant, pipework, &c. See "Official Notices" November 27th.

CLOSED.

Aberystwyth.—The T.C. has accepted the tender of the Chiswick Electricity Supply Corporation, Ltd., for electric light fittings for the Town Hall, at £21.

Atherton.—The D.C. has accepted the quotation of Messrs. Callender's Cable and Construction Co., Ltd., for 360 yards of twin concentric cable; also that of Messrs. G. Hanchett, Barrett and Co., of Pendleton, for one 250-K.V.A. transformer.

Australia.—The following tenders have been accepted:—

Public Service Department, Commonwealth.—
3 miles of switchboard cable, item 1, £229; 3 miles ditto, item 2, £408; 7 miles ditto, item 3, £1,645.—Siemens Bros. Dynamo Works, Ltd.

P.M.G.'s Department, N.S.W.—
22,000 standard battery cells, No. 1, £1,298; 1,500 ditto, No. 2, £151; 7,500 ditto, No. 3, £1,339.—Siemens Bros. Dynamo Works, Ltd.

P.M.G.'s Department, Victoria.—
18,318 standard battery cells, No. 1, £1,081; 200 ditto, No. 2, £20; 2,935 ditto, No. 3, £519.—Siemens Bros. Dynamo Works, Ltd.

P.M.G.'s Department, Queensland.—
200 standard battery cells, No. 2, £20; 400 ditto, No. 3, £71.—Siemens Bros. Dynamo Works, Ltd.

P.M.G.'s Department, South Australia.—
2,000 standard battery cells, No. 1, £118; 400 ditto, No. 2, £40; 200 ditto, No. 3, £35.—Siemens Bros. Dynamo Works, Ltd.

P.M.G.'s Department, West Australia.—
3,500 standard battery cells, No. 1, £215; 1,000 ditto, No. 2, £111; 700 ditto, No. 3, £130.—Siemens Bros. Dynamo Works, Ltd.

P.M.G.'s Department, Tasmania.—
400 standard battery cells, No. 1, £24; 100 ditto, No. 2, £11.—Siemens Bros. Dynamo Works, Ltd.

Home Affairs Department.—
Electric goods, lift, postal stores, Melbourne, £970.—Edmiston & O'Neill.

West Australian Tender Board.—
Insulated wire.—J. R. W. Gardam. —*Tenders.*

Blackpool.—The following tenders have been accepted by the Corporation:—

1,500-KW. turbo-alternator.—British Thomson-Houston Co.
25,000-lb. surface condensing plant.—Cole, Marchant & Morley.
24 c.i. switch fuse pillars.—Sykes & Sugden.
H.T. cable and copper trolley wire.—B.I. and Helsby Cables, Ltd.
L.T. cable.—W. T. Glover & Co.

Bolton.—The Electricity Committee has accepted the tender of the Rees Roturbo Co. for boiler feed pumps for Back-o'-th'-Bank works.

Coventry.—The City Council is recommended to accept the following tenders:—

Turbo-alternator.—British Thomson-Houston Co., Ltd., £10,210.
Four marine-type boilers.—Babcock & Wilcox, Ltd., £11,166.
Double stokers.—Bennis & Co., £2,220.
Four economisers.—Green & Son, £3,524.
Bunkers, boiler-house framework, and coal and ash-handling plant.—Bennis & Co., £11,016.
Induced-draught plant.—Babcock & Wilcox, Ltd., £3,595.
Pipework.—Stewarts & Lloyds, Ltd., £2,486.
Cast-iron tank.—Matterson & Co., Ltd., £360.
Cooling towers.—Worthington Pump Co., Ltd., £3,260.

Finchley.—The tender of Messrs. Blackmore & Co. has been accepted by the U.D.C. to supply 500 tons of Warwickshire peas coal to the electricity works, at 13s. 11d. per ton.

France.—The Electrical Engineering and Equipment Co., Ltd., are executing contracts for several thousand miles of telephone cable for the French Government.

Hebden Bridge.—The U.D.C. Electricity Committee has accepted the tender of the Tudor Accumulator Co. for 10 years' maintenance of the storage battery at the electricity works.

Hornsey.—The B.C. has accepted the tenders of Messrs. Bruce Peebles & Co., Ltd., at £2,170, for two motor-converter sets. Nine firms sent in tenders.

Ilford.—The U.D.C. has accepted the tender of Messrs. O. P. Driver & Son, Ltd., of Kettering, for a refuse destructor, at £7,918.

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London.—The Metropolitan Asylums Board has accepted the tender of Messrs. Toy & Winslow, at £31, for the provision of electric light at the North-Western Ambulance Station; also that of Messrs. J. W. Gray & Son, at £98, for the installation of a system of internal telephones at South Wharf.

Messrs. Duncan Watson & Co. have secured, against keen competition, the Post Office contract for vacuum cleaners.

Messrs. Johnson & Phillips, Ltd., have received an order from H.M. Office of Works for the supply and erection of new power cables for technical purposes at the Imperial Institute, together with necessary switchgear.

Manchester.—The Tramways Committee has accepted the tender of Messrs. Williams, Harvey & Co. for block tin, and that of Messrs. Smith & Forrest for pitch.

The Electricity Committee has accepted tenders of the B.I and Helsby Cables, Ltd., and the Macintosh Cable Co., Ltd., for cable.

Shipley.—The U.D.C. has accepted the following tenders for coal at the electricity works :—

Fyfe, Kemp & Co. ..	1,500 tons	A. Kendall & Sons ..	1,000 tons
J. Wade..	1,500 ,,	Fletchers, Ltd. ..	1,000 ,,

Pollard & Co., 1,000 tons.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, December 4th, at 8 p.m., at Storey's Gate, S.W.; Tuesday, December 8th, at 8 p.m., at Portico Library, Mosley Street, Manchester; and Thursday, December 10th, at 7.45 p.m., at the University, Edmund Street, Birmingham. Thomas Hawksley Lecture on "Pumping and other Machinery for Waterworks and Drainage," prepared by the late Mr. W. B. Bryan, and read by his son, Mr. B. W. Bryan.

Junior Institution of Engineers.—Friday, December 4th. At 8 p.m. At 39, Victoria Street, S.W. Paper on "A Reversible Turbine," by Mr. S. E. Hutson.

Greenock Electrical Society.—Saturday, December 5th. Visit to Coplawhill Car Works and sub-station of the Glasgow Tramways.

Thursday, December 10th. At 7.45 p.m. At Masonic Rooms, 21, West Stewart Street. Paper on "The Electrical Equipment of a Liner," by Mr. J. E. Allan.

Salford Technical and Engineering Association.—Saturday, December 5th. Annual meeting.

Royal Institution of Great Britain.—Monday, December 7th. At 5 p.m. At Albemarle Street, W. General meeting.

Society of Engineers.—Monday, December 7th. At 7.30 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Ordinary meeting.

Association of Engineers-in-Charge.—Wednesday, December 9th. At 8 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Electricity in the Printing Office," by Mr. F. Broadbent.

Institution of Electrical Engineers.—Thursday, December 10th. At 8 p.m. At Victoria Embankment, W.C. Paper on "Automatic Protective Switchgear for Alternating-Current Systems," by Mr. E. B. Wedmore.

(**Scottish Local Section**).—Tuesday, December 8th. At 207, Bath Street, Glasgow. Paper on "The Magnetisation of Iron at High Flux Density with Alternating Currents," by Mr. J. S. Nicholson.

Electro-Harmonic Society.—Friday, December 11th. At 8 p.m. At Holborn Restaurant. Smoking concert.

Northampton Polytechnic Institute.—Friday, December 11th. At 8 p.m. At St. John Street, Clerkenwell, E.C. Annual prize distribution by the Right Hon. Lord Moulton of Bank, F.R.S.

North of England Institute of Mining and Mechanical Engineers.—Saturday, December 12th. At 2 p.m. At Newcastle-on-Tyne. General meeting.

North-East Coast Institution of Engineers and Shipbuilders.—Saturday, December 12th. At 7.15 p.m. At Newcastle-on-Tyne. Paper on "Stability," by Mr. P. Y. Brimblecombe.

NOTES.

The "Electrical Review" during War Time.—As announced in our issue of last week, we shall be pleased to send the ELECTRICAL REVIEW gratuitously to any of our readers who may be serving with the naval or military forces and would like to keep themselves in touch with doings in the electrical world. This offer particularly relates to readers who have left these shores since the beginning of the war, either for active service in the fighting line in France and Belgium or in the Fleet, or for service in Egypt, India or other foreign parts. As the men concerned may not have an opportunity of seeing this notice, we shall be greatly obliged if their friends or acquaintances who know their whereabouts will let them know of our offer, and ask them to communicate their names and addresses to the Manager, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. The matter will then have immediate attention.

Fatalities.—WOLVERHAMPTON.—The inquiry into the cause of death of Thomas Henry Simcox, a tramcar-driver, was resumed on Saturday. The proceedings at the previous sitting were reported in our last issue.

Arthur Millward Pitchford, tramcar conductor, was re-called. In reply to Mr. A. Turton, who represented the relatives of the deceased, witness said the usual method of dragging a car on to the line with a drawbar from another car could not be adopted in this case because both ends of the derailed car were too far off the metals. In witness's opinion the current was going through the deceased until it was switched off, but he had no proof of this.

Bertram Painter, conducto
(Simcox's), which was at r
car went on to the loop, an
cars were connected by me
the front of witness's car and
The deceased told witness t
buffer, Pitchford being instr
rail to complete the circuit
feet. Witness then took th
towards Pitchford. At thi
came into contact with the
the normal way. Shortly aft
and heard a curious gasping
Simcox had had a shock.

Joseph Dixon, motorman, s
and Painter.

Mr. W. A. Luntley, genera
ways, said the car was in pro
it he did not think Simcox c
working voltage of the tramw
consideration had no refere
contact system, the wiring be
cars.

Mr. Lee, consulting electric
Co., Birmingham, was called
sented the insurance compa
thorough knowledge of the
car, and had come to the co
been killed by shock unless
the time when the car was
would only have passed throu
easiest path for the current.
at the time he collapsed prov

Dr. A. M. Bankier, who ha
to November 11th for influen
he examined Simcox there
shorten life or to give rise to
by the post-mortem examina
from disease. Witness agre
Black, of the hospital, as to
nation. The conditions were
shock as described in books.
in any other way.

Dr. W. F. Chalmley, hon. s
Hospital, deposed that he ha
The disease of the heart w
death. The condition of t
cases of sudden death. Wi
from heart disease. Questio
he could not understand any
diseased.

The Coroner having summ
verdict, and on their return
to be due to an accidental el
no reflection whatever on the

Appointments Vaca
works (15s.), for borough of
two junior engineers (30s.),
for Bolton electricity dep
engineer (£250), for Croydo
(£3 10s., £3, £2 15s., £2 10
(£3), two shift engineers (£
three fitter-drivers (35s.), fou
generating station in the S
(£13 per month), for Lancas
engineer (25s.), for Sevenoa
tant electrical engineer (te
engine-driver, mechanical an
Camberwell; switchboard
poration. Particulars are g

The Electro-Harmo
Concert of this Society will
(King's Hall), on Friday ev
8 o'clock. Mr. W. J. Ten
programme is as follows :-
Herbert Heyner (baritone)
Will Edwards, Mr. Ben O
(magician); Mr. Selwyn Dr
pianoforte and accompanist

Cheap Electric Tru
Co. has built new manufac
where it will build a low-
$875, with a mileage of 35-4
turn out 3,000 cars a year;
house motor, Timken axles,
10-12 miles an hour. One
New York Electrical Show
season.

Inquiries.—Makers o
in diameter outside, for co
instruments, are inquired fo

A reader asks for refere
with electric cooking appar

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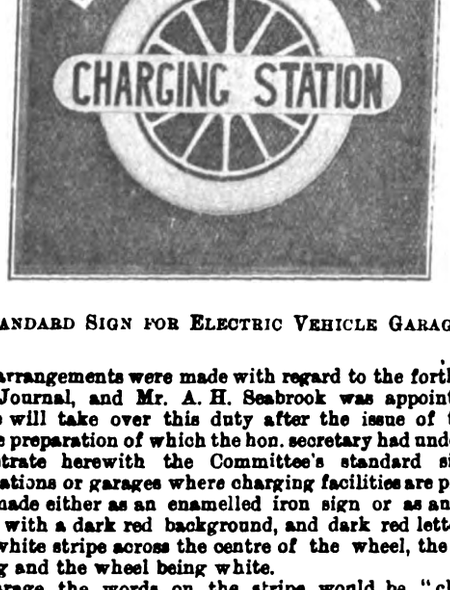
The Electric Vehicle Committee.—The Committee having considered the standard charging plug and receptacle has decided that it would simplify matters if, at the present time, the plugs were made for one size of cable only, viz., one having conductors of 0·1 sq. in. section, the earth wire remaining of the section already recommended.

The Committee also had before it some suggestions made by panel "E" of the Engineering Standards Sub-Committee on Electrical Plant and, as a result, it was decided further to revise the specification, which is now being reprinted.



E.V.C. Standard Sign for Electric Vehicle Garages, &c.

Further arrangements were made with regard to the forthcoming Quarterly Journal, and Mr. A. H. Seabrook was appointed hon. editor. He will take over this duty after the issue of the first number, the preparation of which the hon. secretary had undertaken.

We illustrate herewith the Committee's standard sign for charging stations or garages where charging facilities are provided. It may be made either as an enamelled iron sign or as an illuminated sign, with a dark red background, and dark red letters on a horizontal white stripe across the centre of the wheel, the rest of the lettering and the wheel being white.

For a garage the words on the stripe would be "charging garage." The size suggested is 2 ft. 6 in. square.

Institution and Lecture Notes.—Association of Supervising Electricians.—A large number of members and visitors dined at the London Tavern, Fenchurch Street, last Saturday evening, under the chairmanship of their President, Mr. A. H. Dykes, who, in the course of a speech, outlined the ideals of the Association, the work it had already accomplished, and all that still lay before it. He said that the evening's entertainment was not solely a convivial gathering; it was part of their scheme for bringing fresh recruits into their ranks, making better known to one another those who in the ordinary routine of life were in the keenest competition, and creating a smoother relationship as between manufacturer and contractor. Mr. Dykes paid a glowing tribute to the work of the British electricians in France, whose searchlight, telephone, and telegraph service had been, and would be in increasing measure, of incalculable aid to His Majesty's Forces. Officers confirmed this every day. He made special reference to one of the principal objects of the Association—their fostering of the apprenticeship system. After this war there would be a vast amount of work in the electrical trades, work which in the past had been done by those who were now their enemies, and any man who taught a boy these trades, rather than allow him only to run errands, was doing good work for his country.

In response to the President's appeal, the sum of £4 17s. was subscribed by those present for the Belgian refugees.

After dinner the company were entertained by some clever artistes, under the direction of Mr. T. Clayton, one of the members, who himself contributed the recruiting song, "Fall In."

The hon. secretary, Mr. Banister, announced that they had a total of 72 members, and invited gentlemen in the manufacturing and contractors' trades to endeavour to get others to join whom they knew to be eligible.

Institution of Electrical Engineers.—At the meeting of the Manchester Local Section on Tuesday last Mr. W. M. Selvey's paper on "Power Plant Testing" was read and discussed.

At the meeting of the Yorkshire Local Section on Wednesday the same paper was read, and the discussion was adjourned.

Midland Institute.—At a meeting of the Midland Institute of Mining, Civil and Mechanical Engineers at Sheffield on Friday last, Mr. H. R. Webster read a paper on "A Fire-damp Indicator." He said that the electric lamp had come to stay, but as it could not detect the presence of gas, he had devised an instrument for that purpose based on the principle of osmosis. The working of the instrument was explained and demonstrated. Mr. W. Maurice read a paper on "The Case for the Electric Lamp," and emphasised the importance of the proper management of electric lamp-rooms. The President, Mr. W. Hargreaves, stated that since the introduction of the electric light at Messrs. Briggs's collieries, men who had been receiving compensation for nystagmus had returned to work, and Dr. Court said that, in his opinion, the improved lighting would in time do away with the disease.

Junior Institution of Engineers.—Mr. C. E. Ford last Friday read a paper on the subject of "A Model Drawing-Office System." The manufacture of small and complicated apparatus, he said, such as was met with in electrical instrument making, lent itself admirably to systematic subdivision, which was required in order to avoid waste of time and material. The system, as laid out, aimed at obtaining all that was necessary:—(*a*) For manufacturing; (*b*) To avoid overlapping, and to bring about uniformity and interchangeability of manufacture; (*c*) For order and sales execution. For the working of the system four kinds of drawings were necessary:—(1) Stock sheet; (2) Assembling; (3) Part drawing; (4) Partial assembling drawing. After explaining the system, the author mentioned that although he only dealt with it as applicable to electrical apparatus, it could be applied with equal efficiency to any branch of engineering where a large amount of repetition work was in operation.

The first meeting for the new session of the Sheffield and District Section was held on Friday last, when Mr. E. B. Christmas gave an address on "Electric Furnaces."

Italian Trade.—An agent in Italy wishes to represent British makers of electric lamps and apparatus. Address inquiries to the British Consulate, Milan.

Fire.—A fire on Tuesday burnt out a two-storey building, used for the storage of electrical goods and patterns, forming part of the large works of Messrs. R. Johnson & Nephew, Ltd., wire drawers and manufacturers, Manchester. The Fire Brigade prevented the spread of the flames to other buildings.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Heston and Isleworth Electricity Committee has decided to increase the salary of Mr. M. J. O'Brien, mains foreman, to £162 10s., rising to £200 per annum. In future, Mr. O'Brien's designation will be "mains engineer."

Mr. L. E. Comley has resigned the post of publicity engineer to the Torquay electricity department, in order to accept a post with Messrs. Belling & Co., electric heating and cooking specialists, London.

The Maidstone T.C. has decided to pay Mr. E. E. Hoadley, borough electrical engineer, £100 for extra services rendered during the year ended March 31st, 1908.

The Erith U.D.C. has accepted the resignation of Mr. Coveney, electrical engineer and tramway manager, and has placed on record its appreciation of his 9½ years' services.

Mr. F. Woods, of the Lancashire Electric Power Co., Radcliffe, has been appointed to the post of station superintendent at the Rawtenstall Electricity Works. There were 77 applicants, five of whom were interviewed.

General.—The Salford Council is to be recommended this week to appoint Mr. Ernest B. Martin, M.I.C.E., of Rotherham, to the post of borough engineer in succession to the late Mr. Joseph Corbett. Mr. Martin is at present borough and water engineer of Rotherham, and also tramways permanent-way engineer.

Mr. W. R. Brown, A.M.I.E.E., is resigning his appointment with the A.E.G. Electric Co., Ltd., London, from December 12th.

The Mayor of Blackburn (Alderman Thompson) has been appointed chairman of the Blackburn Electricity Committee, with Councillor Higham as vice chairman.

Councillor T. Wilkinson has been re-elected chairman of the Lancaster Electric Tramways Committee.

Mr. A. B. M'Donald, city engineer, and Mr. J. Fleming, treasurer of the gas and electricity department, of Glasgow, are retiring, the former on a pension of £500, and the latter on one of £340 per annum.

For the current municipal year, Alderman Dudley Stuart, M.I.E.E., has been again elected chairman of the Electricity Committee of Wimbledon Corporation.

Councillor James Heald, electrical engineer, has been re-elected chairman of the Electricity Committee of the Lancaster Town Council.

On Tuesday, Bailie Robert Kirkland, the convener of the Glasgow T.C. tramways, was made a recipient of a presentation on behalf of the members of the Corporation, on the occasion of his approaching marriage. The presentation, which took the form of a solid silver tea and coffee service and a silver salver, was made by Lord Provost Dunlop.

Mr. R. Moritz, a barrister-at-law, has been re-elected chairman of the Hornsey Borough Council's Electricity Supply Committee.

For the appointment of resident engineer at Whalley Asylum 471 applications have been received by the Asylums Board, and the successful candidate is Mr. Fred Riley, at present power superintendent at the Rawtenstall Corporation electricity works. The salary is £275.

Since our "War Items" went to press news has reached us to the effect that Mr. C. Maurice Down, son of Mr. F. J. Down, who

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has been connected with the electrical industry for so many years, has been injured in action at the Front and he is now in a London hospital (Lady Mason's), doing well. Mr. Maurice Down, who is a sub-Lieut. in the 1st Hertfordshire Regiment, arrived in France on November 6th, and reached the base two days later. His regiment was soon in the trenches supporting the brigade of Guards, and eight days of bad weather was experienced. Mr. Down was shot on November 19th, his hand and wrist being smashed. It is expected that he will soon be ready to return to France.

Obituary.—MR. W. ADAMS.—The death has taken place of Mr. W. Adams, who was in business as an electrican at Ashdown Road, Kingston-on-Thames, for about 18 years.

NEW COMPANIES REGISTERED.

Jersey Electric Lighting and Power Co., Ltd. (138,351).—For Druce, Walker & Co., Ltd., on p. 731 of our last issue, read Durell, Walker & Co., Ltd.; and for S. N. Druce read S. L. Durell.

London Battery and Manufacturing Co., Ltd. (138,393).—This company was registered on November 23rd, with a capital of £100 in £1 shares, to carry on the business of manufacturers of electric refill batteries for pocket and other lamps. The subscribers are: W. T. Clarke, 8, New Oxford Street, W.C., electrical engineer, 50 shares; R. W. Gale, 259, Goldhawk Road, W., clerk, 25 shares; W. H. R. Hargrave, 24, John Street, Bedford Row, W.C., solicitor, 25 shares; private company. The number of directors is not to be less than 3 or more than 5; the first are W. T. Clarke, R. W. Gale (chairman), and W. H. R. Hargrave. Qualification £5. Registered office: 17, 19 and 21, Emerald Street, Theobald's Road, W.C.

Thomson-Bennett (Magneto) Ltd. (138,397). — This company was registered on November 23rd, with a capital of £5,000 in £1 shares, to carry on in England and elsewhere the business of manufacturers of electrical and other component parts, accessories and fittings used in the construction, starting, running, driving and regulation of stationary engines or motor vehicles for use on land, water or in the air, etc. The subscribers (with one share each) are: W. E. Godfrey, 9, Kingsley Road, Sparkbrook, Birmingham, clerk; G. E. Mason, 9, Drews Lane, Ward End, Birmingham, clerk; private company. The number of directors is not to be less than 2 or more than 5; the subscribers are to appoint the first. Qualification, 1 ordinary share. Solicitors: Dale & Co., Birmingham. Secretary: W. H. Hughes. Registered office: "Arden Works," Cheapside, Birmingham.

Midland Magneto Co., Ltd. (138,430).—This company was registered on November 26th, with a capital of £1,000 in £1 shares, to carry on the business of manufacturers and agents for and dealers in magnetos, accumulators, dynamos and motor and other engines, electricians, machinists, etc. The subscribers (with one share each) are: W. T. Church, 116, Golden Hillock Road, Small Heath, Birmingham, secretary; E. A. Simpson, 1, Cheddar Road, Balsall Heath, Birmingham, clerk; private company. The number of directors is not to be less than 2 or more than 5; the subscribers are to appoint the first. Qualification 50 shares. Solicitors: Jeffery, Wild & Lovatt, 95, Colmore Row, Birmingham.

Acetylene and Carbide, Ltd. (4,206).—This company was registered in Dublin on November 26th, with a capital of £500 in £1 shares, to carry on the business of manufacturers and sellers and buyers of electro-chemical products, electricians, mechanical engineers, etc. The subscribers (with one share each) are: C. Bingham, 11, Queen Victoria Street, E.C., merchant; A. S. Young, 11, Queen Victoria Street, E.C., merchant; private company. The number of directors is not to be less than 3 or more than 7; the first three are to be appointed by the subscribers. Registered office: City Chambers, 143, Royal Avenue, Belfast.

N. I. Z., Ltd. (138,421).—This company was registered on November 25th, with a capital of £6,000 in £1 shares, to carry on the business of electro-chemists, platers and typers, metallurgists, electricians, electrical engineers, etc. The subscribers (with one share each) are: B. Baines, 17, Green Street, Leicester Square, W.C., solicitor; C. W. Denny, 22, Edwardes Square, W., engineer; private company. The number of directors is not to be less than 2 or more than 5; the first are not named. Qualification 100 shares. Registered office: 1-2, Old Pye Street, Westminster, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Vaughan and Son, Ltd. (61,526).—Capital, £50,000 in £1 shares (20,000 preferred). Return dated September 25th, 1914. 16,580 preferred and 26,789 ordinary shares taken up. £43,369 paid. Mortgages and charges, £5,000.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Acknowledgment of further indebtedness dated 10th November, 1914 (supplemental to trust deed dated 16th October, 1913), to secure £100,000 5 per cent. debenture stock ranking pari passu with £400,000 like stock secured by principal deed, charged on electrical undertakings and lands and company's undertaking and other assets, present and future, except uncalled capital. Trustees: Law Debenture Corporation, Ltd., 41, Threadneedle Street, E.C.

Chipping Norton Electric Supply Co., Ltd.—Particulars of £4,000 debentures, created 10th November, 1914, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

H. W. Smith and Co., Ltd. (123,953).—Capital, £5,000 in £1 shares. Return dated October 5th, 1914. 3,200 shares taken up; £1,200 paid; £2,000 considered as paid. Mortgages and charges: Nil.

Hydro-Electric Co. Concessions, Ltd.—Further charge on company's uncalled capital dated 25th November (supplemental to mortgage dated June 29th, 1914) to secure £250. Holders: Coutts & Co., 15, Lombard Street, E.C.

Suffolk Electricity Supply Co., Ltd.—Issue on 24th Sept., 1914, of £625 debentures, part of a series of which particulars have already been filed.

Yarmouth (I.W.) Electricity Supply Co., Ltd. (56,884).—Capital, £5,000 in £5 shares. Return dated April 14th, 1914. 361 shares taken up; £1,805 paid. Mortgages and charges: Nil.

Dick, Kerr and Co., Ltd. (63, 407).—Capital, £650,000 in £1 shares (350,000 preferred). Return dated October 29th, 1914. 305,000 preference and 260,000 ordinary shares taken up; £565,000 paid. Mortgages and charges: £236,930.

Feld Bros. and Co.,
£1 shares. Return dated Oct
per share called up on 404 sh
the remainder. Mortgages and

Bat Meter Co., Ltd.
shares (12,000 preferred). Retu
and 8,000 ordinary shares take
and 15s. per share on 10,260
paid on 8,000 ordinary shares.

Electric Supply Co. o
£325,000 in £1 shares (175,000
170,375 preferred and 125,000
up on 45,382 shares; £45,382
mainder. Mortgages and charg

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MR. A. W. TAIT presided o
held at Winchester House
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in coal-handling and con
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Africa general business h
results were not so sat
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outbreak of war there w
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for the War Office, and
they were seriously look
factures which would be

Cordoba Light. P

After providing for deben
year to September 30th sh
forward, of £44,321. Aft
shares, £26,321 is carried

Barcelona Tractio

The board have decided to
the half-yearly coupon du
first mortgage bonds, as
continue the arrangement
financial group for provid
the completion of the co
tion. The board, howeve
would provide the comp
tinuing and completing
the adjustment of matu
works, it is stated, will
to meet the bond and
the company at present
with a steadily increasing

Venezuela Telepl

Co., Ltd.—The account
a profit, including £8,728
providing for interest o
commend a dividend of
account of arrears and
renewals and depreciation
—*Financial News.*

Callender's Share

A financial daily states
August 31st show a profit
&c., and including £2,6
directors recommend a
5 per cent. for the year, a
£2,921 to be carried forw

Stock Exchange N

to the Committee to appo
a quotation to :—

Montreal Light, Heat and
stock (Montreal Certificates).

R. & J. Dick,

August 31st show a net
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Mackay Compani

of 1¼ per cent. on the co

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West India and Panama Telegraph Co., Ltd.

The report for the six months ended 30th June, 1914, showed that the amount to credit of revenue was £41,482, against £15,524 for the corresponding half-year of 1913, and the expenses were £26,900 against £26,261. The balance was £14,582, plus £1,724 interest on investments, and £1,905 brought forward, making an available total of £18,212. Dividend on the first preference shares, six months to 30th June, 6s. per share, absorbs £10,369; second preference dividend, six months to 30th June, 6s. per share, £1,401; dividend on the ordinary shares, 1s. 3d. per share (free of income tax), £5,520; leaving £922 to be carried forward. The traffic receipts show a decrease of £4,482, arising to a great extent from the competition at Porto Rico referred to in the last report. In the directors' report for the corresponding period of last year it was stated that negotiations were pending with the Imperial and Canadian Governments for a reduction of rates in return for subsidies. The result of these negotiations is that the Imperial and Canadian Governments have granted a joint subsidy of £16,000 a year for ten years on terms and conditions fully set out in a Parliamentary paper. The subsidising Colonies in the West Indies have also agreed to renew the local subsidies of £10,300 for a like term of years. The contract giving effect to these arrangements was sealed on the 10th August and ratified by the House of Commons on the 26th August; and the reduced rates came into operation on the 1st October, from which date the new subsidy of £16,000 a year will become payable. The Danish Islands of St. Thomas and St. Croix have also renewed their subsidies, amounting to £800 a year, for a period of ten years, in consideration of a reduction in tariffs, which became effective from the 1st October. The directors propose to subscribe 200 guineas to the Prince of Wales's National Relief Fund.

Mr. W. B. Kingsford (Chairman) presided at the annual meeting, at Winchester House, on November 25th. In moving the adoption of the above report, the Chairman first referred to the retirement of Mr. R. T. Brown, the manager and secretary, through ill-health, after an almost continuous service of 40 years. The directors wished to place on record their high appreciation of the faithful and valuable services he had rendered to the company both at home and abroad. He was sure the shareholders and the staff would share in the regret felt by the board in Mr. Brown's retirement. They had appointed Mr. Quick, the company's accountant, to be manager and accountant, and Mr. J. Winser to be secretary. Both of these officials had had about 40 years' experience of the company's affairs. As was stated at the half-yearly meeting, it was thought desirable that he should visit the company's stations in the West Indies, as he had not been there since 1904. Several important matters connected with the company's interests were under consideration in the various colonies, and it was felt that these could be satisfactorily dealt with personally rather than by correspondence. He visited the Isthmus of Panama, Demerara, and all the islands with the exception of Gaudeloupe, and they would be glad to hear that his visit was a satisfactory one. He had little to comment upon in the accounts. The traffic receipts exhibited a decrease of £4,482. A considerable percentage of the falling off was owing to the less general activity in Porto Rico and the competition in the telegraphic business on that island. On the debit side of the accounts the expenses were £26,900 as compared with £26,260 in the corresponding period of 1913, an increase of £640, or about 2.4 per cent. It would be noticed that this increase in the expenses was more than accounted for by one item alone, *viz.*, the extra cost of cable used in repairs, which amounted to £2,096, as compared with £1,217. They would have noticed the paragraph regarding the result of the negotiations with the Imperial and Canadian Governments for the reduction of rates in return for an increase of subsidies. Both the reduction in rates and the increase in subsidies came into operation on October 1st, and it was too early yet to say what the result of the first month's working would prove to be. It was likewise impossible this time to forecast, as he usually did, the result of the traffic receipts for the current half-year up to the present time. He might say, however, that for the month of July they were about the same as for July last year. In August and September, owing to the war, the volume of traffic was very largely in excess of the corresponding months in any previous year since the Spanish-American War of 1898; but until their returns were received and they had cleared accounts with connecting companies it would be somewhat haphazard to say what the effect would be in £ s. d. They could, however, reasonably hope that for these two months the increase would be a satisfactory one. On the other hand, their working expenses would be in excess of what they usually were. Their British stations were practically taken over by the Government, and were required to be kept open day and night without intermission, and as their staff was only large enough to deal with the traffic of an ordinary working day of eight hours much overtime had been imposed upon their clerks, for which they had agreed to pay them. They would readily understand that the strain upon their officials was great, and he could not speak too highly of the willingness with which they had accommodated themselves to the unusual circumstances that had been forced upon them.

Mr. G. Von Chauvin seconded the motion, and it was carried.

Provincial Tramways Co., Ltd.

Mr. Andrew Beattie, D.L., J.P., presided, on Friday last, over the annual meeting held at the offices, Moorgate Station Chambers, E.C.

In proposing the adoption of the report, the Chairman, after referring with regret to the loss the company had sustained in the death of Mr. John Glenn, who had been connected with the company as a director almost since its foundation, said that the profits for the year amounted to £40,297. That was a little less than a year ago, but under present circumstances he thought it might be considered as satisfactory. On the 1st August last the receipts were some £4,534 in excess of 1913; on the 4th August war was declared, the result of which was an enormous decrease in the daily receipts, which lasted until the end of the financial year. These decreases had to be deducted from the increase they had on August 1st, which reduced the £4,534 to only £1,623. He asked them not to find fault with the directors for this, but to place the blame on the real culprit—the Kaiser. In place of having an increase of £6,000 to £7,000 that they would have had if war had not taken place, the increase was reduced to £1,623, which they looked upon with complacency. With regard to the balance sheet, the reserve and depreciation account showed an increase of £5,059, after making the necessary writings off the various local companies' accounts. There was an increase of £2,000 in the reserve for third party insurance, and a decrease of £542 in the net revenue account. Referring to the proposed distribution of the profits, he regretted that they did not see their way to pay 8½ per cent. as they did last year. They believed it more prudent to reduce the dividend to 7½ per cent. and to increase the carry-over. They did not know what was in store for them, and the slight reduction was very little taking the present position into consideration, and having regard to what other trading companies were doing. They had spent a considerable amount on the permanent way, plant and buildings—£6,000 during the year—as it was important to keep the property in a state of efficiency. Their entire rolling stock, permanent way, and other property was well maintained, and had it not been for the war this would have been by far the best year in the history of the company. As to the future, no one could tell what might happen. Many rumours were afloat, but so far as they could judge, after a few months they might hope to enjoy peace and quietness once more. The money spent by reason of the war would have to be paid by the nation generally, and they would do their part gladly. As to the future, he was glad to tell the shareholders that since the 1st October last they were roughly £2,000 better off in receipts than in the corresponding period of last year. They were working the concerns as economically as possible, and although there were certain unavoidable increases in wages and other items of expenditure, it was pleasing to know that the increased traffics were more than sufficient to meet these, and, at the same time, to leave something substantial in hand for the shareholders. They hoped next year to meet them with a good balance sheet, but much depended upon the speedy termination of the war.

Mr. S. Horn, in seconding the motion, said he thought they must all agree that, seeing how they had been handicapped by the war during the best two months of the year, the results were very satisfactory. The shareholders must not go away with the idea that, because up to the moment they had done very well so far this year, the year on the whole was going to be anything like as good as its predecessor. He was afraid they would feel the effects of the war very seriously in the current year, both as regarded increased expenditure and decreased traffics. If, therefore, the dividend was considerably reduced next year they must not be disappointed.

The report was adopted.

Subsequently a resolution was unanimously passed approving of the action of the directors in contributing £210 to the Prince of Wales' National Relief Fund.

Mexican Light and Power Co.—The board states that the condition of affairs in Mexico shows no sign of improvement, and it has no alternative but to defer the payment of the half-yearly coupon due December 1st next on the 6 per cent. second mortgage 50-year bonds.

Brazilian Traction, Light and Power Co., Ltd.—A dividend of 1½ per cent. for the three months ending December, on the 6 per cent. pref. shares, is announced.

Central Electric Supply Co., Ltd. — Warrants for interest on the 4 per cent. guaranteed debenture stock for the half-year to November 30th have been posted.

British Electric Traction Co., Ltd. — The directors have declared the dividend on the 6 per cent. cumulative preference stock for the half-year ended September 30th.

Canadian General Electric Co., Ltd.—A quarterly dividend of 1¾ per cent. is announced on the common stock for the three months ending December 31st.

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STOCKS AND SHARES.

Tuesday Evening.

THE pouring rain of the first part of the week made Stock Exchange men more emphatic than ever about the necessity for re-opening the House, and allowing them to get back to their accustomed haunts, in order that they might be able to deal with at least a shelter over their heads. Official announcement may be made at any time—possibly before these pages are in print—as to the date at which the Government will sanction the re-opening of the Stock Exchange. Arguments for and against the demand have been ventilated in these columns previously, but the latter kind are greatly undermined by the incessant liquidation provided by the elements.

So far as prices are concerned, there is a cheerful sentiment permeating most of the markets. Thanks to the Russian successes on the Eastern frontier of Germany, it is assumed that the pressure on the Western must be sensibly relaxed by the enemy, which would allow the Allies to make a further advance into Belgium. The success of the War Loan contributed to the strength of markets, inasmuch as it demonstrated the confidence of the investor. That the loan was not greatly over-subscribed is considered certain in City circles; and the generally-accepted estimate is that 353 million pounds sterling was applied for, this being three million pounds more than the Government offered.

The country is now comfortably provided with funds wherewith to carry on the war until the end of next July, if necessary. Germany has spent the 250 millions, for which she obtained a vote of credit some time ago, and which has been issued partly in treasury bills, partly in a war loan. The condition of French finance is a subject of some perplexity and discussion, but, so far, the only country to raise a forced war loan has been Holland, if we except the contributions levied upon Belgian cities by the savage interlopers, who will have to pay heavily, by way of indemnity, for their raids upon Belgian coffers.

The obscuring of London's lights shows no signs of diminution, and every week this bring fresh inquiries of shareholders in electric supply companies, who ask rather anxiously what is likely to be its effect upon individual concerns. These proprietors must be prepared to see some comparatively small decline in the profits made by their companies; and if dividends are to be reduced, it is one of those incidents, arising from the fortunes of war, which cannot be helped. Most of the undertakings have some compensation to set off against their loss of profits from illumination.

Street lighting is not a matter which need give shareholders any particular cause for uneasiness, because this branch of the business, as a rule, is one useful more for advertisement than for anything else; and while gross receipts will be affected, the profits are cut so fine that, in net, the effect will be trifling. The City companies have large customers for power, the County of London especially so; and they should be doing well from this branch of their business. The West End undertakings should get a certain amount of compensation from their loss of club and shop lighting through the medium of increased consumption of current in nearly all the big public offices. How long the Admiralty are going to keep the lights turned down nobody seems to know; but if the regulations are as stringently enforced for the next few weeks as they are at present, they will act very detrimentally to Christmas shopping and trade.

The Admiralty and the Metropolitan Special Constabulary have men posted for observation purposes every night on various high points and buildings round London, and from these lofty *pieds-en-l'air* the view in the small hours of the morning is singularly beautiful, now that the lights are turned low in the streets beneath. The deep shadows and the profound silence fill the watcher with a sense of mystery and solemnity. Everything looks so peaceful that it is difficult to believe he is vigilantly standing there because Europe is convulsed in a vortex of war among the nations. At the same time, the steady light of the lamps which are on active service seems to proclaim the City to be watchful in its calmness; and, as he sweeps the horizon with his glasses, he knows there is the invisible companionship of many other men sharing his vigil, sharing, probably, his very material wish that electric radiators might be fitted to lonesome observation points when his country is at war in winter-time.

Inasmuch as a good idea is always worth copying, it may be mentioned that in some parts of London, at least, the gas people are sending to householders letters stating that a representative will call to inquire whether the gas apparatus in use is satisfactory. The representative will furnish advice as to the best method of lighting and warming any particular room, as to the use of gas cooking stoves, or the best way in which to obtain hot water; and the letter asks for an interview, a post-card being enclosed for the householder to say what time and day would suit him best for the appointment. That enterprise of this sort is profitable and effective there can be little doubt; and those electric lighting companies whose men are, perhaps, not fully employed all day, might consider the advisability of undertaking a more thorough and systematic canvass than they have done in the past.

Our price lists this week contain comparatively few changes. There are no alterations in the quotations for Home electricity supply shares, although much interest attaches to the publication of the Parliamentary Bills of the London County Council and of the companies. The L.C.C. Bill was published at the end of last week, and its 54 clauses cover virtually all the ground that there is in connection with the supply of electricity to London. The central idea is to establish what is called The Electricity Authority for the development and w
area defined in the Bill.
senting two Bills—one ver
tion of both being some
L.C.C. Bill, though conceiv
now being up until the ea
continue in abeyance for p
The following is the l
shares in various electrical

Home Elec	
Brompton Ordinary ..	..
do. 7 per cent. Pf.	..
Charing Cross Ordinary	..
do. do. do. 4½ Pf.	..
do. do. City Pf. ..	..
do. 4 Deb.	..
Chelsea	..
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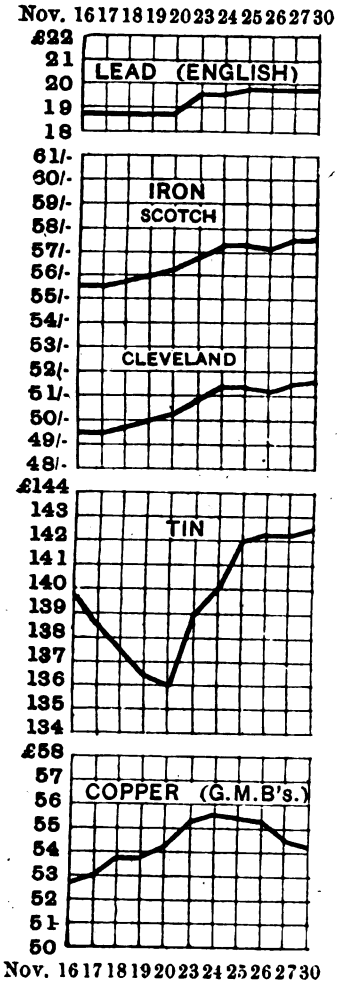
METAL MARKET.

Fluctuations in November.



The Metal Market re-opened for official transactions on Nov. 16th.

A Large Supply Undertaking.—The Rhenish-Westphalian Electricity Works Co., of Essen, is a great undertaking which, together with its associated companies—the Berggeist works, of Bruhl, the Bergische works, of Reisholz, and the Bergische works, of Lennep—furnishes a supply over a superficial area of 4,340 sq. miles, having a population of 2,800,000 persons. The enterprise is partly of the pit-bank class, as one of the stations is located at a colliery, and this explains to a large extent the fact that the company also supplies coke oven gas for illuminating purposes to a number of districts, the total length of the network of gas mains now being nearly 120 miles. Apart from this circumstance, the company has a specially large power load quite independently of the delivery of energy to various tramway companies in which the Essen Co. is financially interested. During the year ended June 30th, 1914, the number of connections of the company and its associated works increased by 95,000 KW. to 320,000 KW., and the Essen Co. alone was responsible for 179,931 KW. of the total KW. connections. The turnover of the combined works advanced from 236,321,000 KW.-hours in 1912-13 to 290,048,000 KW.-hours in 1913-14, and the respective consumption for lighting, power and tramway purposes is certainly remarkable. For instance, the lighting supply only absorbed 27,568,775 KW.-hours in 1913-14, and the tramways 14,313,221 KW.-hours, whereas the consumption for general power services, with 34,000 motors connected, as contrasted with 23,000 motors in 1912-13, amounted to the formidable total of 248,166,004 KW.-hours. These figures show the exceptional demand which has been made upon the principal and subsidiary companies on the part of manufacturers who carry on business in that part of the country. In addition, the consumption of gas reached 24,702,000 cb. metres. The final result of the Essen Co. for the past year is the record of net profits of £209,000, on a capital of £2,500,000, as compared with £169,000 in 1912-13, and the payment of a dividend of 8 per cent., as in the preceding year.

INSTITUTION OF ELECTRICAL ENGINEERS

(*Abstract of* Inaugural Address *delivered to the* Newcastle Local Section *by the Chairman*, Mr. P. V. Hunter, *Nov. 16th*, 1914).

The tendency of engineering development in the production and transmission of electrical energy is in the direction of working on a large scale. As this tendency is due to economical advantage which can only be obtained in this way, and as it persists in spite of obstacles other than engineering, it is to be expected that the size of generating plant and the radius of transmission systems will continue to increase. In the construction and operation of such large generating stations and supply systems engineering problems necessarily arise which are not apparent in smaller systems, although the only obvious difference may be that of size. One of the most interesting phenomena which becomes of greater practical importance proportionately with the size of system is the mechanical forces experienced by circuits carrying heavy currents.

If two conductors carrying current are brought parallel to each other they both experience mechanical stress and are either attracted or repelled according as the currents are flowing in similar or opposite directions. A single conductor arranged in the form of a ring and carrying current experiences a stress tending to increase its periphery, *i.e.*, similar to centrifugal force. If the conductor be formed into a helix the effect of current is to expand the helix in diameter and compress the turns towards each other in an axial direction.

As the magnitude of all such stresses is proportional to the square of the current, they may, while quite inappreciable with normal currents, be of serious moment in the event of an abnormal rush of current amounting to many times normal load. There is no difficulty or material additional cost involved in completely guarding against these mechanical stresses.

The stresses were first experienced as a matter of practical importance in the end windings of turbo-alternators.

The primary precaution is to brace the end windings in a manner enabling them to withstand the mechanical forces. With the object of reducing the magnitude of the forces, reactance coils in series with the generator windings have been adopted, and are recommended where the generators are wound for the pressure of transmission. It is, however, more usual at the present day to transmit at pressures for which generators cannot be satisfactorily wound, and in such cases a more satisfactory arrangement is to use a step-up transformer directly connected to the terminals of each generator incorporating a substantial amount of reactance in the transformer windings. An impedance of 12 per cent. at full load can be satisfactorily obtained in a transformer without extra cost and without the use of iron in the leakage paths. Such an arrangement gives a combination in which the maximum instantaneous value of the short-circuit current is six or seven times full load and the corresponding mechanical forces can be readily dealt with.

A breakdown in the reactance coils or transformers may produce the troubles they are calculated to mitigate, namely, an instantaneous short-circuit across the generator terminals. No commercially effective proposals have to my knowledge been suggested for incorporating substantial additional reactance in the generator stator windings themselves.

There is, however, a tendency on the part of designers to depart from windings having one bar per slot. With two conductors per slot there is an increase of stator reactance and corresponding reduction of the maximum value of the short-circuit current. In the later arrangements each conductor is independently insulated, and the insulation between conductors is double that between conductors and earth. This precaution largely eliminates one of the principal troubles which discredited earlier windings having a number of conductors per slot, namely, failure of insulation between conductors.

There are still objections to multiplying the number of conductors per slot, and it is distinctly advisable to restrict the number to two wherever possible.

Of all electrical apparatus the transformer is that which is in a position to be subjected to the greatest mechanical stress; the short-circuit current may easily be 40 times full load. Fortunately, transformers are more readily braced against the mechanical stresses involved, and there is no real difficulty in constructing a transformer which will not suffer damage under short-circuit. This applies to all ordinary constructions, whether shell or core type, single-phase or three-phase.

A transformer having a full-load impedance of 2½ per cent. and giving a voltage variation from no load to full load at ordinary power factors of approximately 2 per cent. is a satisfactory one from all points of view. Its voltage variation is sufficiently good for all ordinary purposes and the stresses on short-circuit can be properly guarded against by bracing the coils and without materially increased cost.

The value of the short-circuit current is usually deduced from a test in which the secondary of the transformer is short-circuited and sufficient voltage applied to the primary to circulate full-load current. The value of the voltage so obtained divided into the normal primary voltage will give the number of times full-load current which should be passed by the transformer under short-circuit conditions with full primary

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voltage maintained. This assumption is only true if the leakage flux traverses a path which is air or its equivalent.

It has also been found from experience that although a transformer may be so constructed and braced that when first installed it is fully capable of withstanding a short-circuit, it may not be in this condition after it has been in service for a few months. This particularly applies to oil-cooled transformers. The coils settle down and the settlement leaves the coils free to move, with destructive results in the event of a heavy short-circuit. It is therefore a wise precaution to examine each transformer after it has been in commission for a few months and tighten all anchoring bolts.

The majority of transformers manufactured to-day have inadequate provision against the mechanical stresses of short-circuit. That more trouble is not experienced is no doubt almost entirely due to the fact that the generating plant is not able to maintain full primary pressure on short-circuit. This protection will disappear with the growth of the generating system.

Many current transformer failures if properly traced to their source are due to mechanical movement of the primary coils under a heavy rush of current. The soundest arrangement is decidedly that in which the primary consists simply of a bar without turns. Such transformers do not maintain their ratio if at all heavily loaded on the secondary side, but it is

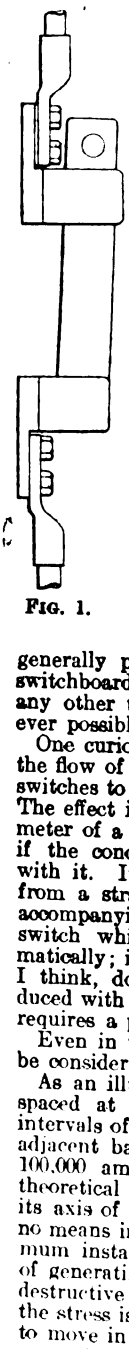

FIG. 1.

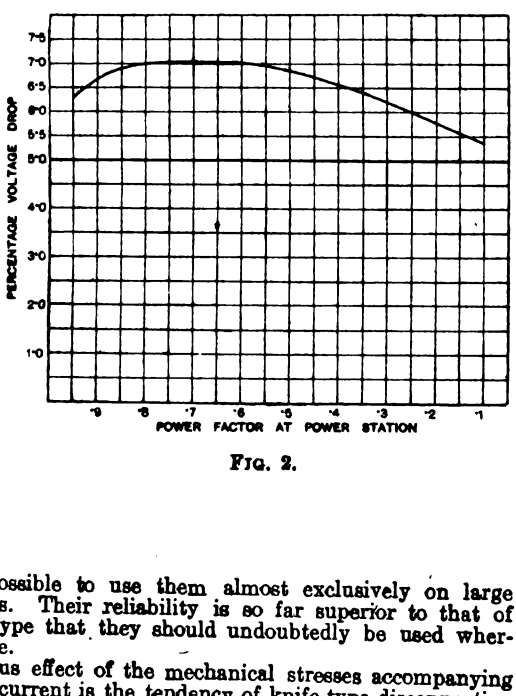

FIG. 2.

generally possible to use them almost exclusively on large switchboards. Their reliability is so far superior to that of any other type that they should undoubtedly be used wherever possible.

One curious effect of the mechanical stresses accompanying the flow of current is the tendency of knife-type disconnecting switches to open automatically under a heavy rush of current. The effect is similar to that which tends to increase the perimeter of a conductor forming a closed loop and does not exist if the conductors above and below the switch are in line with it. It is, however, remarkable how small a deviation from a straight line is required to give this action. The accompanying fig. 1 is a scale drawing of a disconnecting switch which, under a severe short-circuit, opened automatically; if it had not been actually experienced one would, I think, doubt the probability of sufficient force being produced with the arrangement shown to open the switch, as this requires a pull of several pounds.

Even in the case of straight copper connections there may be considerable stress under short-circuit conditions.

As an illustration I will take the case of a line of busbars spaced at 18 in. centres, each individual bar supported at intervals of 3 ft. In the event of a short-circuit between two adjacent bars sufficient to produce a momentary current of 100,000 amperes each busbar support would, according to theoretical calculation, experience a force at right angles to its axis of some 900 lb. 100,000 amperes is a large, but by no means impossible, current; it probably represents the maximum instantaneous short-circuit current of about 50,000 KW. of generating plant at 5,000 volts. The forces are peculiarly destructive as they are of a pulsating nature. The severity of the stress is, of course, increased if the conductor is at all able to move in its fastenings, so that it can deliver a blow to the supports. There is one incidental precaution which may be readily taken when the conductors are in the form of copper strip, and that is to arrange them so that the greatest dimension of each conductor's cross section is in the line of the force. This gives greater rigidity and is an obvious precaution when the need for it is recognised. It is, however, quite common to see such conductors arranged differently.

It is most desirable to reduce the magnitude of the forces, and there is no doubt that a great deal can be done in this direction by the use of reactance. In some cases the indiscriminate use of react
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Perhaps the worst instances of this form of trouble occur where the effects are brought about by leakage from the cables themselves. The most prolific source of such leakage current is inefficient sealing of "trims" at connections, in conjunction with lack of bonding, whereby local leakage circuits are set up, eventually giving rise to other leakage circuits. The extent to which this disease can develop under conditions of negligent maintenance has to be seen to be credited.

Chemical action is sometimes blamed for the corrosion of lead coverings, a notable instance being that of the wooden

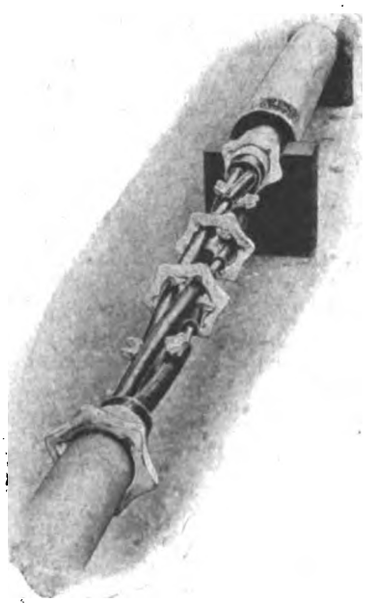

Fig. 10.

bridges which used to be almost universally employed in the solid system of laying cables. The author has examined many cases of this kind which have occurred in this country and abroad, and he has invariably found them to be due to electrolytic action, the wood having formed the path for the current.

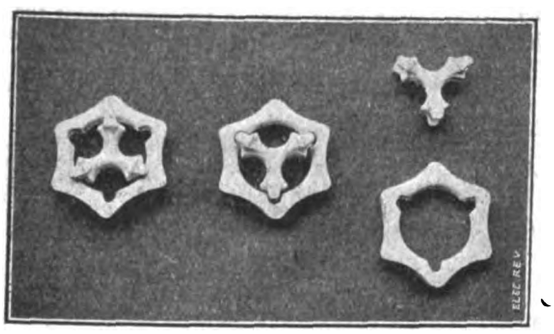

Fig. 11

Apart from very exceptional cases—so exceptional as to be quite distinct from ordinary cable conditions—it may be taken for granted that simple chemical action, as distinct from action assisted by current, is a cause of trouble which may be regarded as negligible with lead-covered cables.

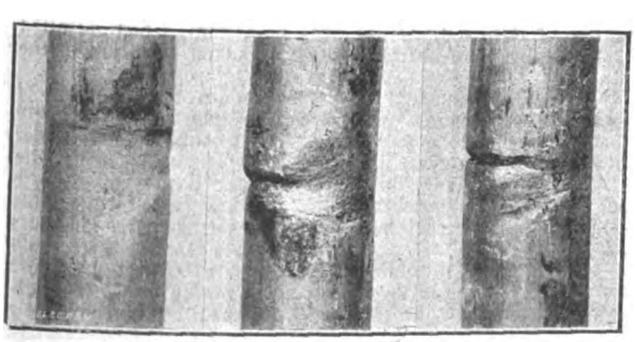

Fig. 12.—Progressive Injury to 1-sq. in. Cable.

Mechanical damage hardly calls for mention, because the various sources from which it may arise are usually obvious. The author's attention was recently called, however, to a type of damage which is of considerable general interest, as it arises from conditions that are of modern growth, and are likely to be encountered in any large town where heavy motor lorry traffic exists.

Within the last two or three years a slowly spreading epidemic of faults of this character has arisen on lead-covered cables laid solid in iron troughs and subjected to the concentrated pounding of the road surface resulting from the accentuated conditions of weight and speed of heavy traffic, and especially where service cables are taken across a street under the roadway. The effect of this pounding is slightly to depress the line of cable and troughing at the least rigid parts, *i.e.*, the joints between lengths of troughing, and in consequence the faults invariably coincide with such joints (fig. 12). It has not been possible to measure the average deflections which occurs, but it is obvious that the actual amount is immaterial, because the effect can be brought about by any degree of the cause, from a single pronounced movement such as may occur in a subsidence of soil, to a long-continued series of minute depressions which might almost be classed as vibrations.

Assuming that it is essential to adopt the solid system of laying cables, preventive measures may be applied in two directions, namely, either with the object of resisting the movement by providing rigidity, or of yielding to it by providing sufficient flexibility. The former methods would entail some such measure as the provision of a substantial concrete bed on which to lay the iron troughing, and the latter the use of non-lead-covered cable in wood or asphalt troughing.

It should be remembered, however, that other methods of laying cables are not so susceptible to this form of damage as the solid system, for the reason that when laid in pipes or ducts or directly in the soil the cable is comparatively free, so that the movement demanded is not concentrated on a length of a fraction of an inch, as it obviously is under the conditions above described.

RUBBER INSULATED CABLES.

The physical properties of vulcanised rubber are fairly well understood and have received much attention from time to time, but efforts to co-ordinate them with electrical properties have not been and cannot be successful, at least in the present state of the art. The reason of this is that maximum strength and elasticity are not compatible with maximum insulation resistance or dielectric strength. Especially is this true as regards the former, as may be judged from the fact that if we modify rubbers specially designed for insulating purposes by introducing into them ingredients which are commonly and satisfactorily used in mechanical rubber goods for the express purpose of obtaining maximum strength and elasticity, we may find that even so small an addition as 0.5 per cent. of certain ingredients may result in a reduction of something like 50 per cent. in the insulation resistance. This in itself might be comparatively harmless, but another extraordinary result from the electrical point of view is that in spite of the physical improvement the molecular structure is so modified by such additions that the insulation resistance falls very appreciably after the cable has been immersed in water for a few hours owing to the absorption of minute quantities of water, whereas insulating rubbers show no such alteration.

A further aspect of the matter is that in rubbers designed purely for insulating purposes it is possible to get peculiar critical stages of vulcanisation, between which there are great differences in the dielectric strength. For instance, it is a comparatively easy matter to vulcanise a thick high-grade rubber dielectric—as used for E.H.T. cables—to a stage at which its insulation resistance would give no evidence, and mechanical tests very little indication, of under- or over-vulcanisation by comparison with standards. Yet its breakdown point may, under such conditions, be only one-fourth of the value obtainable when vulcanisation is carried a little further, or not quite so far. In normal manufacture these critical stages are usually passed.

Working vicissitudes and other factors bearing on the durability of rubber-insulated cables may be divided into three classes, namely, those due to :—

(*a*) The natural deterioration common to all rubber goods.
(*b*) External influences due to working conditions.
(*c*) Internal influences chiefly due to manufacturing conditions.

With regard to (*a*), the rate of natural deterioration is slowest in rubbers made from hard fine Para rubber. Plantation rubber of the same botanical origin (*Hevea brasiliensis*) will undoubtedly in course of time reach the same level in this respect.

Under (*b*) come more or less simple chemical influences, and effects due to leakage current along damp fibrous coverings. These happen largely near ends which are badly trimmed when connections are made. The access of moisture to the strands of a vulcanised rubber cable by way of exposed ends is a fruitful source of trouble. Ordinary variations of humidity of the air may lead to this, even in situations which are apparently dry. Acid products are formed when the moisture comes into contact with the free sulphur which is always present to some extent in the rubber next to the strand, leading to corrosion of the conductor, and resulting in local action on the rubber by the copper salts formed. Powerful oxidizing effects occur on E.H.T. rubber cables where the production of ozone and oxides of nitrogen on the external surface of the dielectric is caused by brush discharges. Preventive measures against any of these external influences are obviously best applied in the form of special coverings. These coverings call for no special

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mention here as they are sufficiently well known to most engineers.

With reference to (*c*), the internal influences due to manufacture chiefly relate to the deleterious effect of copper, by its catalytic oxygen-carrying properties, on rubber. It has always been the practice to "tin" copper wires which come into contact with rubber; but the fundamental importance of the perfection of the tin coating appears to have become generally recognised only within the last few years.

The tinning test devised by the author in 1897—in which cycles of exposure of the tin coating to hydrochloric acid and sodium-sulphide solutions consecutively are employed to indicate the comparative value of the tinning, has been in constant use ever since its introduction.

The sodium-sulphide solution should be prepared by dissolving 25 grammes of pure mono-sulphide of sodium in 100 cubic centimetres of water, adding an excess of sulphur and boiling for about one hour with occasional stirring. The solution should then be cooled, filtered, and diluted to the required specific gravity of 1.142. It should be freshly prepared. The preparation of the hydrochloric acid is simply a matter of dilution to the required specific gravity.

With regard to the brightness of the tinning after the vulcanisation process, some darkening of the tin coating (due to the superficial formation of sulphides of tin) must result, and it will be rather more marked in the case of high grades of rubber, owing to the longer time of exposure to the atmosphere of the vulcaniser, than in low grades. In fact, experienced cable inspectors tend to regard a slightly golden tint as the hall-mark of excellence, and to look with suspicion on silvery brightness. For this attitude there are good grounds. The blackening due to sulphide of copper formed on exposed copper is readily distinguishable from discolouration due to tin sulphides.

A rough demonstration of the fact that the sulphides of tin and copper are harmless to rubber, and that the contact with metallic (and, of course, oxidised) copper is the origin of the deterioration in question, can be made very simply by placing small quantities of copper oxide and the sulphides of tin and copper side by side on a sheet of pure rubber and warming for a few hours. The rubber under and around the copper oxide will be rendered soft and tacky, but will be unaffected where in contact with the sulphides of tin and copper. Generally speaking, all the above-mentioned deterioration effects are accentuated by heat. There is no deleterious action between aluminium and rubber.

It will be gathered that as practically all the effects noted under (*a*), (*b*), and (*c*) are superficial, heavy walls of dielectric such as are used in E.H.T. cables will be much more durable than small thicknesses.

VULCANISED BITUMEN CABLES.

The cohesion between the particles of material is much less in vulcanised bitumen than in rubber. This means that such properties as resilience, elasticity, and resistance to tension, compression, and other mechanical strains have considerably lower values in vulcanised bitumen than in rubber.

At very low temperatures (around or below the freezing-point of water) vulcanised bitumen tends to yield to sudden shock in a brittle fashion, breaking with a conchoidal fracture. At medium temperatures up to, say, 100° F., it is a toughly plastic body having considerable resilience and resistance to mechanical stress. At temperatures in the neighbourhood of 100° F. to 130° F. it begins to lose its toughness, and at still higher temperatures its cohesion disappears to a considerable extent, although its resilience appears to be increased.

In any material of this character the rate at which a given kind of stress is applied has a great effect on the result. A material, intermediate as regards softness or hardness, possessing maximum toughness at medium temperatures, wide limits of temperature range, and approximately equal resistance to all kinds of stress at a low temperature, is obviously the most desirable.

Routine physical tests have been devised by the author for the purpose of controlling the uniform maintenance of such a standard under manufacturing conditions. These tests are as follows:—

(*a*) A shock test by which a standard blow is applied to the sample.

(*b*) A bending test applied at a standard rate of speed and at a standard radius.

(*c*) A penetration test constituting a control not only on the material but on tests (*a*) and (*b*) by ensuring that good results obtained from either of them are not due to slight softness.

These three comparatively rough but mutually supplementary tests afford a very delicate check on matters connected with raw materials, manufacturing operations, and processes of manipulation, and these matters in turn have a very decided effect on the uniformity of the electrical results.

Twin and 3-core vulcanised-bitumen cables are more largely used under such arduous conditions as obtain in mining work than other types, and the fact that such cables are made without internal reinforcement by any other material, gives a good idea of the result of close attention to suitable assembly.

With regard to chemical properties, the stability of vulcanised bitumen is remarkable. It may be regarded as comparable with paper insulation in that causes of deterioration are practically always extraneous causes. The material is exceptionally inert to the action of substances of an acid character. It is much more susceptible to the action of alkaline substances. The direct action of such substances is usually, however, only superficial, and even such severe conditions as continual exposure to coalpit waters—which are usually of an alkaline character—have had no appreciable effect on vulcanised bitumen.

The fallacious impression which exists in some quarters, and which has recently been perpetuated in a Board of Trade Report,* that vulcanised bitumen is softened by contact with coal gas, is correct for natural bitumens, pitches, etc., but is decidedly incorrect for vulcanised bitumen.

It is obvious, and moreover well known, that the susceptibility of alkaline attack must have a great influence under continuous-current fault conditions which can produce electrolytic action, because in most soil conditions it is possible not only to form alkaline substances at parts which constitute the virtual negative electrode of the leakage circuit, but to force such substances by osmotic pressure through the dielectric to the negative conductor. Under these circumstances both the direct action on the vulcanised bitumen of concentrated alkaline substances and the aggravated conditions due to the passage of current (producing continuous supplies of deleterious matter and forcing them to the best position for attack) come into play.

This form of secondary deterioration has been dealt with by Messrs. Dick and Fernie in their book on "Electric Mains and Distributing Systems."

From the results of experiments it would appear that a dielectric must first be rendered conducting, for example, by osmotic influences, insipient flaws, damages, or general weakness, before it will allow sufficient current to pass through it to form electrolytic products in its vicinity. In other words, the dielectric does not, under the influence of temperature solely, permit the sequence of events described by the authors above quoted unless incipient fault conditions are first set up.

The author arrived at the conclusion several years ago that there existed a distinct type of deterioration different from the saponification effect described by Messrs. Dick and Fernie as softening. The search for evidence on the point was a slow matter. The result of the investigation of instances in the tropics may be summarised as follows:—

First, they showed that leakage current played a prominent part in bringing about softening of the vulcanised bitumen, and that such currents even of a very minute order would produce a type of softening other than that caused by saponification in the well-known manner.

Secondly, that moisture must have been a factor in the case, although it was not proved that it had any other function than that of rendering fibrous coverings and other paths conductive.

Thirdly, it appeared likely that, in the presence of the two preceding factors, this particular form of softening occurred more readily in tropical than in temperate climates, and that temperature was therefore also a factor.

Fourthly, time is obviously important in all changes of the kind under consideration.

The results of a number of preliminary experiments showed that the softening could be produced by the combined action of heat and moisture. Also that the time element, which even under faulty electrical conditions might be years, could be reduced to weeks or even hours by varying the temperature.

(*To be concluded.*)

Discussion at Manchester.

Prof. E. W. Marchant said, with regard to dielectric stress, the author stated that in order to obtain the best results the ratio between the outer and inner diameters should be the base of natural logarithms; this also corresponded to the condition in a cable for which there would be no possibility of corona forming in the interior. He cited a case of electrolytic action which occurred in a bitumen cable some years ago; the negative of the cable broke down, and intermingled with the friable substance round the joint was a considerable quantity of pure sodium and pure potassium, which resulted in considerable local heating, which attracted attention to the fault.

Mr. B. Welbourn said that the modern manufacturer of paper cable had made so much progress that it was perfectly safe to re-design on a scientific basis all cables coming under the British Engineering Standard List. It was perfectly safe to cut down dielectric thicknesses, provided the cables were used on modern systems having a sine wave-form. This would not apply to systems employing alternators of ten years ago, having peaky waves. Since the cable manufacturer could not control the destination of his cable, the safest procedure was probably to retain the British Engineering Standard thicknesses over a given voltage, but to put them down deliberately with the idea that in the future the working pressure might be doubled as loads increased. He asked whether the author, in suggesting a high-voltage single-core cable, had considered it commercially justifiable at commercial frequencies of 25 to 50 cycles. The statement in the paper that inter-sheathed grading was not commercially justifiable below 30,000 volts raised the whole question of working pressure on cables. He

* Report of Board of Trade Committee on Electric Mains Explosions, 1914.

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agreed with the inference in the paper that 50,000 volts was the commercial limit of pressure for three-core cables, and said there was scarcely a case where anything higher than 30,000 volts could be justified at 50 cycles on account of the charging current and consequent idle plant. In a particular case, at 11,000 volts the apparent KW. required to charge the cables were 18.2 per mile, for 20,000 volts 23.8 KW. per mile, and for 30,000 volts 84.5 KW. per mile. Therefore, with a network involving 30 miles of 30,000-volt cable, the plant required to charge the cable alone would be about 2,500 KW. He had investigated several cases involving three-core underground cables and, taking into account the cost of transformers, switchgear, etc., there was hardly any saving in going above 30,000 volts. Paper cables which had been working at 2,000 volts 100 cycles for 23 years had shown no sign of deterioration of the paper. They had also had 18 years' experience with 11,000 volts, eight years' with 20,000 volts, and three years' with 30,000 volts. Tests he had made on the effect of long-continued application of pressure to cables on a modern system at high temperatures, about two years ago, showed that there was practically no deterioration of the paper. The trouble with expansion and contraction could be easily overcome by the use of the Vernier joint. He had constructed joints insulated with tape and paper capable of withstanding a working pressure of 150,000 volts. For protection against electrolytic corrosion of lead, continuity and cross-bonding was not sufficient; the predetermined points should be earthed. Systematic examination of continuity, cross-bonding and earthing was essential, for the equipotential points of a system altered.

Mr. S. L. PEARCE said that in connection with the new power station of the Manchester Corporation he felt justified, after careful consideration, in using a cable of 0.25 sq. in. at 33,000 volts. Regarding the grading of cable insulation, he thought engineers would rather pin their faith to a single dielectric which had been fully proved. The various suggestions for anchoring the lead inter-sheaths were ingenious, but they did not appeal to him. The author seemed to suggest that the existing methods of testing cables at 2½ to 3 times working pressure should be followed; so far as the Board of Trade had issued regulations at all at the present time, all they required for cables at a working pressure over 10,000 volts was an extra 10,000 volts. Evidently when working pressures of 40,000 or 50,000 volts were reached engineers would have to be content with a test pressure much less than 2½ or 3 times the working pressure. Regarding the time element in pressure tests, his experience showed that if a cable stood the first five minutes it would not break down in half an hour. The author's suggestion for testing the integrity of lead sheaths was an excellent one, and could be applied whilst working. The insulation resistance value of 50 megohms per mile was altogether too low. The question of movement in cables consequent upon expansion and contraction was of prime importance. The author condemned the impression that vulcanised bitumen was softened by contact with coal gas; if the bitumen filling did contract by the action of coal gas, which the author did not dispute, something else would soon come in to destroy the cable. He had for some years discarded it.

Mr. A. F. W. RICHARDS said it was impossible to forecast the density of the load on distributors for years in advance and consequently they were grossly overloaded now and then. With regard to the joint suggested for pressures of 50 to 100 kilovolts, the idea of non-hygroscopic spacers seemed excellent, but the weak spot was the difficulty of leaving the ferrules absolutely smooth after sweating, as pin points of solder were often sufficient to cause a breakdown at very high pressures. As regarded bonding on lead-covered cable, nothing but a plumber's "wipe" was satisfactory. There were various satisfactory forms of clamps and cone connectors for wire-armoured cables which made a sound job if attention was paid to cleaning the wires and providing a good fit. On solid-laid systems bridges should invariably be of non-hygroscopic material, and for use in this country he preferred asphalt. The proper filling of the trough was a difficult matter; the bends should be left until the last.

Mr. J. H. C. BROOKING said rubber cables, bitumen cables, and lead-covered cables had all been run down at various periods, but they were all perfectly correct under certain circumstances. The author had shown that with proper laying and maintenance, troubles did not appear.

Mr. G. L. PREECE thought the suggestion that 30,000 volts was the highest economical pressure nowadays was probably correct, but the author must have had other views in designing and making cables for 100,000 volts.

Mr. W. S. TAYLOR referred to a good tin coating on rubber-insulated conductors as being essential for long life. There was a general impression that the tin protected the conductor against the sulphur in the rubber, whereas the tin was essential to protect the rubber from the copper. English practice was directly opposed to American and Continental practice in the use of pure rubber adjacent to the conductor. Could it be that English methods were open to improvement?

Mr. L. J. LEPINE said that the 100,000-volt cables which Prof. Klingenberg proposed to lay down in London were in reality 60,000-volt cables. The idea was to use single-core cables and earth the star points, thereby obtaining a potential difference of 60,000 volts between cable and earth. Recently the Victoria Falls Co. decided to install some 60,000-volt cables with a section of 120 mm². The German experts put forward a cable of 500 mm². which they recommended, the object being to reduce the stress. An alternative of 120 mm². was offered and accepted, but when officially inspected it was only 100 mm². He had just returned from Germany, and said that no German manufacturer was allowed to export cable having a greater section than 35 mm².

Dr. G. W. WORRALL, referring to the use of tapes and other materials used in jointing, spoke of a 90-H.P. 5,000-volt pit motor which broke down on one coil. The coil was repaired in the pit, and after about a month's run it broke down again in the same place. After a second repair there was another breakdown, and ultimately the motor was brought to the shops and repaired successfully. The repeated failure was due to the insulating materials becoming damp in the pit, although they were perfectly dry when first sent down. He referred to the heating of bifurcating boxes on three-phase systems, due to the three cable ends entering the box by three separate holes and thereby heating the metal of the casing.

The AUTHOR, in reply, said that vulcanised bitumen breakdowns were well known in the old days and the formation of potassium and sodium in the metallic state repeatedly caused fires in the culverts. Commercial considerations would restrict the use of high-voltage cable to feeding overhead lines, connecting generators and transformers, etc., and consequently such cables would never be used in tremendous lengths, in which case the charging current would not enter largely into the question. There was no necessity to attach a time limit to the maximum stress figures in the paper; the maximum stress figure quoted was one that the paper just failed to support. Regarding the pressures suggested for test purposes, the author feared that those quoted would be demanded, although there was no reason why they should. With regard to bitumen cables, the paper separator was not for mechanical purposes but to prevent the selective action which had been described. The author had known a consignment of lead cable to be very badly affected by vibration in transit aboard ship. The German practice of making high-tension tests and no resistance test was very bad; a water-logged cable might prove all right on high-tension test, owing to general leakage, but a megohm test would prove the cable faulty. Varnished tapes were not used for binding purposes; tapes were treated with the insulating compound immediately before they were applied. In this way a perfectly satisfactory dielectric was obtained.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

THE war is naturally affecting this country a good deal, and there is a considerable amount of unemployment, but, on the whole, conditions are much better than most people, at the commencement of the fighting, expected.

In all possible ways the Dominion and Provincial Governments together with the municipalities, are trying to carry on necessary works in order to give employment, although some of the smaller towns are unable to do very much, since they are short of money.

A large power development scheme now in progress is that of the Laurentide Pulp and Paper Co., at Grand Mère, Quebec, on the St. Maurice River, which is a tributary of the St. Lawrence. A total head of about 77 ft. will be utilised. The ultimate plant capacity is designed to be 180,000 H.P., but only a portion of this will be installed at first. About 25,000 H.P. are required by the company, and the remainder will be available for distribution and sale to others. A very interesting feature about this scheme is that the name Grand Mère was given to a particular rock which has the appearance of an old woman; evidently it is necessary to remove this old lady from her ancestral home on an island, for she is to be carefully transported to the mainland and established there—one wonders how she will stand the strain and worry of removal at her great age.

The Board of Control in Toronto is reported to have recently passed a resolution instructing counsel to apply to the Dominion Railway Board for an order compelling all railways within, and up to two miles from, the city limits to electrify their systems, and the Toronto Street Railway Co. has just been ordered by the Ontario Railway and Municipal Board to provide 50 new cars and carry out a number of other improvements. The Toronto hydro-electric system has been spending large sums of money, totalling almost $1,000 000 beyond the amount which it was authorised to spend; the City Council was asked to sanction the raising of $3,000,000, but has only given its consent for $1,000,000.

In Montreal the Electrical Commission recently decided to discontinue its operations on underground conduit construction, but the contractor came forward with an offer to go on with the work at his own expense until the middle of next summer, provided he is paid then for work done; the Commission has accepted the offer, and it is to be inferred that the work will proceed.

The Hydro-Electric Power Commission of Ontario has recently let a contract for the construction of a large office building, the whole of which will be occupied by the Commission, its staff of engineers, its laboratories and testing departments, &c. The total cost will be about $200,000.

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Until quite recently the Commission acted merely as a middleman in regard to electric power, as it bought all its power in bulk at Niagara and sold it to various municipalities. On October 7th, however, a new phase of its work commenced, viz., that of the supply of power from a generating station designed, owned and operated by its own staff.

This plant, which is only a small one of about 1,000 H.P., is located at Wasdell's Falls, on the Severn River, about 80 miles north of Toronto; power is transmitted to the municipalities of Beaverton, Woodville, Cannington, Gamebridge, Brechin, and the intervening agricultural districts. Another plant of about 4,000 H.P., capable of some extension, is now under construction at Eugenia Falls, on the Beaver River; these falls are about 75 miles north-west of Toronto.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

SOUTHERN RHODESIA.—A copy of the proposed new Customs Tariff of Southern Rhodesia has been received at the Board of Trade. The General Tariff rates are the same (except as regards some prohibitions) as those leviable in the Union of South Africa, but, in consequence of the operation of what is known as the "Rhodes Clause," the preferential rates of duty on British goods are not, in all cases, identical with those leviable in the Union of South Africa.

Upon the following articles the rates will be operative from the date of promulgation of the Ordinance giving effect to the same.

Catalogues or price lists of foreign firms, addressed to importers, merchants or manufacturers, or public libraries and similar institutions—	Free
Diagrams, designs, drawings, models and plans— ...	Free
Belting of all kinds for driving machinery— ...	3 % ad. val.
also rope for driving, and transmission hose— ...	(v. Note 1)
Cranes, elevators and shears—	3 % ad. val. (v. Note 1)
Electroliers, hand lamps and fancy fittings—15 per cent. ad. val. with a rebate of 6 per cent. on goods, the manufacture of any part of H.M. Dominions or of any British Protectorate.	
Machinery for manufacturing, mining and other industrial purposes. Machinery, apparatus, appliances, implements, and electrical material used in connection therewith, for the generation, storage, transmission, distribution of, and lighting by, gas or electric power, but not including electroliers, hand-lamps or fancy fittings... ...	3 % ad. val. (v. Note 1)
Packing and lagging for engines, machinery and piping	3 % ad. val. (v. Note 1)
Pipes, piping, and tubes of all kinds for gas, steam, &c.	3 % ad. val. (v. Note 1)
Railway construction or equipment requisites ...	3 % ad. val. (v. Note 1)
Telegraph and telephone materials and instruments...	3 % ad. val. (v. Note 1)
Tramway construction or equipment requisites—including railless cars (electric)	3 % ad. val. (v. Note 1)

NOTE 1.—A rebate of the whole of the duties will be granted on goods the produce or manufacture of any part of H.M. Dominions or of any British Protectorate.

NOTE 2.—The value of goods for purposes of *ad valorem* duty will be taken to be the true current value for home consumption in the open market of similar goods in the principal markets of the country from which and at the time at which the goods were imported, including carriage to the port of shipment and the cost of packing and packages, but not including agent's commission when such commission does not exceed 5 per centum, provided that in no case shall the value for purposes of duty be less than the cost of the goods to the importer at the port of shipment.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

22,582. "Magnetic games." D. M. HUMBY. November 16th.

22,598. "Night-marching compasses and the like." F. E. COLLINSON and SHORT & MASON, LTD. November 16th.

22,609. "Regulating device applicable to self-induction coils or to windings of Tesla transformers used in wireless telegraphy or other applications of high-frequency." L. ROUZET. November 16th.

22,614. "Electric ignition systems for internal-combustion engines." L. H. HOUNSFIELD. November 16th.

22,632. "Compensating resistances for dynamo and motor field windings and the like." F. BRIMSON COX. November 17th.

22,674. "Methods of using electric condensers for transformation of energy." J. E. TAYLOR. November 18th.

22,691. "Footsteps for telegraph and other like brackets." BULLERS, LTD., &

22,713. "Inverse-current preventer."

22,715. "Automatic and semi-autom AUTOMATIC TELEPHONE CO., LTD., & W

22,716. "Manual and semi-automat AUTOMATIC TELEPHONE CO., LTD., & W.

22,721. "Speed governors." WARWI ber 18th. (General Electric Co., Unit

22,732. "Means for regulating the SVENSKA ELEKTRISKA AKTIEBOLAGET. Nov 5th, 1914, Sweden.) (Complete.)

22,741. "Magnetos." M. PEDERSEN.

22,744. "Grinders for commutators motor-car engines." W. L. ROSS. N

22,779. "Dynamos." S. J. WILLIAM

22,804. "Control of electric circuits P. A. LUNDBERG, & G. PEGG. Novemb

22,807. "Wireless control systems."

22,826. "Alternating electric current Co., LTD. November 20th. (General

22,837. "Method of and apparatus f MELLERSH-JACKSON. November 20th. (Complete.)

22,854. "Arrangements for produci particularly of a high frequency." R.

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22,871. "Regulating devices for mix WICK MACHINERY CO. (1908), LTD. United States.)

22,872. "Electric heating apparatus ance units." C. O. BASTIAN. Novem

22,879. "Apparatus for directed w BELLINI. November 21st. (Convention plete.)

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23,218. ELECTRICAL COOKING APPAR Kensington Accessories Co. October

23,959. ELECTRODES FOR USE IN THE October 22nd. (October 22nd, 1913.)

24,198. ELECTRIC SWITCHES. V. H

24,337. ELECTRIC ROTARY CONVERTE Brown, Boverie et Cie. October 27 24,305/13.)

24,672. QUICK-ACTION MECHANISM FO J. Roothaan & Ferranti, Ltd. Octob

25,006. THREE-POSITION BLOCK IN PURPOSES. McKenzie & Holland, Ltd

25,283. TELEPHONE SYSTEMS. J. S

25,437. DEVICE FOR RECORDING O Denbigh. November 7th. (May 5th,

25,544. FITTINGS FOR ELECTRICAL November 8th.

25,621. ELECTRIC SOLDERING-IRONS. 10th.

27,611. APPLICATION OF ELECTRICAL AND THE LIKE. F. A. Wilkinson.

27,870. ELECTRIC SWITCHES. A. Bo

28,952. TELEGRAPH RECEIVING-APPAR NALS INTO THEIR COMPONENTS AND T DEVICE, OR TO PERFORATE A TAPE ACC OR OTHER SYSTEMS OF WORKING. Eas Wood. December 16th.

29,691. ELECTRIC SIGNALLING. C. R Syndicate, Ltd. December 24th.

29,779. ELECTRIC CAPSTANS. W.

19

1,227. DYNAMO-ELECTRIC STARTIN ENGINES. H. Lucas & W. C. Turne

2,844. DEVICES FOR AMPLIFYING FE Richards. February 3rd. (February

3,012. SOUND-PRODUCING HORNS F H. Lucas & W. H. Edwards. Feb

3,552. ELECTRIC TRAIN OR TRAM C Shand. February 11th.

4,249. RUNNING ELECTRIC MOTORS SUPPLY SYSTEMS. R. Haddan (D. A.

6,210. AUTOMATIC OR SEMI-AUTOMA Betulander. March 11th. (May 24

7,079. POCKET AND OTHER ELECTRI March 20th.

7,331. TELEPHONE SYSTEMS. E. A

7,884. ELECTRICAL INSULATION FOR OR TRAMWAYS. B. R. Wills & J. C tion on 19,603/13. August 29th. C

10,514. RENEWABLE ELECTRIC CAR 28th. (May 6th, 1913.)

11,845. METHOD OF RENEWING AN PACKED AND EXTERNALLY LEAD-FILLE May 13th. (May 14th, 1913.)

15,399. VACUUM TUBE LIGHTING A 28th, 1913.)

15,455. ELECTRIC FURNACES. F. J.

17,025. ELECTRIC POCKET LAMPS. Ready Co. July 17th.

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THE

ELECTRICAL REVIEW.

VOL. LXXV. DECEMBER 11, 1914. No. 1,933.

ELECTRICAL REVIEW.

Vol. LXXV.] CONTENTS: December 11, 1914. [No. 1,933.

	Page
Electricity and Civilisation	773
The Thermophone	774
Australian Tramway Arbitration Awards	774
Lead	774
About a Personal Apology	775
Over-Pressure Protective Gear for High-Tension Circuits, by K. Edgcumbe (*illus.*) (*continued*)	775
Trade in the Argentine Republic	777
Motor Vehicles for Electrical Work (*illus.*)	777
Electrical Applications for Parliament to Consider	778
Correspondence—	
U.S.A. Safety Rules	779
Street Lighting in Chicago	779
Workhouse Supply	779
Why Great Britain Loses Trade	780
"The Mechanical Design and Construction of Generators"	780
Trading with the Enemy	781
Signalling Supplies Wanted...	781
Handles for Electric Ovens	781
Legal	781
New Electrical Devices, Fittings and Plant (*illus.*)	782
Our Legal Query Column	782
War Items	783
Business Notes	785
Notes	791
City Notes	794
Stocks and Shares	795
Market Quotations	796
An Electrical Anemometer (*illus.*)	797
Electricity on the Farm	798
Illuminating Engineering in War Time	800
Institution of Electrical Engineers	801
The Thermophone, by M. de Lange	801
Cables, by C. J. Beaver (*illus.*) (*concluded*)	802
Power Plant Testing, by W. Selvet (*illus.*)	803
New Patents Applied For, 1914	804
Abstracts of Published Specifications	804
Contractors' Column ... ... Advertisement page	xviii

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ELECTRICITY AND CIVILISATION.

IN his address to the Birmingham Local Section of the I.E.E., Dr. A. H. Railing makes a striking departure from the beaten track. Taking the broadest view of human society and its environment from the dawn of history to the present day, he endeavours to trace the progress of civilisation from its rudimentary beginning and to show that electrical engineering, by virtue of its unique characteristics, sets the crown upon the work. Naturally the development of society and civilisation proceeded from the simple to the complex, involving the early introduction of specialisation and the study, more and more minute and detailed, of divergent branches of knowledge; it is curious to note, however, that the progress of engineering science, on the other hand, has taken place in the opposite direction, commencing with the study of astronomy and passing through gravitation to dynamics, and so on to the properties of the molecule, the atom, and, finally, the corpuscle—the most elementary particle of matter (or rather, electricity). Thus, science has advanced from the infinite to the infinitesimal, from the complex to the simple; yet, strange to say, of that force upon which the mechanism of the whole universe depends, whose operation is familiar to the most primitive barbarian and has been under observation from the beginning of things, of gravitation we know no more than we do of the great mystery of life itself.

Dr. Railing seems to attribute electrical engineering in some way to the knowledge of the corpuscle, for he says: "In engineering we came last to the science of the corpuscle, and its application, electrical engineering"; here we cannot follow his argument, for it is historically the fact that electrical engineering attained to vast proportions before the corpuscle was so much as thought of, and it is not clear to us that the science of the corpuscle has exercised any marked influence upon the progress of electrical engineering; as in many other cases, the application has preceded the explanation. Wheatstone developing the electric telegraph, and Faraday, when he laid the foundations of heavy electrical engineering, knew next to nothing of the corpuscle, and Maxwell erected his magnificent electromagnetic theory on the basis not of particles but of vibrations. The science of the corpuscle no doubt is destined to affect profoundly the future course of electrical progress, but if we take, for example, the *Journal* of the Institution of Electrical Engineers we shall find it mentioned only in a few rare instances. It is difficult, too, to conceive of electricity as the mother of optics, dynamics and chemistry.

As regards the effect of electrical engineering upon human development, however, we are of course entirely in agreement with the author; as he says, "the world is the field of the electrical engineer." In innumerable ways the latter has promoted the well-being of his fellow-creatures, unconsciously perhaps, and without set

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purpose, and has immensely increased "the collective efficiency of mankind;" and we cordially endorse the author's remark that this knowledge should be a source of profound satisfaction to him and a spur to increased activity. It is well from time to time to look round us and endeavour to obtain a comprehensive view of our position and our work in the world, and Dr. Railing is to be congratulated upon the happy thought of directing the attention of his colleagues to the sociological aspect of their vocation.

The Thermophone.

In another column we give an abstract of a paper presented to the Royal Society, on the 3rd inst., on "Thermophones." The apparatus shown consists of a loop of exceedingly fine wire, mounted within a metallic case having a small orifice; this in turn is fitted within an ebonite case, or tube, of such size as to be readily inserted in the ear. It acts as an efficient telephone receiver, an ordinary microphone, in circuit with a battery, being employed as a transmitter.

The author traces the origin of thermophones to Sir Wm. Preece, who submitted a paper to the Royal Society in 1880, describing an apparatus in which a wire, under the influence of telephonic currents, vibrated a diaphragm to which it was attached. But an earlier example, and one, moreover, which was actually called "the thermophone," by Theodore Wiesendanger, was described in our issue of October 1st, 1878 (*Tel. Journal*, Vol. VI, page 400). At that time considerable interest was taken in the source of sound in the telephone, the utility of diaphragms, and so on. The possibility of using a microphone as a receiver was shown by Blyth and Hughes, and the almost forgotten carbon receiver of Bell was a subject of discussion. Thermal action was the explanation favoured in all these cases. The thermophone of M. de Lange is directly operated by the variations in temperature set up in the loop, and is an interesting scientific development. M. de Lange claims that his invention is of the greatest practical value, and we note that, as usual, the lay Press has gone somewhat further than the inventor, in one case assuming that the "last word in telephones" has now been said. It will be very creditable to the present age if that be so, but it will be wiser to assume that nature has not yet revealed all her secrets, and that science may still be encouraged to continue research. It may also be wise to remember that the principal use of a telephone receiver at the present day is as part of a very complex system, and that the success of its operation is dependent upon its fulfilling all the operative conditions of that system. The demonstration can only be made satisfactorily by those acquainted with the requirements and provided with the necessary facilities. We think, therefore, that any statement regarding the practical advantages of the device should be reserved, and in the meantime congratulate M. de Lange on the development of the thermophone principle culminating in an instrument of much scientific interest.

Australian Tramway Arbitration Awards.

On December 21st, 1912, Mr. Justice Higgins, the President of the Commonwealth Court of Arbitration, gave his award in the case of the tramway employés, which had occupied his attention for 93 days. At the time we devoted considerable space to this matter, which was a dispute between the Australian Tramway Employés' Association and eleven of the principal tramway undertakings in the country. It will be remembered that eventually, at the suggestion of the Judge, direct negotiations between the masters and men resulted in voluntary agreements in nine cases, a judicial award being given in the other two, namely, the Brisbane Tramways Co., Ltd.,

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in the successful pursuit of the Huns. Japan is also a buyer of lead and has done some fair quantities for shipment from the United States to Yokohama, and further purchases are pretty certain to be made. There are inquiries still in the market, indeed, for this destination. There is a good deal of interest taken in the lead position in Germany, and it is known that prices there are much higher than here, which is only natural when it is remembered that Germany imports lead ores and concentrates on a large scale under normal conditions. There is, of course, a tendency in Germany to minimise the effects upon the country's lead supplies, of the blockade of her trade, but the position is one of some scarcity, as is clearly enough shown by the prices ruling there and here, and it is much to be desired that this feature of the situation will be developed considerably. While the United States market was recently very stiff, there has just lately been a rather easier attitude on the part of producers there with the correspondingly increased inclination to export material. It is very doubtful how the position will develop across the Atlantic, however, for there are many considerations to be taken into account, not the least of which is what appear to be some faint signs of returning activity in the steel trade. Should these be confirmed, the entire industrial situation in North America may be altered. As for Mexico, political affairs there seem to be going from bad to worse, and there is not the slightest chance of industrial operations assuming a moderate degree of activity for months to come. There are too many candidates for the Presidency, and too many bands of thieves and robbers masquerading as "armies" for reasonable security to life and property to be in sight.

About a Personal Apology.

There are apologies and apologies. Sometimes nervous and bashful creatures make their excuses so awkwardly that in their eagerness to correct themselves they become more and more involved and confused, and ultimately wish they could vanish out of sight. What is more disconcerting than to have to stammer out an apology for an apology? Yet there are times when this has to be done.

A well-known electrical firm, whom it is not our intention to accuse of either nervousness or bashfulness, thought fit to advertise an apology to readers of our last week's issue. In thus confessing that it had been guilty of "commercial ineptitude," it was acting within its legitimate rights and privileges as an advertiser, and if that had been all, we should not have raised any objection. But, unfortunately, that was not all—not by a long way, for since Friday morning last we have been deluged with communications from all parts of the country consequent upon the widespread circulation of postcards, drawing attention to an apology on a certain page, by the advertiser referred to. These cards, a number of which have been forwarded to us, carried an Electrical Review heading and no other, and were so printed and worded as to convey the impression to those who were unacquainted with our methods that the Electrical Review was offering the recipient an apology for something or other.

It is due to all of our friends, and it is due to ourselves, that we should most emphatically state that not only did we have nothing whatever to do with the issue of the card, but it was done entirely without our knowledge or authority. Furthermore, we must offer the strongest possible objection to the taking of so unwarrantable a liberty with the name and reputation of this journal. We feel reluctant to accuse a maker of foolproof devices of "commercial ineptitude," and under all the circumstances we think that the most charitable construction that we can put upon the matter is that illness and absence from duty, which all of his friends have regretted, were responsible for the oversight which permitted so gross a blunder in publicity methods.

OVER-PRESSURE PROTECTIVE GEAR FOR HIGH-TENSION CIRCUITS.

By KENELM EDGCUMBE, M.Inst.C.E.

(*Continued from page* 746.)

Protective Gear.

From what has been said it will be clear that, although the over-pressures due to internal causes are usually less severe than those due to atmospheric disturbances, they are at the same time much more varied as to the form they take. Thus (apart from static charges) all atmospheric disturbances may be said to involve either a high frequency or a steep wave front, whereas internal troubles range from a steep wave corresponding to a frequency of perhaps 1,000,000 periods per second, down to resonance with the frequency of supply at say 50 periods per second.

Condensers.—It is evident that condensers are of no practical use for dealing with surges of internal origin, since those involving a steep wave front, which are the only ones against which condensers can be used, form a comparatively small proportion of the total to be dealt with. This is fully admitted by even the most enthusiastic supporters of the condenser, and all are agreed that some form of air gap connected to earth through a resistance is the only effective remedy. The best form of gap and resistance has been the subject of much discussion, but the only patterns which need be considered at the present day are the following:—

The Multi-gap or Wurts arrester.—This arrester, a simple form of which is shown diagrammatically in fig. 10, was at one time very much used in America but has now, largely, been superseded by other patterns except for small installations of comparatively low voltage. It consists of a number of metal cylinders mounted on an insulating base and separated from each other by narrow air gaps. Some two-thirds of the gaps are shunted by a resistance (or by two resistances as shown in fig. 10), the unshunted gaps being so adjusted as to allow sparking over at a pressure exceeding the normal by say 50 per cent. So soon as these unshunted gaps break down the line is put to earth through the resistances, and in the case of an insignificant surge the current so conducted to earth may be enough to relieve the line. In most cases, however, this will not be so, and a further discharge will take place over the shunted gaps. So soon as the surge has passed to earth, and the line current follows as it inevitably will, the resistance shunts the gaps to such an extent that the shunted arcs can no longer be maintained. If the surge P.D. to earth has again fallen to normal the unshunted gaps will be too long to maintain the arcs which will, likewise, be extinguished. The extinguishing of the arcs is materially assisted by the cooling effect of the comparatively large mass of metal in each cylinder. In order to prevent too heavy a discharge to earth a resistance (R) is usually connected in the earth circuit to limit the current.

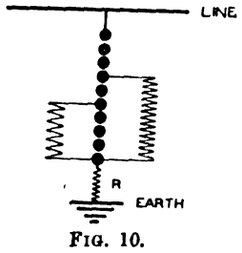

Fig. 10.

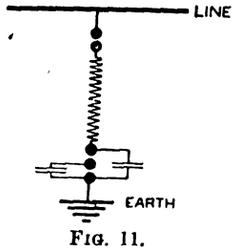

Fig. 11.

The chief advantages of the device lie in its compactness and low first cost, but as has been said, it is

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incapable of dealing with any large amount of energy, and if, with a view to doing so, a number of the arresters have to be connected in parallel the advantages disappear. It may be added that the shunting resistance usually consists of a carborundum rod, a drawback to which lies in its liability to break down under repeated discharges.

The Giles limiter or "Valve."—This apparatus, which has been used a good deal in Germany and elsewhere on the Continent, is a multi-gap device based upon much the same idea as the Wurts but somewhat different in construction. It is illustrated in fig. 11. The upper gap is set to spark over with say 50 per cent. excess P.D. to earth. Before a discharge has taken place all the spark gap electrodes are at earth potential (owing to being connected to earth through condensers), except the top one, which is connected to line. Should the P.D. to earth exceed that for which the upper gap is set, a spark will pass over, and this will bring the second and third electrodes nearly to line potential and a spark will pass on to the fourth, and so on till all the gaps are discharging, in series, to earth through the resistance. So soon as the over-pressure has subsided the P.D. across those gaps which are shunted by condensers is insufficient to maintain the arc and the circuit is broken. It has already been shown that a condenser shunting an arc has the effect of breaking it with extreme rapidity, and were it not for the high resistance in series with the gaps, serious trouble might arise through over-pressures caused in this way. The Giles limiter being very similar in principle to the multi-gap arrester suffers from much the same disadvantages, namely, that it can only deal with a comparatively small quantity of energy unless a large number are connected in parallel. Besides being expensive it is fragile and has itself to be protected by means of a fine fuse which may blow without the fact being noticed. It has, on the other hand, the advantage of enabling the spark gap to be accurately set by means of a fine screw thread on the upper electrode and, the gap being enclosed in a glass cylinder, is less liable to disturbance with dust, etc., than is the case with the open multi-gap arrester.

The Horn Gap.—This form of gap, due originally to Siemens, is the oldest and by far the most extensively used form of protective gap. *If properly designed and used* it affords the best form of protection. It was at one time customary to connect horn gaps directly to earth so that when they discharged the line was put to earth, and this would often happen on more than one phase at the same time, thus producing a dead short between lines as well as to earth. When it is added that in the majority of cases the arresters were erected on poles in the open and exposed to short circuits due to snow, insects, twigs, etc., it is little to be wondered that arresters so installed were the cause of many serious breakdowns.

Such a procedure is based upon an entirely wrong conception of the use of an arrester. As has been said already, it is almost impossible to protect a line from danger in the event of a direct stroke and the danger due to surges, which constitute fully 90 per cent. of the pressure rises to be dealt with even on overhead lines, is confined almost exclusively to the apparatus connected to the line. This being so the protective gaps should form part of the gear at main and sub-stations, and on no account should they be scattered promiscuously along the line. Further, they must never be connected direct to earth, but invariably through a resistance.

The action of the horn gap (fig. 12) is well known. The distance between the lower extremities of the horn is adjustable, and is set to spark across at say 50 per cent. above the working pressure. Owing to electromagnetic repulsion due to a current flowing across the gap (a circuit always tending to increase the area it encloses) the arc is driven up the gap between the horns until the ever-increasing length of the arc becomes too great for it to be maintained, and it breaks. The action is aided, though to a comparatively small extent, by the upward rush of heated air. The breaking of such an arc is gradual, the resistance progressively increasing till it breaks, and it has none of the instability and suddenness of break exhibited by the normal arc. In fact it is doubtful if it is really correct to speak of it as an arc at all. Mr. Duddell has defined the arc as a circuit in which "the electrodes are being continuously volatilized, and the vapour of the electrodes takes part in the passage of the electric current." In the case of the horn gap, the volatilization of the metal is quite insignificant and the breaking of the circuit is devoid of all "quenching." In fact, when very low currents have to be broken and the electromagnetic repulsion is consequently small, a magnetic blow-out is sometimes fitted, but this will be found unnecessary, unless under exceptional circumstances.

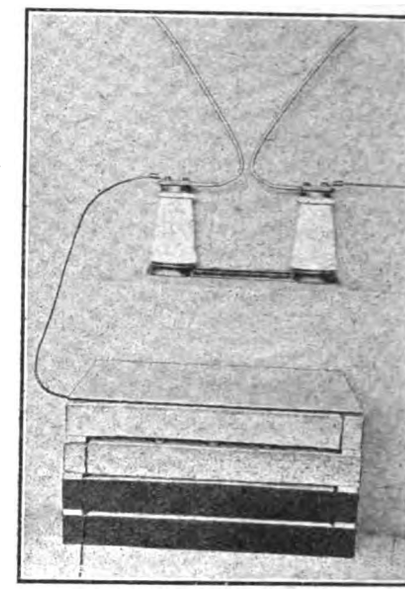

Fig. 12.

Owing to the suddenness with which it was at one time supposed that the horn gap arc was broken, it was suggested that pressure rises must be produced thereby. It may be said at once, however, that there is no ground whatever for such a suggestion. In fact, Schrottke (*E.T.Z.*, Vol. 31, p. 443) some time ago made most careful oscillographic tests with a view to settling this particular point. A 10,000 volt 50-cycle line was constructed and connected to earth through horn gap dischargers having series resistances of 1,800 and 600 ohms respectively, and again without any resistance at all. In no single case could a pressure rise be detected.

These and many other tests show conclusively that the horn discharger does not break the circuit with sufficient suddenness to produce a rise of pressure. In fact, the resistance shunted Wurts, the condenser shunted Giles, and the electrolytic arresters are each liable to break with much greater suddenness than the horn discharger. A further point which has sometimes been urged against the horn gap refers to the possibility of oscillations being set up by its acting as the spark gap of an oscillating circuit. The experiments of Schrottke (*E.T.Z.*, Vol. 31, p. 443) show conclusively that such oscillations do not occur, owing to the nature of the discharge which in no way corresponds to the ordinary oscillating spark gap.

With a view to obtaining greater accuracy of setting, so-called "relay" horn gaps have been used. In these arresters, which take various forms, the main gap is bridged by a comparatively high resistance having a small and accurately adjustable

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platinum-tipped gap in series with it. This auxiliary gap is situated just below the main gap, and so soon as it discharges the air is ionised and the more widely set main gap discharges also. Such an arrangement only presents advantages for low pressures where the setting of the coarser gap is less easy and with the voltages at present in common use it has not been largely used.

In connection with the setting of all dischargers it is best to make the final adjustments on site, partly owing to the effect on the setting of small variations in construction or mounting, but still more because no two systems are the same as regards their requirements, and experience alone can determine the voltage at which the discharge would best occur.

(To be concluded.)

TRADE IN THE ARGENTINE REPUBLIC.

Writing on the subject of opportunities which will arise in the Argentine as a result of the withdrawal of German competition, the United States Consul at Rosario remarks that although stocks generally are large, business is impressionable, and, provided export trade recommences reasonably soon and crop prospects continue good, confidence should revive rapidly.

Up to the present Germany has had a strong hold on the market for electrical supplies. A good enquiry may be expected in the near future for articles such as globes, wire, fittings, etc., the market for which is more or less constant. The same holds true of dynamos and small motors, for which there is a good demand in the country, and supplies of which (nearly four-fifths from Germany) are said to be not very large. A slight increase may be expected in demand for electric fans, which already come, however, largely from Italy and the United States. The opening here is best illustrated by the fact that of the total imports of electrical appliances and supplies, valued at £1,796,000 in 1913, £1,032,000 came from Germany, £466,000 from the United Kingdom, and only £106,000 from the United States. The first demand in this important field will be for globes, cable, carbons, and small accessories. If the situation is favourable, the market for articles of this description should be excellent. Prices of common electric supplies have been raised from 10 to 20 per cent., and many firms, including German supply houses, are selling only against cash.

These hints by the American Consul for capturing German trade give point to the following excerpts from a German report on electrical matters in the Argentine which appeared just before the outbreak of hostilities.

The Argentine Electro-Technical Association, which was only founded last year, has, it says, done a good work in standardising conditions in respect to electrical installations and materials. These follow very closely the conditions of the Verband Deutscher Elektro-Techniker. Formerly numerous disputes and difficulties arose owing to the differing conditions under which various nationalities used to sell.

The two competing wireless telegraphy companies, the "Telefunken" (Siemens Schuckert) and the Marconi Company, made good progress last year. The former received a number of orders from the Argentine and Paraguayan Governments for inland wireless stations, whilst the Marconi Company derived considerable benefit from the Argentine law, which ordered wireless apparatus to be installed on all ships (including river steamers) frequenting its ports having fifty people on board. There is a special future before wireless telegraphy in the Argentine, because of the costliness and unreliability of other means of transmitting news, particularly in the thinly populated districts. At the same time, telegraph lines are being extended and improved, better results having been obtained both commercially and technically between the larger towns. Storms and floods, however, often cause serious interruption not merely on branch lines, but also on long main lines. The two large Buenos Aires telephone companies are enlarging their operations. The Union Telefonica, which has systems in and between Buenos Aires and other cities, has introduced the automatic telephone in Cordoba.

As to power plants, the existence of a few big groups, which provide various towns with electric power, does not mean that there is room for a lot of enterprises of this kind, but plants of from 150 to 200 kw. are becoming fairly numerous.

Electrical apparatus and instruments of all kinds are, of course, in continuously increasing demand. It has been suggested that standard switchboards should be kept in stock in Buenos Aires. One firm has already reaped advantage from having made a start in this direction. The installation of large reserve accumulator batteries is being discontinued, owing to the use of Diesel engines. Meanwhile, a local factory is doing good business with comparatively small batteries. There is a sale for batteries for lighting country houses in conjunction with naphtha motors.

In overhead construction, as well as underground circuits, methods have changed for the better, and a higher class of work is being put in.

The metallic filament lamp has completely ousted the carbon filament lamp and is partially replacing the arc lamp for street lighting. In this field, however, there is opportunity for profitable enterprise. Hitherto for street lighting the single differential arc lamp, with open arcs, has been principally used, of 8 and 10 to 12 amps. for direct-current and 12 to 15 amps. for alternating-current.

There are excellent opportunities of increasing sales of small pump motors, electric fans, cooking apparatus and domestic irons. The missionary work to be done lies less in the direction of introducing novelties of this nature than in the direction of overcoming a certain prejudice which has arisen through the placing on the market of an inferior quality of goods.

Already three Argentine ports are equipped electrically, viz., Buenos Aires, Rosario de Santa Fé, and Santa Fé. In view of the satisfactory results attained there, it is only a question of time before all important harbours will be similarly equipped. While on the subject of crane equipments, it may be noted that electric goods and passenger lifts are growing in favour throughout the Argentine. Of the latter there are estimated to be from 2,500 to 2,800 in Buenos Aires alone, mostly with double button-switch control.

MOTOR VEHICLES FOR ELECTRICAL WORK.

Motor vehicles have for some years been used as tower wagons in connection with the maintenance of the overhead conductors of electric tramways. As, however, automobiles are becoming more generally employed for industrial and commercial purposes, the scope of their use by electrical engineers is also steadily extending. Only the other week we alluded to their adoption by the British G.P.O. authorities as an auxiliary to their telegraph cable-testing department, while now comes some information with regard to other purposes for which petrol cars are being utilised by the electrical industry.

The first is in connection with the exchanges of the New York Telephone Co., which extend throughout New York, Brooklyn and the surrounding suburbs. This concern has in service a fleet of nine 12-15 cwt. motor lorries designed for use in carrying material and equipment needed for making the necessary connections between a modern telephone switchboard installation and the conduit manholes in the streets.

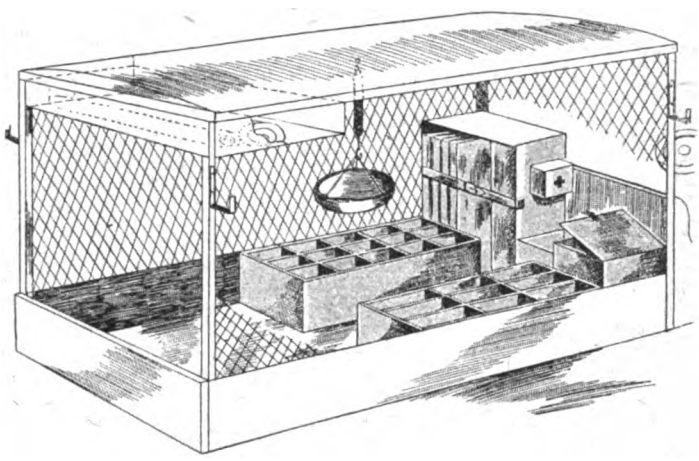

Fig. 1.—Special Body of Motor Vehicle used by the New York Telephone Co.

The vehicles are fitted with specially-designed bodies, the features of which are the low side boards and wire side screens. The length of the body is 8ft. 6in., the width 4 ft. 4 in., and the height 6 ft. 4 in. From the accompanying illustration, fig. 1, it will be seen that the interior of the body is provided with several boxes, each of which is intended to carry some material used in connection with telephone installation work. At the forward left is a tall, narrow box, open on the side facing the rear. Several long thin strips of paraffin, which, when melted, are used in waterproofing cable joints, are carried in this box and are held therein by means of a leather strap. Directly to the rear of this box is located a long, shallow box, divided into several compartments by means of wooden partitions, and intended for the storage of small pipe fittings, such as elbows and nipples in which wires are carried over fences. In the front of the body, on the right, are two square boxes, in one of which is carried the lead used in wiping cable joints, while the other accommodates miscellaneous tools and the petrol stove used in melting the lead. Directly to the rear of this box is another long shallow one, divided into several compartments in which are carried the fittings used in switchboard installations.

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Under the roof of the body, at the rear end, is a shallow box open at its front side, in which rolls of fireproofed canvas, used in the wrapping of cable joints, are carried. A spring balance, with a suspended pan, intended for weighing the amount of lead used, is hung from the centre of the body top. For use in case of accident, a first-aid-to-the-injured kit, marked with a Geneva cross, is also provided, it being attached to the side of the box which holds the strips of paraffin. On the outside of each of the four roof posts is a U-shaped iron bracket used for the carrying of ladders, lengths of pipe, sump pumps, and coils of rope.

Another interesting use of motor vehicles, the machines being, in this case, of the electric type, is that of the New York Edison Co. in connection with the maintenance and repair of arc lamps in New York. The vehicles, which have a carrying capacity of from 15 to 20 cwt., are also fitted with bodies of special design, "A place for everything, and everything in its place," having apparently been the watchword of those responsible for its production. The body is of the panel type, and is of the following internal dimensions:—Length, 9 ft. 6 in.; width, 4 ft. 6 in.; and height, measured on the centre line, 6 ft. Wooden racks, 15 in. in depth, composed of compartments of different sizes, for the carrying of varying classes of material, are fitted on each side of the body, leaving an open passage-way 23 in. in width, in the centre. The racks on the left side differ from those on the right, the only particular in which they are similar being that their tops are the same distance below the roof of the body. The space between the cambered roof and the flat tops of the racks, which is approximately 8 in., is used for carrying coils of wire, miscellaneous tools and mechanics' overalls, the material being held from falling out by means of small doors hinged at their upper edges, three such doors being fitted on each side.

On the right side of the body, directly beneath the doors of the top compartments, are fitted two horizontal shelves for large exterior arc-light globes. Both shelves are divided into six compartments of sufficient size to accommodate one globe

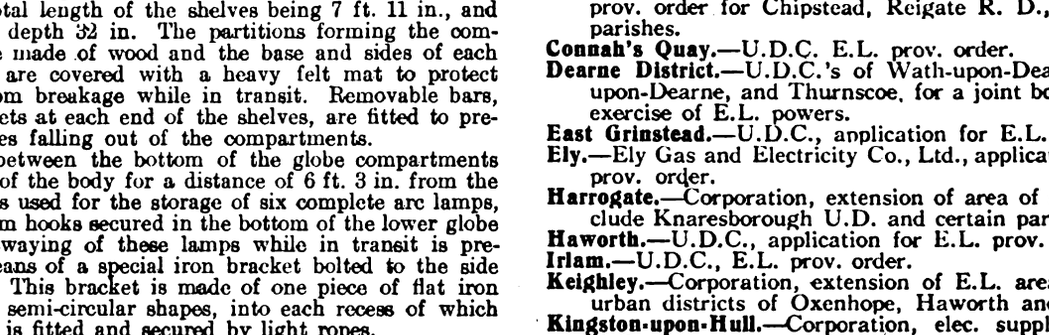

Fig. 2.—Details of Interior of Arc Lamp Renewal Vehicle used by the New York Edison Co.

in each. The compartments are 15 in. wide and 15 in. in height, the total length of the shelves being 7 ft. 11 in., and the combined depth 32 in. The partitions forming the compartments are made of wood and the base and sides of each compartment are covered with a heavy felt mat to protect the globes from breakage while in transit. Removable bars, held in brackets at each end of the shelves, are fitted to prevent the globes falling out of the compartments.

The space between the bottom of the globe compartments and the floor of the body for a distance of 6 ft. 3 in. from the forward end is used for the storage of six complete arc lamps, suspended from hooks secured in the bottom of the lower globe shelf. The swaying of these lamps while in transit is prevented by means of a special iron bracket bolted to the side of the body. This bracket is made of one piece of flat iron bent into six semi-circular shapes, into each recess of which one arc lamp is fitted and secured by light ropes.

To the rear of the arc lamps, and directly beneath the globe compartments, are fitted, in two horizontal rows, four small drawers, 15 in. in width, 15 in. in depth, and 5 in. in height. Directly beneath these drawers, in which are carried miscellaneous pipe fittings, such as elbows, T's and nipples, are four open compartments for the accommodation of other miscellaneous supplies. Each of these compartments is sub-divided into two parts by means of shelves slanting backwards from the centre of the body.

On the left side a shelf, similar to that on the right, is located directly beneath the roof of the van. Below this shelf is another which is divided into two compartments for two of the globes, similar to those carried on the right, and a number of smaller compartments for small glass globes which are fitted inside the large exterior globes. The first two compartments are 15 in. in depth, width and height, while the smaller ones, though of the same depth and height, are only 4½ in. in width. Directly beneath the four small rear compartments are four others of the same dimensions and used for a similar purpose. The compartments are lined with felt and the globes are wrapped in tissue paper.

The space between the forward end of the body and the four lower rear compartments is utilised for six more arc lamps, of a larger size than those carried on the right; they are, however, carried in the same manner. A sheet-metal tool box is located at the rear end of the body beneath the four small lower globe compartments. A small box, open at one end, is also fitted at the rear side of these compartments, as indicated in fig. 2, it being intended for carrying a small quantity of arc-lamp carbons. Two 12-foot step-ladders and one 20-foot extension ladder, carried on U-brackets fitted on the front and rear roof posts of the body, complete the equipment carried. When completely loaded, the van has a carrying capacity of six of the large and six of the small type arc lamps, fourteen of the large exterior arc lamp globes, and sixty-four of the small interior globes. Besides this, quantities of arc-lamp carbons, bolts, screws and miscellaneous fittings are carried in the small compartments.

We are indebted to *The Commercial Vehicle* for the illustrations.

ELECTRICAL APPLICATIONS FOR PARLIAMENT TO CONSIDER.

The following is a list of the applications for electric lighting, power and traction powers that have been filed for consideration by Parliament and the Board of Trade next session. The list is, as might be expected, much shorter than usual:—

(*a*) Electric Light and Power.

Altrincham.—Application by Altrincham Electric Supply, Ltd., for alteration of 1893, 1896 and 1912 orders. Transfer to Altrincham and District Electric Supply, Co., Ltd., 123, Queen Victoria Street, E.C.

Andover.—Crompton & Co., Ltd., application for E.L. prov. order.

Ascot.—Ascot and District Gas and Electricity Co. Various powers, including power to take supply of energy in bulk.

Boston.—Application by R. A. Smith for E.L. order for Boston and district.

Chipstead and District.—Application by G. Allom for E.L. prov. order for Chipstead, Reigate R. D., and several parishes.

Connah's Quay.—U.D.C. E.L. prov. order.

Dearne District.—U.D.C.'s of Wath-upon-Dearne, Bolton-upon-Dearne, and Thurnscoe, for a joint board for joint exercise of E.L. powers.

East Grinstead.—U.D.C., application for E.L. prov. order.

Ely.—Ely Gas and Electricity Co., Ltd., application for E.L. prov. order.

Harrogate.—Corporation, extension of area of supply to include Knaresborough U.D. and certain parishes.

Haworth.—U.D.C., application for E.L. prov. order.

Irlam.—U.D.C., E.L. prov. order.

Keighley.—Corporation, extension of E.L. area, to include urban districts of Oxenhope, Haworth and Oakworth.

Kingston-upon-Hull.—Corporation, elec. supply in Hessle U.D.

Knaresborough.—U.D.C., E.L. prov. order.

Litherland.—U.D.C., E.L. prov. order.

London.—L.C.C., establishment of Electricity Authority for London and adjoining districts; taking over undertakings and powers, and many incidental provisions.

London.—London Electric Supply (No. 1), new company to exercise any powers with regard to elec. supply in or near London that may be conferred upon the L.C.C. or any other public authority.

London.—London Elec. Supply (No. 2), new company to supply energy for all purposes in administrative County of London and parts of Middlesex, Hertford, Buckingham, Berks., Surrey, Essex, and Kent; take over existing companies, etc.

Mid-Somerset.—Application for prov. order by Christy Bros. & Co., Ltd., to supply Street U.D.; Glastonbury borough; City of Wells; and parts of rural districts of Wells and Langport.

Normanton.—U.D.C., E.L. prov. order.

Ormskirk.—Ormskirk Gas Light Co., elec. supply in Aughton; generating station, etc.

Plymouth.—Corporation, various powers relating to the electricity and tramways undertakings.

Reading.—R.E.S. Co., Ltd., extension of area to include Henley-upon-Thames, and parts of Henley and Wokingham.

Ryde (I. of W.).—U.D.C., provisions for transfer of 1899 E.L. powers to I. of W. E.L. & P. Co., Ltd.

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Selby.—Electrical Distribution of Yorkshire, Ltd., E.L. prov. order.
Skipton.—U.D.C., application for E.L. prov. order.
Southampton.—Corporation, extension of supply area to include Bitterne and South Stoneham, etc.
Stanley.—Electrical Distribution of Yorkshire, Ltd., E.L. prov. order.
Teignmouth.—Messrs. J. & W. Purves, E.L. prov. order.
Tenby.—Corporation, E.L. prov. order.
Tunbridge Wells.—Corporation, extension of supply area, to include Southborough and parts of Tonbridge, Sevenoaks and Ticehurst.
Yorkshire Electric Power Co., Ltd.—Sub-division of shares; removal of restrictions as to supply for lighting; lighting supply in certain districts; and other powers.
Warrington.—Corporation, extension E.L. powers, to include parts of Runcorn and Warrington.
Woodford and District.—County of London E.S. Co., Ltd., elec. supply powers for Buckhurst Hill, Chingford, Loughton, Wanstead and Woodford, and Chigwell.
Ystradgynlais.—R.D. Council, E.L. prov. order; purchase of undertaking of Glantawe E.S. Co., Ltd.

(*b*) Electric Tramway and Railless Trolley Vehicles.

Aberdare.—U.D.C., new tramways, tramroads, and railless traction, bulk elec. supply powers.
Bristol.—Bristol Tramways & Carriage Co. Ltd., extension of time for exercise of certain powers.
Bury.—Corporation, additional tramways.
Dewsbury.—Corporation, new tramways; running powers over other systems; motor omnibuses; further elec. supply powers.
Halifax.—Corporation, new tramways in Halifax, Brighouse, and a number of urban districts; powers to carry minerals and goods on all Corporation tramways, trailer cars, trolley vehicles, etc.
Hull.—Corporation, further tramway powers.
Lincoln.—Corporation, further tramway provisions, extension of generating station, running electric trolley vehicles, etc.
London.—L.C.C., new tramways and tramway reconstructions; power to run coupled and trailer cars north of the Thames; various incidental provisions.
Rhondda.—U.D.C., additional tramways in Clydach Vale and Blaenrhondda.
Rotherham.—Corporation, new tramways; motor omnibuses; amendment of provisions as to contribution toward maintenance of roads traversed by trolley vehicles; electricity provisions.
Sheffield.—Corporation, new tramways, compulsory purchase of and running powers over Rotherham Corporation tramways in Sheffield; motor 'buses.
South Shields.—Corporation, new tramways; motor omnibuses; also certain provisions relating to electricity supply undertaking.
Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board.—Additional tramways in West Riding, and in Chester and Derby counties; extension of elec. supply area; purchase of Glossop elec. supply undertaking from the Urban E.S. Co.; and other powers.

(*c*) Railways.

Metropolitan District Railway Co.—Various general, extension of time, widening, and other powers; also agreements with railway companies for laying cables from Lot's Road to Central London Railway, and supply of energy to other railways.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

U.S.A. Safety Rules.

We have read with much profit your comment, in the October 30th issue, on the safety rules for operation of electrical equipment and lines, published in Circular No. 49 of the National Bureau of Standards.

Your conclusions as to the considerations which led to the issuance of operating safety rules before the construction rules, are generally correct, and we fully realise the many features of construction and installation in this country in which the life hazard has been less guarded than have fire hazard, continuity of service, or initial costs. The reason for the development of such construction is, no doubt, to be found in the fact that such electrical standards as are now effective in this country have been developed by fire protection and operating interests, with little or no assistance or restraint by Governmental or similar influences directly representing the public safety.

In your own country, construction from an early date received the constant attention and guidance of the public authorities, and, to the extent that inspection has secured compliance with your regulations, accident-prevention requirements have been incorporated no less than those for fire hazards. In this country the application of uniform standards by uniform inspection methods has been largely confined to interior wiring installations, and, in them, to surveys from the fire-hazard standpoint. We are forced to realise difficulties introduced in the preparation of construction and installation rules by the great development which has taken place to some extent unrestricted.

Your further comments are awaited with much interest, as representing the point of view of engineers familiar with the working, over long periods, of comparatively rigid accident-prevention requirements. Appreciating your careful consideration of this subject and the Bureau Circular, we are—

S. W. Stratton, *Director.*

Department of Commerce,
Bureau of Standards, Washington,
November 16th, 1914.

Street Lighting in Chicago.

In your issue of October 30th, 1914, page 607, appears a communication under the title of "Street Lighting in Chicago." Your correspondent criticises as "most misleading" an account extracted from the *Electrical Review and Western Electrician*, in your issue of October 9th. It is apparent that he is not informed with regard to the recent developments in incandescent lamps. Mazda lamps corresponding to the 600-C.P. size, as used in Chicago and as made by the leading manufacturers in the United States, *do* give an actual efficiency measured by 2 mean horizontal C.P. per watt consumed, with a rated burning life of 1,350 hours.

These lamps are now being adopted rapidly by the leading cities in this country, in competition with arc lamps.

While I am not as familiar with the recent progress in flame arc lamps as I am with the incandescent, I am aware that both European and American-made electrodes have been used here. I have every reason to believe that the results obtained have not been far different from those obtained in Europe, except that our practice has tended toward the enclosed flame arc, on account of its superior operating characteristics and maintenance cost, which under our conditions more than compensate for the difference in efficiency. The only arc lamp which we now recognise as competing with the Mazda, for street lighting, is the Magnetite or luminous arc.

While it is true that the flaming arc is more efficient as measured arbitrarily in initial C.P. per watt, operating comparisons in Chicago and elsewhere show that both the Mazda and Magnetite arc will, under average conditions, deliver more useful illumination in the street, per dollar of cost, than does the flaming arc. It was on this basis that the Mazda lamp was selected in Chicago, allowance being made in figuring the operating cost for current, labour and materials of maintenance, and interest and depreciation on the investment.

Candle-power is a much abused term, and comparisons based on such values, unless qualified or interpreted, are the most frequent source of misleading conclusions in street lighting practice. Candle-power efficiency comparisons, properly made, are of considerable value, still they do not form a complete basis for the selection of units for lighting service, and the other items, such as character of distribution, cost, &c., are frequently of sufficient value to give reversed results.

G. H. Stickney,
Assistant to Sales Manager, Edison Lamp Works.

Harrison, N.J., *November 19th*, 1914.

Workhouse Supply.

I have been particularly interested in the report *re* Willesden Workhouse supply. As I am not acquainted with the details of the conditions existing at the workhouse, the remarks by the District Council's engineer certainly tend to strengthen my opinion regarding the operation of Institution engineering arrangements. I have made quite a deep study of this particular branch of work for some years now, and have been very keen in observing plant in use at institutions, &c., as to their various merits in dealing economically with the various loads one finds in such places. Personally, I feel confident that it is possible to arrange the load and plant in such a manner that it is a very difficult matter commercially for a public supply of electricity to step in and displace your own arrangements for generating. To supply engineers this may be a rather difficult point to appreciate, but anyone who has dealt with such problems must admit that when you have steam boilers and plant in use, not necessarily for electric lighting and power, but compulsorily for other purposes, it opens a great field for thought, and a vast deal could be written on the subject. He would be an excellent engineer who could furnish a complete report, as to how the various costs for the different sources of steam, light and power in an institution should be set out. Of course I mean for, say, a period of one year, as it is quite possible for a number of hours, and perhaps days, but when exhaust steam is utilised for heating buildings, it is almost impossible to obtain reliable figures over a long period. It does not follow that such combinations are not economical and efficient, and, further, it is a fact that if you do not take the fullest advantage of your necessary power and steam plant, the purchase of electrical energy to displace your own steam plant increases the cost of dealing with the other necessary load, which has to be dealt with, as most of the factors that make up the cost for lighting and power in

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institution work cannot be dispensed with. If a supply company could step in and sweep out all the boiler and steam plant and dispense with most of the staff, that would be another matter, and I think if all the conditions and costs, &c., were known about the institution in question, especially when the District Council's engineer mentions that it would have been necessary to install a battery of such dimensions as to warrant a cost of £150 annually with only an annual load of 44,701 units to be dealt with, it would assist in arriving at more definite calculations.

It is, and always must be, a difficult problem for a Board of Guardians, for instance, to discuss thoroughly the different methods proposed to them regarding their engineering arrangements, and it is unfortunate that more reliable information is not published from time to time regarding institution arrangements. I have no doubt it would astonish many engineers to hear of the amount of plant involved in institution work, and the total cost of fuel for various purposes, and the numbers of different types and systems for heating purposes that are advocated, and used in almost every institution. The purchase of electrical energy from an outside source would completely take away, in almost every case, the commercial efficiency of the plant working as a whole combination. In conclusion, I think that the information furnished by Mr. Blake certainly makes the cost against the Guardians very misleading, especially to engineers who are not acquainted with the varied and difficult problems to be dealt with in institution work.

An Institution Engineer.

Why Great Britain Loses Trade.

It occurred to me that it might be of some interest to your subscribers to know one of the reasons why there is not more British electrical machinery in Canada than there is, and I would state, for the information of manufacturers, that a good deal of the trouble is due to improper installation. The conditions of construction or installation and operation of plant in Canada are very different to what they are in the Old Country. For instance, in the Old Country it is usual to get the engineer who will ultimately take charge of the operating of the plant to supervise the construction also. In this country this is not the case, as it is seldom that trained engineers are actually in charge of the operation of plants. These men are drawn from a class who have often started as firemen or oilers, and have actually worked their way up to taking charge of the station in which they have had all their training, and are able to hold their jobs through a knowledge of that particular job only. These men are termed "operators," and in many cases are only capable of starting or stopping a plant and keeping it oiled, &c, and are not able to locate other than very obvious troubles. I have come personally across two or three cases in Canada where plant supplied by British firms has given serious trouble, due to manufacturers not realising the above conditions, and I am sure that if manufacturers would instruct their offices in Canada not only to see that the plant was supplied as per specification, but to see also that it was started and operated for two or three months, a great many of the unpleasant experiences which they are subject to would disappear. I could, of course, give specific instances where lack of attention has given British material a very bad name, and where the trouble has been caused by so-called "Operators" not understanding the material which they were operating. It is, therefore, very apparent that the manufacturers must see that everything is correct before passing it out of their hands.

Canada.

Montreal, *November 25th*, 1914.

[Our correspondent states that there are many cases in Canada which the above conditions fit exactly, and he will be glad to give further details in response to personal inquiries which may be made through ourselves.—EDS. ELEC. REV.]

There has been a great deal of rather windy talk about capturing German trade, but we poor exiles in the Colonies would be only too glad if the firms at home would only treat us decently as regards the goods we do order from Great Britain. Packing is bad, no instructions are sent with complicated machinery, articles are sent incomplete, and suggestions for improvements are treated in the most off-hand manner. In connection with the above I give typical cases I have myself seen if not suffered from :—

1. Two large flat iron dials were sent out packed in straw, instead of being placed on strips fastened to the sides of a tin-lined case, so that the dials would neither touch each other nor the case. As it was, the painting was ruined and the graduations and figures were quite illegible. They had to be painted again, but will never look the same. The customer was just bled of so much money through the supplier's carelessness.

2. A petrol engine was supplied (through an agent) with the piece of machinery it was to work. The engine and piece of machinery were of a new pattern, but no drawing or instructions were sent. Connection pipes were not supplied, nor a water tank for cooling water, nor was there any note of what size of tank would be necessary. This engine had been sent to an engineer in the jungle, whose curses were deep, and who, if it had been in his power, would have seen that no more orders went to that firm.

3. I was supplied with a machine which worked well, but developed several defects in use. I went into the matter very carefully and made practical suggestions which could have been carried out at little, if any, extra cost. Those suggestions were sent on to the manufactur
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India, *November 13th*, 19

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Preston, *November 30th*

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He spells it "staisfactory." On page 134, line 10, he calls "inertia" what probably most technical men would call "moment of inertia." Of course, the Reviewer knows these are unimportant, and they were not specifically mentioned in the review, but the author deliberately says that he cannot find the misprints, after his attention has been directed to the pages.

Regarding pulleys and gearing: Naturally the author thinks his methods of dealing with these details are largely novel. However, the Reviewer is still of the opinion that quite as good results might be obtained from pocket-books—as they have been in the past, and possibly will be in the future.

Regarding stator frames: The Reviewer is not concerned with wrong formulæ that have been published in technical papers. As a matter of opinion, the Reviewer thinks this part of the book out of proportion altogether in regard to the rest of the work.

The Reviewer, after careful consideration, really cannot see that he can do better than repeat the last paragraph of the review:—"The general impression of the book on the Reviewer is that it contains a good deal of information, but, at the same time, he would strongly recommend any buyer to check the mathematical expressions before he uses them. The price also seems excessive."

The Reviewer.

Trading with the Enemy.

In your issue of last week you quoted a letter of mine to the *Financial Times* on the "Trading with the Enemy, 1914, Amendment Bill."

Since the time of writing, the Bill has become law, but, unfortunately, although an amendment was put forward to embody a clause which should empower the Secretary of State or the Board of Trade to determine or suspend any contract made between British subjects and an enemy alien, through lack of active support the amendment was withdrawn. The withdrawal, however, was not on the score of actual opposition as such, but due practically—as the Attorney-General put it—to the difficulty of getting an adequate commercial expression which would cover all the exceedingly complex cases which would have to be dealt with under such provision.

The Act, of course, had a very hurried passage through the House, as it had to be got over in practically two or three days, so that one can sympathise to a certain extent with the Attorney-General in not wishing to include any amendment on this score of contracts, unless it was in such a fashion to reach finality.

Now, however, when there is plenty of time properly to formulate a measure to meet the case, it is important that some steps should be taken by commercial men to come to unanimity as to what it is necessary to embody, and then to make representations to the Attorney-General with a view to the introduction of a further Amendment Act.

That the Attorney-General is prepared to receive such representations is most clearly put forward in his speech; when the contract amendment was being dropped, he said:—"If I gather, as a result of consultation with hon. members in this House, and citizens outside, that it is really desirable to make a trial, I will endeavour to get the help of a limited number of those who would be able to help." He goes on to say that these would include one or two members, and one or two of commercial experience, and, possibly, some of judicial experience.

What is particularly necessary is that there should be unanimity of opinion among commercial men. As the Attorney-General said, proceeding further:—"It is no good unless you are in a position to say what you want definitely, both for yourself and everybody else."

It is to be hoped, therefore, that something will be done on these lines as soon as possible, as there are contracts involving altogether a huge amount of money, which are being held up pending definite legislation. Directly such is forthcoming these contracts can be transferred to British firms; incidentally, also, this would mean the immediate employment of a considerable amount of labour.

That there is nothing to be gained by leaving the whole matter in its present state of uncertainty must be patent to every commercial man.

T. W. Cole.

London, E.C., *December 8th*, 1914.

Signalling Supplies Wanted.

The Commanding Officer of a Signal Company, R.E., attached to the new Expeditionary Force, wants to borrow the following articles:—

1. Small lathe with slide rest and tools. Not necessary for it to have screw-cutting gear, although it would be helpful.
2. Bench vice, about 12-lb. weight.
3. Tools of all kinds, carpenters' or other trades (a list is difficult to compile, but would be furnished).
4. Soldering gear, both large and small bolts.
5. Brazing lamp.
6. "Quantity and intensity" detectors (two).
7. Duplex telegraph galvanometers (two).
8. Telephone receivers with cords (a couple of dozen required).
9. Microphones (half a dozen).
10. Portable telephone sets complete (half a dozen).
11. Insulated wire on drums suitable for laying out of doors. Must be flexible and not easily broken (some miles).

Any cash subscription will be welcome, and an account can be rendered, if desired, for expenditure on ebonite, brass, German silver wire, or copper scraps, which might "make up" into something. Platinum suitable for electric contacts. Assorted nails, screws (brass especially), electric terminals. Insulating copper wire of all sizes, from fine 40 B.W.G. for winding bobbins, up to heavy rubber-covered for exposed places. Bell wire can be bought locally.

It is impossible to obtain them in the usual way through the Government supplies, and there are no doubt many of your readers who are in a position to assist a very gallant arm of the service in this manner.

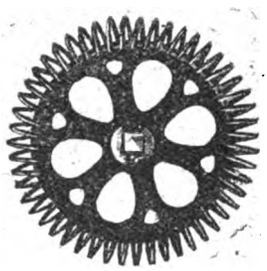
I shall be glad to receive any offers in writing at this address, but I cannot undertake to receive any of the goods. I will place any suitable offers before the Commanding Officer above mentioned.

R. Macleod,
Secretary, National Service League.

London, S.W., *December 8th*, 1914.

Handles for Electric Ovens.

May I suggest that manufacturers of electric cooking ovens should adopt a standard form of handle which would always be easy and cool to grip. A simple and cheap form is a wire valve



wheel as shown on the enclosed illustration which is always cool even when used on valves passing steam at the highest possible temperature.

W. H. Allen, *Engineer and Manager.*

Corporation Electricity Department,
Loughborough, *December 2nd*, 1914.

[The device illustrated is the "Cosmopolitan" handle of Messrs. Holden & Brooke, Ltd.—Eds. Elec. Rev.]

LEGAL.

The Osram Lamp Works, Ltd., v. The Corona Lamp Works, Ltd.

The defendants' application to postpone the trial of this patent action on the ground that the German experts they had retained to give evidence for the defence were no longer available, and that supplies of tungsten acid required for any further experiments were unobtainable owing to the war, was renewed before Mr. Justice Sargant in the Chancery Division on Thursday, December 3rd.

Before the application was proceeded with Mr. Walter, K.C., for the plaintiffs, said he desired to make an offer, and, if it was not accepted, he should ask for an adjournment to cross-examine the defendants' witnesses on their affidavits. The case had been pending since July 3rd. On October 16th, his Lordship gave the defendants an adjournment of six weeks, and he now offered them another six weeks.

Mr. Romer, K.C., for the defendants, said the plaintiffs had taken two years to get ready.

Mr. Walter said, as his offer was not accepted, he would ask that the application for an adjournment should stand over to cross-examine two of the defendants' deponents.

His Lordship said he had never before heard of an application to cross-examine witnesses on an application for postponement of a trial, but the circumstances were exceptional, and there was nothing in the rules against cross-examination.

Mr. Romer did not object, and his Lordship said he would take the cross-examination before him in Court on Monday, December 14th.

Arbroath Electric Light Co.'s Valuation Appeal.

The Lands Valuation Appeal Court, at Edinburgh, on December 4th, considered an appeal by the Arbroath Electric Light and Power Co., Ltd., who complained of an entry of £1,215 in the valuation roll in respect of their works and mains, claiming that £500 should be the entry in the roll. By a majority the Valuation Committee fixed the valuation at £1,100. The appellants contended that the method of valuation adopted by the assessor in taking only one year's accounts was not in accordance with the proper application of the revenue basis; that an average of at least three years' accounts should be taken; and that prior to this

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year the Assessor based his valuation on an average of three years' accounts, and 1913 was an abnormally good year for the company. The Assessor held that in 1913 additions were made to the plant and machinery to the amount of nearly £8,000, increasing the value of the subjects by a third, and accordingly the profits earned in 1911 and 1912 did not reflect the earning capacity of the undertaking in its present state, while the profits of 1913 did more nearly represent that earning capacity. After hearing counsel, their Lordships made avizandum.—*Edinburgh Evening Dispatch.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

G.E.C. Main Regulators.

We recently described in these columns the rectangular type of main regulator with strip resistance, manufactured by the General Electric Co., of Witton; the accompanying illustrations show a quite different pattern. The regulator, fig. 1, is of the G.E.C. standard construction, and will control a 5,000-kw. turbo-alternator; this pattern of regulator has been supplied by the G.E.C. to an important municipality. It consists of a circular face-plate regulator of extremely strong construction, mounted on the same angle-iron frameworks as, and connected to, a G.E.C. cast alloy grid resistance. It will be seen from fig. 2 that the connections between the contacts of the regulator and the resistance are of solid copper bar, to enable a thoroughly good connection to be made; the regulator contacts are turned round at right angles, and the copper rods are screwed to them; therefore there are no loose wires to be found anywhere in the regulator, the whole of the contacts being solid throughout.

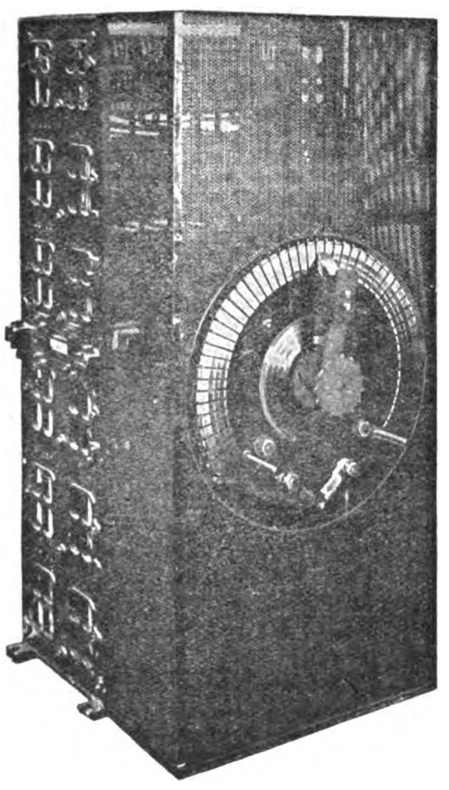

Fig. 1.—G.E.C. Main Regulator for 5,000-kw. "Witton" Turbo-Alternator.

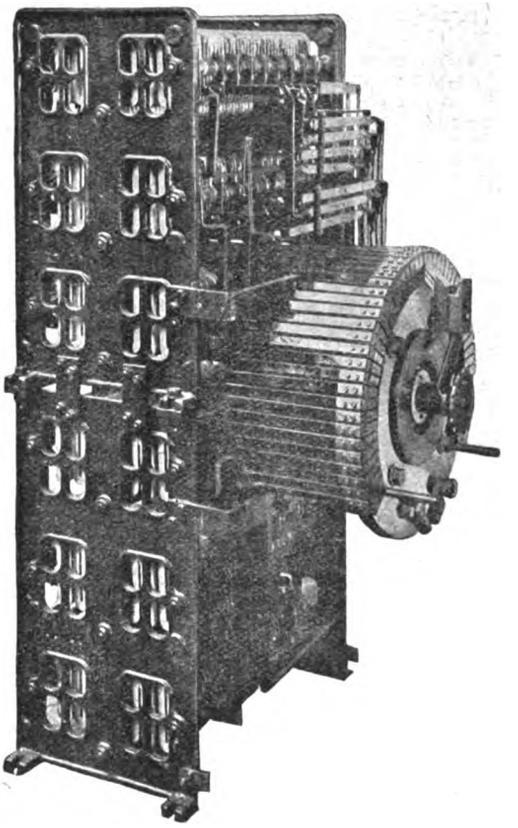

Fig. 2.—Interior View of Main Regulator, showing Solid Connections.

The "Underwood" Digger.

Mr. A. L. Underwood, of 35, Queen Street, E.C., has sent us particulars of his new digger or grab, for which special advantages are claimed, including lightness, simplicity and ease of control. It is suitable for handling coal.

"Eclipse" Heating and Cooking Apparatus.

The Electric and Ordnance Accessories Co., Ltd, of Chester Road, Aston, Birmingham, send us particulars of a number of domestic heating and cooking devices which, they point out, form seasonable gifts at the present time. Amongst these are the toaster and combined toaster and grill, either of which is suitable for table use, the latter—shown in fig. 3—being suitable for grilling chops, bacon, &c., and keeping plates, dishes and liquids warm, as well as toasting. This apparatus is recommended especially for small households on account of its great convenience.

We also illustrate in fig. 4 an "Eclipse" kettle, one of numerous designs, in polished copper, pure-tinned inside; the company also supply breakfast cookers, fry-pans, jugs, urns, &c., in addition to the above.

Fig. 3.—Combined Toaster and Grill.

A variety of "Eclipse" heaters are available, and we illustrate in fig. 5 a Sheraton-style radiator of attractive design. The company's convectors are guaranteed for five years, with the exception of illuminating and radiator lamps.

Fig. 4.—Eclipse Kettle.

Fig. 5.—Sheraton Style Radiator.

We may also draw attention to the "Eclipse" irons, which form a welcome addition to the average household equipment, and can be supplied in various patterns.

OUR LEGAL QUERY COLUMN.

"Push" writes:—"I shall be extremely obliged if your legal contributor will answer, through the medium of your valuable paper, the following question, which is at the present of vital importance to the electrical supply industry. Without a Corporation possessing special powers, are they within their legal rights in supplying energy to their consumers at the power rate for cinematograph or photograph developing, &c., or can it be argued that they are giving one particular trade a preferential tariff, seeing that they are using the energy supplied for lighting purposes, although it is not for general illumination?"

*** The question is a nice one. It may be argued, with some show of reason, that electricity used in a cinematograph lantern is not being used for general illumination. One might even go further and say that some of it is being used, in a sense, for power, inasmuch as the moving parts of the lantern are driven by electricity. Having regard to the express provisions of Sec. 19 of the Electric Lighting Act, 1882, it does not appear to be possible for anyone obtaining current for the ordinary purposes of illumination to raise any objection to the charge made at a

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cinematograph theatre. That section provides that: "Where a supply of electricity is provided in any part of an area for private purposes, then, except in so far as is otherwise provided by the terms of the licence, order or special Act authorising such supply, every company or person within that part of the area shall, on application, be entitled to a supply on the same terms on which any other company or person in such part of the area is entitled under similar circumstances to a corresponding supply."

Having regard to these terms, it is reasonably plain that no ordinary consumer on the one hand, and no power consumer on the other, could object to the terms on which energy was supplied to a cinematograph theatre.

WAR ITEMS.

Electricity Supply Employés and the War.—It will be remembered that the question of allowances to be made to electric supply employés taking the place of those who have gone to the front, if they themselves should elect to go shortly after entering upon their engagements, was raised at West Ham. The matter has now come forward at Fulham. A man was temporarily engaged in August to take the place of a regular employé who had enlisted. In November the said temporary employé himself enlisted, and an application for allowance to be made to his mother during his absence had to be considered. As a result the Electricity Committee now recommends the Council to pass the following resolutions:—

(a) That the resolution passed by the Council on the 9th September, 1914, with reference to leave of absence and payment of officers and servants away on naval or military service, be limited in its application to the permanent staff, and that it be an instruction to the chief officers that no man eligible for naval or military service be employed to fill temporary vacancies caused by employés joining the forces.

(b) That, as from the date of this meeting, the aforesaid resolution of the Council of the 9th September, 1914, be deemed to apply only to such officers and servants who enlist for active service abroad.

The Associated Municipal Electrical Engineers (Greater London) has forwarded to the Committee the following copy of an important letter received from Major-General Sir Francis Lloyd, K.C.B., commanding the London District, on the subject of recruits, viz.:—"Headquarters, London District, Horse Guards, S.W. 25th November, 1914. Sir,—I am informed that many employés of the various Electrical Associations in the London Command have already joined His Majesty's Forces, and are serving their country both at home and abroad. It has now come to my knowledge that many other men employed in the electrical services of the Metropolis are also desirous of joining the forces in the field, and that there is considerable risk of the necessary staffs being thereby so depleted that the power stations and electricity centres will be insufficiently manned. I need hardly say that the result of expert employés leaving their occupation in such a manner would entail great inconvenience to the civil population of this city, and might very easily have disastrous consequences on the conduct of the war. Under these circumstances I desire to express to you my undoubted opinion that the ordinary public services of the Metropolis are at the present time of the first importance, and that the trained men who maintain their efficiency are serving their King and Country in a proper manner and as usefully as if they were fighting in the field, and further, that to disorganise the electric and power services of London by enlisting at the present moment would be a serious dereliction of their duty to the State. I should be glad if you would give the fullest publicity to this letter.—(Signed) FRANCIS LLOYD, Major-General Commanding London District." The Electricity Committee report that they have considered this matter, and whilst they are in accord with the views expressed by Sir Francis Lloyd, are of opinion that the men who are eligible and willing to serve should at least be granted some certificate that they have offered, and they suggest that representations be made on these lines to the Military Authorities. They accordingly recommend:—

That representations be made to Major General Sir Francis Lloyd urging the desirability of a certificate being issued to the men employed in the various electric lighting stations in the Metropolis, who are eligible for and desirous of joining either the naval or military forces for active service abroad, that they are engaged on equally important duty by remaining at their post during the present crisis, and further indicating that it was through no fault of their own that they did not actually join the forces in the field.

Hart Accumulator Men with the Forces.—We have received the following letter:—"Your readers may be interested to know that 87 employés of the Hart Accumulator Co., Ltd., of Stratford, London, are serving in H.M. Forces, both at home and abroad. The percentage of men having left the works and offices on this account is between 25 and 33. Shortly after the outbreak of war the employés, by means of voluntary weekly contributions, initiated a scheme of relief for the dependents of their fellow workmen who had enlisted, and with the co-operation of the company and its directors, the committee has already been able to grant relief of over £250 to the most necessitous cases. Two of our number we shall unfortunately see no more, whilst a few have been wounded in action, but we hope to welcome the remainder back to East London safe and sound at no distant date.—A. F. J. DAVIS, Secretary (pro. tem.) to the Relief Fund. December 4th, 1914."

German Capital in the Russian Electro-Technical Industry.—H.M. Consul-General at Moscow (Mr. C. Clive Bayley) has furnished the following particulars, taken from the "Vyestnik Finansov" (Petrograd of 28th September/11th October, regarding the investment of German capital in the electro-technical industry of Russia:—"During the last twenty years the German electro-technical industry has won for itself a special position in foreign countries. The various electro-technical groups in Germany are so closely connected that they may practically be considered as one large combine, and the triumph of German capital has been so complete that the various foreign markets have had to accept the conditions dictated by the leaders of this powerful trust. As regards Russia, the German electrical firms have established what is practically a monopoly, as hardly any large electrical installation in Russia has been carried out without their help. The total capital invested in the various Russo-German electrical companies is shown in the following table:—

	Year of Foundation.	Ground Capital. Roubles.
Allgemeine Elektrische Gesellschaft	1910	12,000,000
Allgemeine Elektrische Gesellschaft	1901	12,000,000
Siemens and Halske	1898	5,000,000
Siemens—Schuckert	1913	15,000,000
United Cable Factories	1906	6,000,000
Polish Siemens Electrical Company	1912	1,000,000
"Volta" Share Company	1899	1,050,000
Total	—	40,650,000

Of these companies the shares of only two are quoted on the Russian Bourses, and even then only formally. The report of the Russian A.E.G. for 1913 states that, 'thanks to a whole series of orders from Government and private establishments, the activity of the company has been very considerably extended. The number of fulfilled orders exceeds by 20 per cent. the turn-over of the previous year, while the number of orders in hand exceeds the total turn-over for 1913.' The reports of the other companies bear witness to similar successes. An illustration of the German methods of combination may be taken from a protocol of a general meeting of shareholders of the United Cable Factories, from which it appears that of a total of 19,200 shares (of 250 roubles each), 6,235 are held by Siemens and Halske, 6,120 shares by the Allgemeine Elektrische Gesellschaft, and 6,120 shares by Felten and Guilleaume. This same United Cable Factories also belongs, together with three other enterprises, to the so-called Abnehmer Syndicate, a syndicate of consumers of copper, which in its turn has contract relations with the Russian copper syndicate, Mied. German capital is also directly interested in a whole series of electrical concerns in Finland, and in this connection it is interesting to note that the realisation of Finnish municipal loans in Germany generally included conditions whereby all municipal orders were to be given preferentially to German firms."—"Board of Trade Journal."

U.S. Electrical Exports for September.—The "Electrical Review and Western Electrician" states that a partial recovery from the severe financial and commercial shock experienced in August is noticeable in the figures for September. Adjustment to war conditions is shown by a gain of over half a million dollars in the electrical export total of September over that of the preceding month. Whereas the August total was but 45 per cent. of that of the corresponding month in 1913, the September total is nearly 69 per cent. of that of September last year. For the four classes for which numbers of articles exported are given in the government reports, there were shipped in September the following: electric fans, 1,502; arc lamps, 60; carbon-filament lamps, 150,731. The values of the various classes of electrical shipments for September and for the corresponding month of a year ago are given in the following table:—

	Sept., 1914. Dollars.	Sept., 1913. Dollars.
Batteries	38,452	65,398
Dynamos or generators	119,756	161,400
Fans	18,029	64,901
Insulated wire and cables	91,375	213,094
Interior wiring supplies, etc. (including fixtures) ...	34,149	70,777
Lamps—Arc	1,472	3,835
Carbon-filament	9,960	29,944
Metal filament	30,988	20,235
Meters and other measuring instruments	14,375	—
Motors	315,115	491,473
Static transformers	26,871	129,486
Telegraph instruments (including wireless apparatus)	3,791	15,164
Telephones	158,922	196,140
All other	685,240	792,473
Total	1,548,468	2,254,254

Appeal.—The Queen's "Work for Women" Fund (33, Portland Place, London, W.) is asking the women of the United Kingdom to forward, by December 16th, a shilling each to the Fund, as a New Year's offering. Sixty workrooms have been started in London, in which employment is being given to thousands of women and girls who have been thrown into distress through the war.

Oldham Corporation Contracts.—At a meeting of the Oldham T.C. on December 2, Councillor C. Hardman (chairman of the Electricity Committee) announced that further correspondence had taken place with the Tudor Accumulator Co., Ltd., who had agreed that money due to them from the Corporation should be paid into the bank to an account in the joint names of the company and the Corporation, and should not be taken out of the bank until the end of the war.

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Supplies for the Allied Governments.—We are asked to state that all questions relating to the purchase and export of food supplies, munitions of war, and field equipment, for the French, Belgian, Russian and Serbian Governments, are now dealt with by the International Commission for the Purchase of Supplies (Commission Internationale de Ravitaillement). The Executive Office of this Commission, and the offices of the French, Belgian, and Serbian Delegates thereon, are at India House, Kingsway, W.C., while the offices of the Russian Delegates are temporarily at 192, Cromwell Road, S.W. Application for permission to export goods, the export of which from the United Kingdom is prohibited, should, if such goods are required by the Allied Governments or their accredited Agents, be addressed in writing to the Commission. The Commission will only consider such applications if they are accompanied by documentary evidence as to their official origin. Applications which are unsupported by such evidence, or applications in respect of goods which are ordered by private firms for purely industrial purposes, must be made in the ordinary manner to the Commissioners of Customs and Excise, Lower Thames Street, E.C. Owing to the possible shortage of certain classes of goods for which there is a great demand, it may be found impracticable to make any exception to the prohibition against the export of such goods. Consequently, merchants and manufacturers wishing to supply goods for the use of any of the Allied Governments are warned not to enter into any negotiations until they have ascertained from the Commission Internationale de Ravitaillement that permission for the export of such goods will be granted. Having granted permission to export, the Commission will make the necessary arrangements direct with the Customs Authorities for the clearance of the goods, upon receiving from the manufacturer or merchant at least 48 hours' notice of each shipment, together with the following particulars:—

(1) Nature and quantity of goods to be shipped.
(2) Name and address of consignor.
(3) Name and address of consignee.
(4) Port and approximate date of shipment.
(5) Ship or line by which shipment is to be made.
(6) Port of discharge.
(7) Marks on packages, if any.

Westinghouse Employés and the War.—Up-to-date a total of 1,046 men have left the British Westinghouse Company to join either the Army or the Navy, two of whom have been killed in action. The greater number have, of course, joined the Army Regulars and Territorials. Many have joined the Public Schools Battalion, others have joined the newly-formed Naval Brigade as electrical engineers, and one ex-Westinghouse man has highly distinguished himself, i.e., Mr. Sippe, who was one of the three who set out to fly over, and dron bombs on, the German airship hangars at Dusseldorf in October. In an article in the November number of the "British Westinghouse Gazette" it is stated that from the commencement the Westinghouse Company saw the necessity of helping the dependants of those who have left, and immediately set aside a large sum of money for this purpose. A representative committee was appointed and a very carefully organised scheme evolved, whereby each case is visited and reported upon once every fortnight, and at the present time 422 cases a week are dealt with. In addition to this action by the company, a sum of £1,166 was contributed during the first month of the war by the staff and distributed to the various public relief funds, and a further sum is contributed regularly each week or month by the office and works employés for a stand-by fund; this amounted up to 17th November to no less than £1,705. A rifle range has been erected in the works' grounds on which shooting takes place each day in the dinner hour and on Saturday afternoons. Two butts are at present in use, one of 25 yds. range and the other of 50 yds. range, each accommodating ten men at the one time. An extension to the 50 yds. butts, to accommodate fifteen more men, is practically completed. Only those who are not eligible to join the forces are allowed to shoot on this range; at the present time 1,500 men have passes. An average of 10,000 rounds per week is being fired, and the individual scoring is improving steadily.

Burnley Tramwaymen.—With reference to our note of last week concerning the large number of Burnley tramway employés with the forces, the decision that any further men in the electricity and tramway departments desiring to enlist should give due notice, has been construed as a proposal to stop recruiting, and explanations were demanded at the meeting of the Town Council. It was pointed out that that was not the intention; they wished to preserve the service which was necessary if they were to continue the allowances to the men at the front, which now amounted in the case of the tramways to £80 a week. The Chairman of the Electricity Committee pointed out that most of the men holding responsible positions, and who were invaluable, were young, and that they were being made uncomfortable by the humbugging they got for not enlisting. They were in an awkward position, but the Committee could not do without them. The explanations were accepted.

Constantinople Telephones.—In the course of an article, from an American authority, on "Constantinople Comedies," the "Evening News" on Tuesday stated:—"Turkish controllers .... have not yet seized the telephones, as they would be unable to operate them without foreign assistance."

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Personal.—In the "London Gazette" for December 4th, the following announcements under the Naturalisation Act, 1870, appear for the month of November, 1914:—

Name.	Country.	Date of Oath of Allegiance. 1914.	Occupation.
Jarmay, Gustav	Hungary ..	Nov. 19	Director of Messrs. Brunner, Mond & Co.
Kinsbrunner, Charles ..	Austria ..	Nov. 8	Consulting Engineer, and Doctor of Political Economy and Science.
Legrand, Albert Eugene	France ..	Oct. 27	Electrician & chauffeur.
Mannheim, Ernest Arthur	Germany (Naturalised in Australia)	Nov. 4	Mining Engineer.
Moser, William	Belgium ..	Nov. 12	Civil Engineer.
Sandberg, Christer Peter	Sweden ..	Nov. 8	Consulting and Inspecting Engineer.
Sandberg, Nils Percy Patrick	Sweden ..	Nov. 8	Consulting and Inspecting Engineer.
Sandberg, Oscar Fridolf Alexander	Sweden ..	Nov. 8	Consulting and Inspecting Engineer.
Von Chauvis, George ..	Germany ..	Nov. 8	An Engineer.

Mr. Louis Phillippe Lichtenstein, a director of the New British Ever-Ready Co., Ltd., of Holloway, has changed his name to Louis Philip Lightstone by a deed poll dated November 4th, 1914. Mr. Lightstone is a natural born Englishman.

By deed poll executed on Nov. 22nd, Mr. G. F. Metzger, M.Inst.C.E., M.Inst.E.E., M.Inst.M.E., has adopted the surname of Bonnor in place of Metzger, and he will henceforth be known as Gustavus Ferdinand Bonnor. Mr. Bonnor is a British subject, having been born at Dalston, London, some 47 years ago, and it is in order to avoid misconceptions as to his nationality and consequent unfair prejudice that he has made the above alteration. Readers of the "Electrical Review" well know that Mr. Bonnor, as Mr. Metzger, has had a lifelong connection with electrical engineering in England, especially in connection with electricity supply, he having been for many years city electrical engineer at Bath and Manchaster respectively, and we are sure that there will be many expressions of sympathy with him in the very serious position in which the spy mania has placed him. As electrical engineer to the South-East Kent Electric Power Co., Ltd., his duties required him to reside within a fortified area, at Shepherdswell, Dover; but the military authorities, presumably objecting to his German name, ordered him to leave the district. Mr. Bonnor is now temporarily established at Toksowa House, Dulwich Common, London, until the embargo is removed; he is, however, still associated with the South-East Kent Electric Power Co. Mr. Bonnor will be glad if his many friends, from whom he will be very pleased to hear at the above address, will take this notice as official intimation of his change of name.

Mr. Christopher Wade, managing director of Richard Wade, Sons & Co., Ltd., Hull, has gone as a voluntary Red Cross motor-ambulance driver for at least six months. Mr. Wade's brother and ten of the office staff are with the forces.

BUSINESS NOTES.

Consular Notes.—*Concessions in Tripoli.*—Electrical manufacturers are being advised by the United States Consul in Tripoli to follow up the applications which are being made in Rome for concessions to operate lighting and tramway systems in Tripoli. Two Italian electric light companies are jointly endeavouring to secure both concessions.

CEYLON.—*Import Trade Position.*—The official figures of Ceylon's import trade are not very illuminating as regards the different countries which share in the supply of electrical and allied goods. The United States Consul has, however, compiled some figures, from unofficial sources, which give a reasonably exact idea of the relative trade in the various articles from the participating countries:—

Article imported.	1912. Total.	1913. Total.	1913. United Kingdom.	1913. Germany.
Brassware	£21,000	£27,000	*£26,000	£1,000
Cement	†	52,000	25,000	20,000
Copperware ...	5,000	26,000	*5,000	20,000
Electrical materials	24,000	15,000	14,000	1,000
Machinery ...	71,000	246,000	222,000	10,000
Lamps	15,000	18,000	9.000	7,000
Telephone materials	†	3,000	3,000	—

* Includes India. † Not separately classified.

The American Consul considers that his countrymen have a very good chance of increasing their sales in Ceylon. In machinery and tools they have attained some success owing to careful attention to deliveries and packing. He believes the purchasing power of the country to be good just now (Drought threatens a setback.—ED.), as the rubber slump has been counterbalanced by the excellent results from other crops. The standard of comfort among the native population has risen distinctly, and the opening of the Indo-Ceylon Railway promises to solve many problems of labour supply. A description of plumbago mining in the island provokes the comment that this industry has not yet adopted very efficient methods, and suggests a potential demand for winding, pumping and compressor plant.

NEWFOUNDLAND AND NEW BRUNSWICK MARKETS.—In connection with the new trade promotion campaign of the United States Department of Commerce, their Consuls have been devoting considerable attention to the Newfoundland and New Brunswick markets, where they have high hopes not merely of barring Germany as a future importer, but also of weakening Great Britain's position. The chief reasons for the increased importations of American goods into Newfoundland in the past are that local merchants, manufacturers' agents, and importers are taking advantage of the trade literature on file at the United States Consulate; that the more enterprising merchants are sending their buyers to the United States, which was not the case a few years ago; and that American manufacturers are studying the requirements of the Newfoundlanders. This has resulted in the importation of a finer line of goods as regards make, finish, and style. In the opinion of the American Consul, sales of goods can be substantially increased by more persistent efforts and care in filling orders, packing the goods, &c. The fact should be borne in mind that Newfoundland is not a part of Canada. Merchants and importers are averse to having their inquiries and orders for goods referred to a representative in Canada. They prefer to deal direct with the head office or works, claiming that it is more satisfactory as regards prices and freight rates, and that the goods come in better condition on account of less handling.

In New Brunswick, the curtailment of the normal supply of many manufactures of the belligerent countries was not at first of importance, seeing that stocks were fairly full and trade somewhat depressed. Now, however, merchants are becoming optimistic and the future outlook for trade is much brighter. Plans have been made for the usual logging activities during the winter and next spring, and all the mills will run to full capacity during 1915. This also means a resumption of normal business at the stores. There will certainly be an increased demand for electrical goods and supplies and everything connected with mill equipments. Amongst German goods which are under commercial interdiction are electric fancy lamps and tungsten lamps, semi-rotary wing pumps, &c. These German goods have been supplied chiefly through Montreal.

SWITZERLAND.—In a report just issued, from the pen of H.M. Vice-Consul at Zurich, it is remarked that although Switzerland is mainly dependent for her industrial prosperity on exports of her own manufactures, the yearly value of manufactured goods imported into the country is by no means inconsiderable. Last year, the value of her imports of machinery and ironware amounted to £3,536,600, whilst her exports under these headings (including also vehicles) amounted in value to £5,422,000. Year by year, however, Switzerland's imports of manufactures are steadily increasing, notwithstanding that her own manufacturers are also increasing their exports. The Vice-Consul's remarks are based upon the provisional trade returns.

The Vice-Consul says that British manufacturers and exporters still underestimate Switzerland's importance as a market for our goods. The share of the United Kingdom in the imports into Switzerland has not only been small as compared with the total imports from all countries, but shows no sign of proportionate increase. In 1911 the United Kingdom only supplied 5½ per cent. of Switzerland's total requirements, 5·9 per cent. in 1912, and 5·8 per cent. in 1913. This is a poor showing, particularly in view of the frequently-expressed desire both in the Swiss Press and by Swiss merchants, for a more equally balanced trade in return for the large business they do with the United Kingdom. Only recently one of the principal Swiss exporters to the United Kingdom and her Colonies expressed to the Vice-Consul the opinion that the imports of British goods could certainly be considerably increased if British manufacturers would follow the example of the German commercial traveller, and study German methods and terms, or at any rate establish branches or agencies in the principal Swiss towns. In his opinion British manufacturers are either unaware of, or indifferent to, the very sympathetic attitude of the Swiss consumers towards British goods, particularly among the well-to-do classes.

The Vice-Consul has prepared a list of articles in which the United Kingdom already does an export business to Switzerland to a certain extent; but it is only reasonable to assume that with increased efforts a much larger trade might be done therein. In this list figure machinery, ironware and metal goods generally, india-rubber goods and instruments.

No stronger hint as to the best method of improving our trade could be furnished than by the record of the number of commercial travellers who applied for the requisite Swiss licence last year. Foreign countries were represented by a total of 7,040, of which Germany applied for 5,000, France 1,500, and the United Kingdom only 72. A personal investigation of the requirements of the Swiss market is most desirable. The principals of firms, or their representatives, might first call on the British Consuls, who would be able to assist them in giving information as to the chief firms engaged in their branches of commerce.

If, however, it is not possible to send travellers, the appointment of Swiss agents, able to correspond in English, would be the most likely way of securing a better share of trade. A further aid to the development of British trade in Switzerland would be the sending of price lists and circulars in the French or German language. In the great majority of instances in which catalogues in the English language are sent no results can be expected. Price lists should be compiled with the weights and measurements given in kilogrammes and metres, and the prices quoted in francs, the

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latter including freight and duty to destination. It is still necessary to emphasise the uselessness of drawing up these price lists giving our English weights, measures and currency. If it is desired to open up business connections with good Swiss business firms, it will be necessary to meet them as regards terms of credit, and to accept sample orders as a commencement. The usual Swiss terms of credit are three months net. German manufacturers, however, in order to open up business with new customers, will extend the term of credit to one year, or even longer. They likewise instruct their travellers or agents to accept sample orders, thus frequently securing permanent customers.

The principal towns visited by commercial travellers are Zurich, Basle, Berne, Geneva, St. Galle, Lausanne, Lucerne, Winterthur, La Chaud-de-Fonds and Bienne.

Our Consul at Geneva, in dwelling on the opportunities which might be watched for by the representatives of British firms, points out that although the Cantonal Government restrict their calls for tenders to firms established in the canton for a certain number of years, they do not restrict the origin of their supplies to a certain country, but permit local tenderers to order them as well from the United Kingdom as from any other country. Amongst articles frequently required by the tenderers are plant for central heating, plant for electric lighting, reinforced concrete, &c.

According to a Swiss trade journal, the future of the Swiss machinery industry is becoming more and more dependent upon the trade with foreign countries. The demand at home for Swiss machinery declined considerably during the year 1913, but this falling off was compensated for by orders received from abroad.

The journal adds: "This result would not have been achieved but for the excellent organisation which exists for the promotion of our Swiss export trade, and by which new markets are continually being opened." Ample testimony to the truth of this is afforded by the detail statistics of Switzerland's electrical exports, which we shall shortly publish.

The various factories engaged in the machinery trade were busily employed during the year 1913, and it was anticipated that this year would show a similar result, in spite of a restriction of orders from Germany early in the year. The war, however, has naturally upset these expectations. On the electrical side, however, a considerable increase in home orders is expected, as the Federal railway department has decided that a portion of the Gotthard line (from Erstfeld to Bellinzona) shall be electrified. The introduction of the electric system will involve the establishment of several large water-power stations. One station has already been commenced at Airolo with 50,000 H.P., and a central station at Amsteg with 32,000 H.P.

Liquidations.—APPARATUS AND ACCESSORIES, LTD.—A meeting of creditors is called for December 16th, at 119, Finsbury Pavement, E.C., under the Companies' (Consolidation) Acts, 1908, 1913.

THE OLDHAM BOILER WORKS CO., LTD.—This company is winding up voluntarily, with Mr. H. Hague, of Retiro Chambers, Yorkshire Street, Oldham, as liquidator. A meeting of creditors is called for December 17th.

GENERAL ELECTROLYTIC PARENT CO., LTD.—It is stated in a provincial paper that a meeting is called for December 14th to consider a resolution for voluntary liquidation.

THE MIDLAND ELECTRIC CORPORATION (1900), LTD.—A meeting will be held at the North-Western Hotel, Lime Street, Liverpool, on January 12th, 1915, to hear an account of the winding up from the liquidator, Mr. H. E. Abbott.

Bankruptcy Proceedings.—G. E. HIPKINS, electrical engineer, Dudley.—First meeting, December 11th, Official Receiver's Offices, 1, Priory Street. Public examination, January 5th, Court House, Dudley.

A. J. LOADER, medical electrician, Nelson, Lancs.—First meeting and public examination, December 18th, at the County Court House, Bank House Street, Burnley.

Private Arrangements.—LLANELLY MOTOR AND ELECTRICAL ENGINEERING CO., LTD.—In pursuance of Sec. 188 of the Companies' (Consolidation) Act, 1908, a meeting of the creditors interested herein was held on Thursday, December 3rd, at 28, Baldwin Street, Bristol, when it was stated that the company was incorporated in October, 1912, with a nominal capital of £5,000 divided into 900 preferred ordinary shares of £5 each and 500 founders' shares of £1 each. Of the preferred ordinary shares 358 have been issued for cash; the founders' shares were all allotted as fully paid. The statement of affairs showed that the total sum ranking for dividend was £2,437. The net assets were £2,325, or an estimated deficiency of £112. The present position was attributed to loss on trading, depreciation in stock and bad debts. It was resolved that the company be wound up voluntarily, and that the appointment of Mr. Arthur Collins as liquidator be confirmed. A small advisory committee representing the creditors was appointed to act with the liquidator in realising the estate.

British-Made Indicators.—MESSRS. GENT & CO., LTD., of Faraday Works, Leicester, ask us to remind contractors who have been in the habit of buying German electric bell indicators that they now have on the market an entirely new pattern of pendulum indicator, which has been specially got up to meet the demand for a cheap indicator, and which can be guaranteed to be of British manufacture throughout. Contractors should ask their factors for details of this indicator.

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LIGHTING

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Birmingham.—The demand for electric power by the manufacturers in the city engaged on Government contracts has increased to such an extent that the Electricity Supply Committee is specially considering the subject with a view to meeting the situation.

Blackpool. — NEW PLANT. — The Tramways and Electricity Committee has appointed a deputation to visit various towns to inspect and report upon modern types of boilers.

Bolton.—STREET LIGHTING.—The T.C. has accepted the tender of the Electricity Committee for lighting Long Lane, Darcy Lever. The Gas Committee also tendered.

Boston.—PROV. ORDER.—Mr. W. B. Cownie, of the National Electric Construction Co, Ltd, who intends applying for a prov. order for E.L., has submitted his proposals to the Paving and Lighting Committee, which was favourably impressed.

Bradford.—The Electricity Committee has concluded an agreement with Messrs. John Best & Sons, Ltd., with respect to a bulk supply of electricity in connection with the tunnel for the outfall sewer from Frizinghall to Strangford.

The offer of Messrs. Clough, Smith & Co, Ltd., to erect an overhead transmission line between Frizinghall and Esholt, has been accepted; also the offer of the Sturtevant Engineering Co. to supply a filter of a larger capacity than the one previously ordered for the 5,000-KW. turbo-alternator at the electricity works.

The Baths Committee is arranging for the Tong Street Cottage Baths to be lighted by electricity.

Buckinghamshire.—The C.C. has referred to the Parliamentary Committee the Bill of a London electric company, which affects Beaconsfield, Eton, Slough, and rural parishes near Amersham, High Wycombe and Chesham.

Burton-on-Trent.—The Electricity Committee of the T.C. has resolved to appoint its electrical engineer as agent to the Corporation in connection with the hiring out of electric radiators, outside lamps, motors, &c.

Canada.—In a report of the coal mines branch of the Alberta Department of Public Works, for 1913, it is stated that electricity was used at 29 mines in 1913, of which 10 were situated in the Crow's Nest Pass district. The horse-power of electrical apparatus in use was 4,228 above ground and 1,147 below ground. Four electrical and 163 compressed-air coal-cutting machines were in operation, producing 120,870 and 848,481 short tons respectively.

New regulations governing the construction and erection of electric signs have been adopted by the Montreal Council. The by-law forbids the illumination of signs except by means of electric bulbs forming each letter or figure of the advertisement. The by-law applies to signs hanging more than 6 in. from the buildings; the signs must not protrude more than 6 ft.; the space to be illuminated is fixed at not less than 75 per cent. of the total area. The electric wiring and fixtures must be passed by the Canadian Fire Underwriters' Association.—*Canadian Electrical News.*

Carrickmacross. — STREET LIGHTING. — The electric lighting installation is nearing completion, and it is proposed to have 50 and 100-C.P. lights in different parts of the town for public lighting.

Chippenham.—STREET LIGHTING.—The T.C. has decided to ask the Electric Supply Co. to quote terms for lighting 31 lamps which have been added to the borough through the extension of the district.

Colwyn Bay.—PROPOSED LOAN.—The T.C. has decided to make application to the L.G.B. for a loan of £35,000, for the purpose of extending the electricity works. The extensions will include the erection of a new refuse destructor and generating station, and the new works will be equipped with turbine plant of 1,500 KW. capacity at 6,000 volts, energy being transmitted by underground cable to the present works.

Dover.—LOAN SANCTION; NEW PLANT.—The T.C. has received L.G.B. sanction to a loan of £1,000 for cables. A five years' agreement from March 31st next has been entered into with the Board of Works for energy for the Duke of York's School. If the annual consumption is 30,000 units, the price is to be 3½d. per unit, and if that number of units is exceeded, 3d. If, through the school not being in use, the consumption is below 30,000, the charge is to be 4½d, with a minimum payment of £150. The mains are to be extended so as to supply the new military huts at Northfall and Long Hill. The war department will pay the cost of the extension, £172, and undertake the wiring work. In order to meet the increasing demand for current it is proposed to install a 1,000-KW. turbine set.

Dublin.—The Corporation Electricity Supply Committee has cancelled its contract with a Nuremberg firm for arc lamp carbons, and has purchased, at an increased cost, 2,000 pairs of carbons from the London Continental Stores Co.

Durham.—COLLIERY ELECTRIFICATION.—The South Moor Colliery Co. has decided upon a comprehensive scheme for the complete electrification of its group of collieries in the Annfield Plain and Shield Row district of the Durham coalfield. The installation at the outset will consist of two 750-KW. mixed-pressure turbo-generators, one of which will be placed at the Crag Head group of collieries, which are also being electrified, and the other at the Louisa Pit. The whole of the collieries will be linked together by a ring main, and a complete equipment of pumping and hauling machinery will be installed. The scheme is to be carried out under the direction of Messrs. W. C. and K. A. Mountain, as consulting engineers.

Eastbourne.—CAMP LIGHTING.—The T.C. has decided to extend the mains in order to light the military camp in Summerdown Road; about 500 lights will be utilised.

The electrical engineer reports that if any more of the skilled workmen enlist it will be very difficult to keep the works going, as there is now great difficulty in replacing them. The Council has decided that before any more of the staff enlist the consent of the Electricity Committee must be obtained.

Eccles.—The T.C. has received sanction to borrow £3,000 for mains and £450 for a coal conveyor and elevator. The Electricity Committee expresses the opinion that the present is an inopportune time for the promotion of the I.M.E.A.'s proposed Bill, but it is prepared to consider the question of giving support to the Bill if introduced in the near future. The Committee has deferred the consideration of the question of contributing to the costs of the action of the Ilford U.D.C. with the Gas Co. pending the receipt of further information thereon.

Farnworth.—The U.D.C. has consented to the Lancashire Electric Power Co.'s supplying electrical energy to the Bolton Textile Mill Co.'s new mill in Gower Street, Farnworth, until the expiration of the agreement between the Council and the company. The Power Co. has informed the T.C. that it is taking steps to prevent as far as possible any interruption of the supply of current by installing suitable apparatus.

Grappenhall.—PROV. ORDER.—The P.C. has decided not to object to the Warrington Corporation's application for a prov. order.

Hayle.—OVERHEAD MAINS.—The U.D.C. has granted the Cornwall Electric Power Co. permission to erect overhead lines in the town for the transmission of energy.

Hereford.—Subject to the consent of the B. of T. and the R.D.C. being obtained, the D.C. has decided to supply Tupsley Court; if wayleaves over fields are secured, an overhead line will be used.

Holmfirth.—OVERHEAD MAINS.—The U.D.C. has applied to the B. of T. for consent to use overhead lines throughout the district for the transmission of current at a pressure of 460 volts.

Hove.—The Lighting Committee has resolved to reduce the charge for power and heating to a flat rate of 1·5d. per unit from January 1st next, and the meter rent by 1s. per quarter from the same date.

Irvine.—E.L. SCHEME.—Plans for an electric substation have been passed by the Irvine Dean of Guild Court. The building will contain static transformers which will reduce the voltage of the current coming from Kilmarnock to Irvine from 1,100 to 415 volts. The engineers expect to be able to supply current to consumers by Christmas.

Knaresborough.—PROV. ORDER.—The U.D.C., at a special meeting on Monday, passed a resolution confirming the decision to apply for a prov. order for electricity supply. A motion to defer the matter for six months was rejected.

Leigh (Lancs.).—LOAN SANCTION.—The L.G.B. has sanctioned the borrowing of £3,000 for the purposes of the electricity undertaking.

Leyton.—WINDOW LIGHTING.—Owing to the police order prohibiting outside shop lights, the electrical engineer has received applications for a supply of current for window lighting. As this appears to be temporary, until outside lighting can be used again, the engineer has, in those cases in which a new service is required, made a charge of £2, to be refunded at the end of three years if the installation is used regularly during this period.

London.—POPLAR.—The Electricity Committee has decided to carry out cable extensions, at an estimated cost of £6,922, £500 being for switchboard extensions. The net profit of the undertaking for the half-year ended September 30th last amounted to £2,414, compared with a loss in the corresponding period last year of £129.

BATTERSEA.—The B.C. is to apply to the L.C.C. for sanction to a loan of £9,000 for mains, services and meters for the electricity undertaking.

The L.C.C. has consented to the retention of the coal-handling plant, across Lombard Road to the electricity generating station, for a further period of 10 years.

L.C.C.—The Finance Committee recommends sanction to a loan to the St. Pancras B.C. of £8,970 for mains, plant, house services, meters and lamps on hire.

GREATER LONDON ELECTRICITY SUPPLY. — The Stepney B.C. is supporting the Hammersmith B.C. in its efforts to obtain the postponement of the London electricity supply scheme, at least until the session of 1915. The postponing of the scheme is also urged by the Fulham B.C., the Middlesex C.C., and the Staines and Walton U.D.C.'s.

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Middleton.—PROPOSED LOAN.—The T.C. has decided to make a supplementary application to the L.G.B. for sanction to borrow £273 for extensions at the electricity works.

Nutford and Lothingland.—WORKHOUSE LIGHTING.—The B. of G. has decided to obtain from the Oulton Broad Electricity Co., Ltd., an estimate for installing 170 lights at the Workhouse, and also for the supply of energy.

Runcorn.—E.L. SCHEME.—The R.D.C. has appointed a Sub-Committee to consider an application of the Warrington Corporation for consent to the grant of the E.L. extension order for the supply of electricity to various rural parishes.

Salford.—STREET LIGHTING.—The Electricity Committee has decided to supply energy to the Prestwich U.D.C., for street lighting purposes, on the Polefield Hall estate, at 1½d. per B. of T. unit.

Sheffield.—PROPOSED LOANS, &C.—The Finance Consultative Committee has been requested to approve a supplementary estimate of £25,000 on capital account in respect of mains for the year ending March 25th next. Application is to be made for sanction to borrow £85,400 for the provision of additional plant at Neepsend power house. From this year's working of the electricity undertaking, the Committee expects a surplus of £8,359, out of which £2,800 will have to be provided in respect of cooling towers, £550 for a motor lorry, and £1,600 as a proportion of costs of the Corporation Act of 1912. For the year 1915-16, although the estimated gross profit shows an increase of £21,949 as compared with the present year, the estimated surplus for the 12 months is put at £4,252, a decrease of £4,107, accounted for by the fact that the figures in respect of the interest are estimated at £50 846, as against £38,750, and in respect of the sinking fund, at £56,834 as against £42,874.

Skerries (Co. Dublin).—The electric lighting scheme is expected to be in operation in January next.

Southport.—ARC LIGHTING SUSPENDED.—Owing to a shortage in the supply of lamp carbons, the Electricity Committee has decided to suspend the whole of the street arc lighting in the town until further notice.

Stockton-on-Tees.—BULK SUPPLY.—The T.C., in order to meet the increasing demand for current, has decided to purchase from the Cleveland and Durham E.P. Co. a minimum of 1,000,000 units per annum. The agreed price was not made public.

Stretford.—STREET LIGHTING.—The Electricity Committee recommends the adoption of a scheme for the improvement of the lighting of Chester Road by substituting 2,000-C.P. half-watt lamps for the old Brockie-Pell arc lamps, at an initial cost of £80 and an additional cost of £192 per annum for energy and maintenance.

Stroud (Gloucester).—The company holding the prov. order for E.L. for the district is negotiating for a site adjoining the U.D.C.'s refuse destructor on which to erect a generating station.

Swinton and Pendlebury.—STREET LIGHTING.—The U.D.C. has decided to introduce the Barrow system of electric lighting over the whole of the tramway route in the district. It is intended to have the scheme in full operation in January.

Torquay.—LOAN SANCTION.—The L.G.B. has sanctioned loans of £13,808 for new plant for the electricity works, and £2,052 for buildings.

Tunbridge Wells.—The borough electrical engineer has been instructed to report upon the question of the charging of electric accumulators.

Turton.—LOAN SANCTION.—The L.G.B. has sanctioned the borrowing of £1,060, representing excess expenditure by the Electricity Committee up to March 31st last; £2,150 for prospective expenditure on mains; £250 on services; and £100 on meters.

Uxbridge.—SEWAGE PUMPING.—The U.D.C. has decided to adopt electric power for driving the pumps at the sewage works, and to enter into a contract with the Uxbridge and District Electric Supply Co., Ltd., for a term of three years. It is proposed to install an electric motor, coupled direct to the pumps, at a cost of £71.

West Ham.—The Town Clerk reported that the arbitration in the matter of the Council's dispute with the Hart Accumulator Co., with reference to amounts deducted by it from the electricity accounts on account of the alleged interruptions of the supply of current, had been proceeded with, and that the arbitrator had found against the Corporation on the ground that it had committed breaches of the agreement between itself and the company, and that the Council was liable for damages in respect thereof. In this connection the Electricity Committee reports that the arbitrator stated his award in the form of a special case, and having considered the advisability of setting down the case for argument in the Courts, and in connection therewith, having also considered the opinion of counsel engaged by the Corporation on this point, the Committee recommends that the solicitors be instructed to proceed with the special case.

Witney.—Messrs. May & Hawes, the Council's consulting engineers, have written pointing out that the actual expenditure incurred on the scheme has been £6,819, as against the estimate of £6.800, despite certain extra work being carried out.

Whitstable.—ELECTRIC S
Saturday last the undertaking of t
was inaugurated. The company, f
of the year, entered into an arr
which the generating plant is hous
to contain the sewage pumping pla
The generating plant consists of
driven by Hornsby horizontal sing
of ample size to give suitable overl
conjunction with a 130-cell D.I
capacity, and a 10-KW. booster is
Messrs. Crompton, is double-pole, a
bars in anticipation of a possible po
addition to the generator panels th
one each for the battery and boost
A feature of the Whitstable und
wholly overhead. About six mile
with wooden poles and bare copp
latter being certain insulated span
feeders are arranged horizontally s
plane on the poles; an earth wire
wires, and is earthed at each pole
lightning arresters being provided
supply is 230 volts at the consumer
The contractors for the entire
Saunders & Co., Ltd., of Westmi
carried out under the direction an
and Monkhouse, also of Westmi
engineers, to whom we are indebte
The undertaking starts with a
and a dozen three-light brackets
about half the town; furthermor
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installed.
The tariff for lighting is a flat
of the large amount of small pro
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year for two or three-light consu
good many. One result of the
the area has been a reduction in t
as soon as the company started op

TRAMWAY and

Australia.—N.S.W. TRAM
Commissioner, reporting on the w
ways for the quarter ended Septe
tramway earnings were £430.4
£407,628, representing increases
year of £50,435 and £20,748 resp
bered 70,782,671, a decrease of 1,8

Barnsley.—TRAMWAY AC
on two women who died from inj
accident mentioned in our last
just before the car started th
driver of another car, and the con
believed it to be his driver's sign
the result that the car ran away
dental death, owing to the car
ductor," and they added that the
without informing the conductor
the brakes until he knew the driv

Bristol.—The Tramways
applying for an extension of time
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Clayton-le-Moors.—The
to the extension of time that is
the Clayton-le-Moors Light Railw

Dewsbury.—TRAMWAY
decided to promote a Bill in Parl
tion of an additional tramway a
regard to the tramway, electricity

Edinburgh.—TRAMWAY
meeting of the Corporation Tram
acquiring the tramway undertak
of the company's lease was consi
agreed that no action should be
pany's lease does not expire till
stood, stated that it considered
£292,742, and it was willing to s
The offer included the cars at
valued in the last balance-sheet
equal to four years' profits and fo
ing to a statement prepared by th
of the undertaking at the figu
would involve a loss of £70,0
with the price the Corporation w
the lease.
Proposals dealing with addi
methods of traction, including on
ways to Queensferry, were remitt

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Hove.—Railless Traction Scheme.—The T.C. is being recommended to enter into an agreement with the Brighton Corporation for an extension of time for the construction of the through routes of the railless traction scheme, for a further period of six months, on condition that the latter Corporation agrees to defer making application to the B. of T. for the appointment of an arbitrator.

Leigh (Lancs.).—A deputation of the Corporation has been appointed to visit other towns to obtain information as to the running of motor-'buses and railless trolley cars.

Manchester.—Effect of the War.—At a recent meeting of the Tramways Committee an interesting review of the war's effect upon the tramways of the city was given by Mr. J. M. McElroy, the general manager, showing that the number of employés now with the colours was 1,153, and these were costing the department in wages £823 per week, equal to £42,769 per annum. The revenue since the outbreak of war had been seriously affected, and, as compared with the corresponding period from April 1st to the present date, the receipts had fallen by £12,800. From April 1st to the outbreak of the war the receipts showed an increase of between £6,000 and £7,000, but since the war this had been swallowed up, and they were now £12,000 below last year. As to the suggestion that the Committee should provide free travelling facilities for members of the City Battalions, Mr. McElroy pointed out that the policy of the management had been that where men were living at home, or were billeted some distance from the place of drill, tokens were issued whereby they travelled morning and night free of charge, but this was not done if the men were in camp. They had issued tokens representing a value of £1,777, equal to 426,000 journeys.

Sheffield.—In view of the report of the tramway manager on the power brake which had been in service on one of the cars during the past fortnight, the Tramways Committee has decided to accept the offer of Messrs. Cole, Marchant & Morley, Ltd., to supply nine of these brakes at £100 each. The Committee expects to derive a total income from the tramways for the year ending March 25th next, of £382,520, as against an expenditure of £347,688. The estimates for the year ended March 25th, 1916, show a slight decrease, the figures being £368,069 and £339,481 respectively.

The Corporation is to promote a Bill in Parliament to construct a tramway from Bawtry Road and Sheffield Road to the city boundary at Tinsley; to give the Corporation running powers over the Rotherham Corporation tramways from Weadon Street to the city boundary at Templeboro; to secure power to purchase the Rotherham Corporation tramways within the city, and power to run motor-omnibuses from the city boundary at Handsworth Bridge to Aston.

York.—With a view to facilitating the carriage of stores, the military authorities have asked the Corporation to extend the tramways from Lendal Bridge to the railway goods station, and from Fulford Road to the Ordnance Stores, and have offered to advance the necessary money for carrying out the work. It is estimated that the scheme will cost £4,700.

TELEGRAPH and TELEPHONE NOTES.

Alien's Wireless Installation.—The Court-Martial held at Woolwich on November 17th, on Harold Fochtenberger, who was accused of having wireless telegraph apparatus in his possession without permission, passed sentence of six months with hard labour, but this was remitted, and a sentence of three months' detention without hard labour was substituted.

Another Wireless Torpedo.—It is reported from the United States that the Government has under consideration the purchase of the radio-controlled torpedo-boat *Natalia*, the invention of John Hays Hammond, jun.

Australia.—As the Postal Department is incurring an annual loss on the working of the telephone system throughout the Commonwealth, an increase in the tariff is inevitable. The total deficit last year was £221,756, more than half of which arose in New South Wales; of the capital towns, only Sydney shows an excess of expenditure over revenue. The latest estimate of the total number of stations in the Commonwealth is 119,000. One of the principal causes of the loss is the large proportion of small exchanges which are kept continuously open, though the amount of traffic is small.

Post Office Telegraphs.—In the report of the Postmaster-General, briefly summarised in our last issue, it was stated that the number of telegraph offices open on March 31st, 1914, was 14,152 an increase of 108. The number of ordinary telegrams transmitted was 69,441,000, a decrease of 1,203,000, and the receipts were £2,146,673, a decrease of £37,439, as compared with the previous year; for Press telegrams the figures were 4,194,000 (− 153,000) and £140,619 (− £7,281); foreign telegrams 11,471,000 (+ 12,000) and £533,115 (− £3,182). The total shows a decrease in traffic of 1·6 per cent. for the year. At 6,257 offices where the traffic is light, the telephone has been substituted for the telegraph; at 2,197 of these offices the same instruments are also used for public telephone calls. The system is being installed in 432 other offices, and its installation at 800 more is under consideration. Joint extensions of the telephone and telegraph systems are now made where the traffic would not have justified the provision of either service alone, and the average cost of such extensions has fallen from £56 to less than £40.

The dispatch and delivery of telegrams for telephone subscribers by telephone is increasing, over four million messages having been so dealt with during the year. Manual typewriters are now used generally at large offices for typing telegrams, over 300 being in use, in addition to the direct printing telegraph instruments. High-speed telegraph apparatus has now reached a high state of development; for Wheatstone working the Gell perforator has been standardised, and the Creed reperforator and printer has been much improved. Sextuple-duplex working, which gives six separate channels in each direction on a single circuit, has been applied to the Baudot system experimentally between London and Birmingham, and quadruple-duplex sets will shortly be installed between London and Liverpool and Glasgow. A new form of Murray multiplex apparatus is being worked experimentally between London and Manchester.

The main underground telegraph system is approaching completion, and as the standard of maintenance of overhead wires has been improved the number of interruptions on these has been lessened. Many phantom circuits have been provided for telegraphing over the trunk telephone lines, which are very substantially constructed and less likely to be interrupted than the lighter telegraph lines. The coast communication system has been considerably improved.

Telegraphic communication with the Continent has been improved by laying a new four-wire cable to Germany, and by the extension of multiplex working on the Baudot system.

The provisions of the International Radio-Telegraph Convention of June, 1912, came into operation on July 1st, 1913. At the end of the financial year there were 879 ships registered in the United Kingdom equipped with wireless telegraphy under licence from the Postmaster-General, as compared with 646 in the previous year. New coast stations were opened at Land's End and Fishguard in place of those at the Lizard and Rosslare, and new stations will shortly be opened at Valentia and in Guernsey. To provide against interruption of the telegraph lines to Aberdeen and the north of Scotland, a high-speed wireless station is to be erected near Stonehaven, to work in connection with that at Cullercoats. A licence has been issued to the Marconi Co. for commercial wireless service between Poldhu and Spain; and licences are under consideration for the new Marconi station in North Wales (communicating with a new station at New Jersey, U.S.A.), and one on the west coast of Ireland, which is being constructed by the Universal Radio Syndicate (Poulsen system) for communication with Canada.

A revised agreement was made with the Marconi Co. on July 30th, 1913, for the construction of high-power stations in England, Egypt, East Africa, South Africa, India and Singapore, at a cost of £60,000 each, plus a royalty of 10 per cent. of the gross receipts so long as any valid Marconi patents are used (not exceeding 28 years). The sending aerial in this country is being erected at Leafield, near Oxford, and the receiving aerial at Bishop's Cannings, near Devizes. Sites have also been secured in Egypt, at Abu Zabal, near Cairo, and Abu Sueir, near Ismailia; in India, near Poona; in East Africa, near Nairobi, and in the Transvaal.

During the year 184 new telephone exchanges were opened, compared with 55 in the previous year, and 44,058 stations were added to the system, an increase of 6 per cent., compared with 29,638 (4·2 per cent.) in 1912-13. The total number of exchanges on March 31st was 2,831.

Of 1,905 new public call offices, 1,348 were provided with full facilities for trunk line service, and 90 with partial facilities. Arrears of construction work are almost overtaken; 20 of the National Telephone Co.'s London exchanges have been replaced by new ones, and four large exchanges are in hand. The trunk system was increased by 106 new exchanges, 456 additional circuits, and 47,279 miles of wire, and the trunk calls increased by over two millions. It has been necessary to commence an underground telephone cable between London and Birmingham and Liverpool, as well as other cables between important centres. Last December a cable 72 miles in length—the longest submarine telephone cable in the world—was laid across the Irish Sea, affording three, or perhaps four, additional circuits. At the end of the year the expenditure on trunk lines amounted to £7,578,026. On November 1st, 1913, great reductions were made in the charges for calls between England and France, and the number of calls increased by 20 per cent., to 184,277. The telephone traffic to Belgium increased by 25 per cent., to 62,520 calls. Communication has been opened between London and Switzerland, and a direct Anglo-Dutch cable will be brought into use next year. Three automatic telephone exchanges are being constructed, and eight more are about to be commenced. Rural subscribers (farmers' lines) numbered 2,242 on March 31st.

The total mileage of Post Office wires, including spares, was 2,886,025 miles, an increase of 8·4 per cent. Of this, telegraphs accounted for 267,252 miles, telephones for 1,846,565 miles, and spares for 772,208 miles of single wire; while aerial wires measured 947,392 miles, underground 1,926,743 miles, and submarine 11,890 miles.

The net loss on the working of the telegraphs for the year is estimated at £1,230,956, and the net profit on the telephones at £272,643.

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Secret Wireless Station.—A Court-Martial was held at Hull, on December 6th, on Archibald George Cocks, of the Bungalow Aerodrome, Filey, who was charged with having wireless apparatus in his possession without permission. Evidence was given as to the finding of apparatus in the prisoner's house, capable of receiving signals. The prisoner said he was a British subject and British born, and had used the apparatus for lecturing to Boy Scouts.

South America.—It is stated by the Pan-American Union that there are 120 wireless stations in Argentina, 100 in Brazil, 44 in Chile, 24 in Uruguay, and 12 in Peru. Paraguay is erecting 10 and Bolivia 7 stations; Colombia has 2 stations in operation and others in course of erection, and Ecuador has 4 in prospect. Thus ships near the coast, provided with wireless apparatus, can be constantly in communication with the land. A station is probably working also at Juan Fernandez, where German cruisers are known to have lain for several days; this station is within the range of the powerful station at Punta Arenas, on the Strait of Magellan.

The Colombian Minister for Foreign Affairs has given orders for the removal of the high-power wireless station at Cartagena.

Telegraphy at the Front.—According to the official "Eye-witness" at the Front, the Army Signal Headquarter Office is the nerve centre of the Army in the Field, receiving messages from all quarters, including the base and England, by telegraph, telephone, wireless telegraphy and motor-cyclist. About 3,000 messages are handled daily, and both the Wheatstone high-speed apparatus and duplex telegraphy are in operation.

CONTRACTS OPEN and CLOSED.

OPEN.

Argentina.—The last issue to hand (for June) of *La Electricidad y la Maquinaria* states that by the end of that month the new conditions of tender submission drafted by the municipality of Rosario for a lighting concession would be ready. The lighting may be by electricity or gas. Six tenders were submitted for the previous submission, but all were held to be inacceptable. It was thought that only one tender would be sent in on this latter occasion.

Australia.—SYDNEY.—February 15th, 1915. Potentiometer, for the Municipal Council. Specifications (10s. 6d.) from the City Electrical Engineer, Town Hall.—*A. Mining Standard.*

ADELAIDE.—January 20th. Telephone material, fuse, &c., for Postmaster-General. See "Official Notices" to-day.

January 27th. Accumulators, and power board, for Postmaster-General. See "Official Notices" to-day.

MELBOURNE.—January 6th. Six 100-K.V.A. single-phase transformers. 7,230 yards of single conductor lead-covered cable, for the City Council. See "Official Notices" to-day.

Dundalk.—December 21st. G.N. Railway (Ireland). Electric motors and accessories, sub-station switchboard, hard drawn copper wire, bitumen wires. See "Official Notices" December 4th.

Glasgow.—December 12th. The Corporation invites offers for the installation of electric lighting, telephones, bells and fire-alarms, required at Robroyston Hospital. Mr. W. W. Lackie.

Greece.—ATHENS.—The Hellenic Direction of Telegraphs calls for tenders for supplies of 1½, 2 and 3-millimetre brass wire, also for phosphor-bronze wire and for 3½-millimetre galvanised-iron wire. Particulars from, and offers direct to, Ministry of Communications (Direction of Telegraphs), Athens.

Hornsey.—December 29th. E.H.T. switchgear and E.H.T. three-core cable, for the Borough Electricity Works. See "Official Notices" December 4th.

January 2nd. L.T. switchgear, &c., for the T.C. See "Official Notices" to-day.

Hull.—December 14th. Electrical goods, for the Board of Guardians. Mr. R. H. Winter, Clerk, St. Mary's Chambers.

Johannesburg.—January 5th, 1915. Materials, renewals, &c., for tramway equipments, for Municipal Council.

Leeds.—January 22nd. Overhead electrically-driven travelling crane, coal and ash-conveying plant, for Electric Lighting Department. See "Official Notices" to-day.

Manchester.—December 16th. Corporation. Ten 50,000-lb. water-tube boilers complete; two 15,000-KW. turbo-alternators complete. See "Official Notices" November 13th.

December 21st. Corporation. Three reactance coils, for generating station. See "Official Notices" December 4th.

Nottingham.—December 28th. Electric motor and laundry plant for the B.G. Mr. J. A. Battersby, clerk, Shakespeare Street.

Spain.—December 20th. The municipal authorities of Pino de Campo (province of Palencia). Tenders for the concession for the electric lighting of the town during a period of five years.

Torpoint.—Public lighting, for the U.D.C. Mr. R. H. Beaumont, Council offices.

Walthamstow.—December 23rd. U.D.C. 1,500-KW. turbo-alternator, 600-KW. triple-expansion engine and dynamo 1,000-KW. rotary or motor-converter. See "Official Notices" December 4th.

Warrington.—December 18th Electric bell installation at the Oak Specifications, &c. (half-a-guinea, re Murray, Education Office.

Winchester.—December 1 500-KW. D.C. turbo-generator, with &c. See "Official Notices" Novembe

CLOSE

Blyth.—Messrs. Johnson & P an order from the Blyth Shipbuildi supply and laying of three-core low- covered, steel tape armoured cables tion with their dock extension.

Bradford.—The Electricity C offer of the Sturtevant Engineering filter for the turbo-alternators, at £3 Clough, Smith & Co. to erect an between Frizinghall and Esholt.

Bristol.—The Electrical Co contract with the East Bristol Colli 26,000 tons of coal to the Avonbank ending September 30th next.

Cleckheaton.—The Cleckhe has accepted the tender of Messrs. the carrying out of electricians' wo the Society at March.

Dartford.—The E.L. Commi acceptance of the following tenders sion of the electricity works :—

Wm. Press & Sons.—Laying 14-in. cast
Babcock & Wilcox, Ltd.—Pipework, £4
Johnson & Phillips, Ltd.—Switchgear,

With regard to the proposal to hire has been recommended to accept th Chalmers, Ltd., for a turbine.

Dewsbury.—The Electricity has accepted the following tenders :—

Union Cable Co., Ltd.—
A. Hirst & Son.—Spare

Glasgow.—The Tramways acceptance of tenders from the follo

Section pillar castings.—James Allen,
Scrap lead.—Pegler Bros. & Co., Ltd.
" copper.—P. & W. MacLellan, L
" armature coils and vulcanised c
" zinc and cells.—R. M. Easdale
" lead-covered cable.—Ballardie,
" rubber.—City Waste Rubber Co
Special trackwork.—Titan Trackwork

Hereford.—The City Counc of Messrs. Harding Bros., Ltd., to w 11s. 6d. per house.

Hornsey.—The B.C. has a H. Pickrill, at £3,779, for erecting Muswell Hill.

Llandudno.—The U.D.C. Messrs. Henleys, Ltd., for electric ca

London.—STEPNEY.—The reports the purchase of 4,300 tons o taking, in lots of 100 to 500 tons, a to 14s. 9d. per ton.

POPLAR.—As the B.C.'s contract Ltd., for cable expired in October l price in copper, the engineer has en over two years with the company a £52 10s. per ton, with rise and fal obtained 10 tons of copper from Me price. The Committee has approve and has authorised him to place an further quantity of 30 tons of copp below £60 per ton.

WOOLWICH.—The following tende Electricity Committee :—

Cole, Marchant & Morley, Ltd.—Insts £75.
Heenan & Froude, Ltd.—Rotary air fi
Ferguson, Pailin & Co.—Erection of s

Macclesfield.—Councillor W has received the contract for inst the Macclesfield Arms Hotel. Mr. tract for effecting improvements in the Masonic Room.

Morley.—The T.C. has a Howley Park Coal and Cannel Co. the Electricity Works.

Normanton.—The Joint B cepted the tenders of Messrs. C. J. C storage battery, £149; voltmeter, £11.

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Salford.—The T.C. has accepted the offer of Messrs. T. Mitchell & Sons, Ltd., to purchase a motor-driven boiler feed pump at the electricity station for £40.

Sheffield.—The Electric Supply Committee has accepted the quotation of Messrs. A. Reyrolle & Co., Ltd., at £94 10s., for the supply of 24 overload relays for sub-station switchgear; also the tender of Messrs. Longbottom & Co. for a supply of coal to the generating station. The Tramways Committee has accepted the offer of Messrs. Durham, Churchill & Co. to supply a 45-H.P. 3-ton motor chassis for £650.

The City Council is being recommended to enter into negotiations for extending the present contract with Messrs. Willans & Robinson, Ltd., for a turbo-alternator, subject to a satisfactory price being arranged. The Electric Supply Committee proposes to instruct the general manager to place an order for 100 tons of electrolytic copper wire bars to be made up into cables.

Ship Lighting.—The G.E. Co. have again been successful in securing a 12 months' contract for the supply of Osram ship-lighting lamps from the Cunard Steamship Co., Ltd.

Southampton.—The Harbour Board has accepted the tender of Messrs. Stothert & Pitt, Ltd., for electric controllers for cranes.

Stretford.—The tender of Messrs. Veritys, Ltd., has been accepted by the Electricity Committee, at £55, for the supply of a 15-H.P. motor.

Sunderland.—The T.C. on Wednesday accepted the following tenders:—

Everett, Edgcumbe & Co., Ltd.—Recording voltmeters.
J. W. Thompson & Co.—Coal-chutes.
Phœnix Dynamo Manufacturing Co., Ltd.—Control panel for sub-station feeder booster.
Underfeed Stoker Co., Ltd.—Underfeed stoker.

Torquay.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for a duplicate set of turbines and condensing plant, at the following prices:—

Turbines, £3,837 (increase of 7·8 per cent. on previous price); condensing plant, £1,247 (increase of £45); rotary converter, £1,168.

Tunbridge Wells.—The tender of the Western Electric Co., Ltd., has been recommended for acceptance for a triennial supply of cables. It is proposed to purchase from the Western Electric Co. 30 tons of copper at about £53 per ton.

Wakefield.—The Electricity Committee has accepted the following tenders:—

C.I. floor plates.—E. Green & Son, £29 15s.
Coal.—Victoria Coal and Coke Co.

York.—The City Council has decided to accept the tender of Mr. J. W. Pease, of Doncaster, for the construction of the tramway track to Hull Road, at £22,203.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, December 11th. At 8 p.m. At Holborn Restaurant. Smoking concert.

Northampton Polytechnic Institute.—Friday, December 11th. At 8 p.m. At St. John Street, Clerkenwell, E.C. Annual prize distribution by the Right Hon. Lord Moulton of Bank, F.R.S.

Association of Engineers-in-Charge.—Saturday, December 12th. Social and Dance.

North of England Institute of Mining and Mechanical Engineers.—Saturday, December 12th. At 2 p.m. At Newcastle-on-Tyne. General meeting.

North-East Coast Institution of Engineers and Shipbuilders.—Saturday, December 12th. At 7.15 p.m. At Newcastle-on-Tyne. Paper on "Stability," by Mr. P. Y. Brimblecombe.

Friday, December 18th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General meeting.

Junior Institution of Engineers.—Monday, December 14th. At 8 p.m. At 39, Victoria Street, S.W. Presidential address by the Marquis of Graham on "The War and Engineering."

Institution of Electrical Engineers (Newcastle Local Section).—Monday, December 14th. At 7.30 p.m. At the Mining Institute. Paper on "Cables," by Mr. C. J. Beaver.

Manchester Local Section.—Tuesday, December 15th. At 7.30 p.m. At Engineers' Club, Albert Square. Paper on "Automatic Protective Switchgear for Alternating-Current Systems," by Mr. E. B. Wedmore.

Yorkshire Local Section.—Thursday, December 17th. At 7.15 p.m. At Hotel Metropole, Leeds. Special General Meeting to Welcome the President, Sir John Snell.

Birmingham Local Section.—Wednesday, December 16th. At 7.30 p.m. At the University, Edmund Street. Paper by Mr. E. B. Wedmore.

Institution of Mechanical Engineers (Graduates' Association).—Monday, December 14th, at 8 p.m. At Storey's Gate, S.W. Paper on "Conditions Governing the Power of the Petrol Engine." By Mr. C. B. Dicksee.

Association of Supervising Electricians.—Tuesday, December 15th. At St. Bride's Institute, Bride Lane, E.C. Paper on "Wiring Systems," by Messrs. C. R. Bates and C. J. Banister.

Nottingham Society of Engineers.—Wednesday, December 16th. At 8 p.m. At "Welbeck" Hotel, Milton Street. Lecture on "Mechanical Stoking," by Mr. E. Kenyon.

Wireless Society of London.—Friday, December 18th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment. Lecture on "The High-Frequency Resistance of Wires and Coils," by Prof. G. W. Osborn Howe, D.Sc.

Association of Mining Electrical Engineers.—Saturday, December 19th. At 4.30 p.m. At Royal Technical College, Glasgow. Paper on "Experiences of Surface Earthing in Scottish Mines," by Mr. P. S. Glover.

ABOUT A PERSONAL APOLOGY.

With reference to the Leaderette appearing on page 775 of this issue regarding the circulation of "Apology" advertisement postcards, we shall be grateful if readers who received such cards will, if they still have them in their possession, kindly forward them to us.

NOTES.

Christmas Holidays.—Owing to the Christmas holidays and the consequent closing of the Electrical Review offices on Friday and Saturday, December 25th and 26th, our issue for the week after next will appear on Wednesday morning, December 23rd. Will readers, contributors and advertisers kindly take note of the following times for sending in matter, &c.:—

Editorial: All communications for the Editorial department, except the latest items of special news, should be sent in so that we receive them by Monday morning, December 21st.

Advertisements: The Advertisement department announces elsewhere in to-day's pages that all new advertisement copy and alterations to existing displayed advertisements should reach 4, Ludgate Hill, E.C., not later than Friday morning, 18th inst. "Official Notices" and small prepaid advertisements can be received up to 9.30 a.m. on Tuesday, the 22nd inst.

Foreign Trade.—The November Figures.—The following are the electrical and machinery figures given in the official returns for November:—

Imports.	*Month of November.* £	*Inc. or dec.* £	*Eleven months, 1914.* £	*Inc. or dec.* £
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	62,825	— 94,165	1,152,017	—279,754
Machinery	417,364	—145,648	6,160,153	—504,009
Exports.				
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	235,943	— 701,112	2,833,330	—2,224,877
Machinery ...	...1,739,633	—1,569,633	29,878,937	—4,191,189

British Electrical Export Trade.—At the next meeting of the Sales Managers' Association, which is called for Thursday, 17th inst., at the Holborn Restaurant, Mr. H. Scholey will open a discussion on "The Position of the British Electrical Industry and Methods of Extension in the Markets of the World." Readers who desire to be present should communicate with the hon. sec. of the Association, Mr. F. R. Jones, Sardinia House, Kingsway, London, W.C.

Electric Gear Changing.—According to the *Motor*, some data as to the current required by an electrically-controlled gear box (for motor-car work) are now available. In a recent American test energy was supplied by a 12-volt 80-ampere-hour battery, which was not recharged during the period of test, and 134,490 gear changes were made, representing a hundred changes a day for four years, so that the gear in the matter of energy consumed is a very economical one.

Municipal Borrowing in Canada.—A correspondent at Ottawa writes:—"The Canadian municipalities, who have been unable to borrow money for local improvements for the last year or so in London, and whose works for improvement have consequently been at a standstill, will soon be forced to borrow in the New York money market instead of in London. This is not so strange after all, for New York is, or should be, the natural source to which Canadians should look for funds, at least during the present crisis. There is utterly no prospect of our municipalities getting funds from London for a long time to come. There is no other source than New York for our towns to obtain money to carry on and extend much-needed local improvements and to meet pressing obligations. In borrowing in New York decidedly more attractive rates of interest have been offered and accepted than in London. Some of the provinces and municipalities have been trying to dispose of debentures in the home market, but this is limited, and sales proceed but slowly. The money for future improvements must come from a foreign market, which has no sentimental feelings on account of our connection with the British Empire, as London has had, at a heavy rate of interest. But the money must be obtained at any cost by our rapidly-growing towns and cities and expensive Provinces, and it is good that the money so badly needed may be obtained, although the outlook of being forced to, obligate ourselves in a foreign market is not pleasing on practical as well as sentimental, grounds."

Edison Works Destroyed.—As we go to press we learn with regret that the entire plant of the Edison Company, New Jersey, has been destroyed by fire. The loss is estimated at £1,000,000 sterling.

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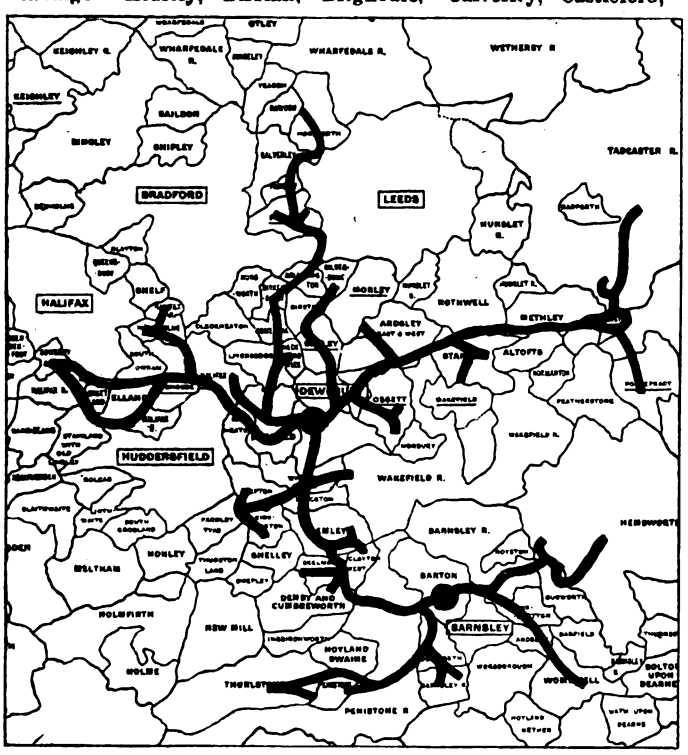
Fire Risks.—Under the new *régime* it is a common thing to see the brilliancy of electric lamps in shops toned down by the use of tissue paper or other highly combustible screens. The danger arising from this practice cannot be too seriously impressed upon the users. Although no harm may occur so long as the shade is not in contact with the glass, it is courting disaster to adopt this method of reducing the illumination, especially at this season when shops and shop windows are being dressed with highly inflammable goods. Let us not forget the terrible fire at Messrs. Arding & Hobbs's shop in 1909; one such experience is enough.

Yorkshire Electric Power Co.'s Supply.—Following an unsuccessful application last year, this company is promoting a Bill in Parliament to remove various restrictions imposed on its supply in certain districts.

The company is authorised to supply electricity over a large part of the West Riding, and it has developed in districts near large towns a supply of electricity for power purposes which is widely used by collieries, mills and factories. In addition various districts depend on the company for electric light, but there are other more rural ones in which no lighting supply may be given by the company even though the mains pass through the districts, and this anomaly it is proposed to remove. The proposals have received a considerable measure of support.

At present the company supplies in bulk the following undertakings:—Ardsley, Birstall, Brighouse, Calverley, Castleford,



Darton and district, Farsley, Gomersal, Goole and district, Greetland, Heckmondwike, Hipperholme, Horsforth, Liversedge, Mirfield, Ossett, Pontefract, Pudsey, Ravensthorpe, Rothwell and district, Sowerby Bridge, Whitwood, Wombwell and Worsborough. Of these undertakings, five are being worked by the local authorities, and five have been transferred by the local authorities who originally owned them to the Electrical Distribution of Yorkshire, Ltd.—a company formed in association with the Power Co. for the purpose of working E.L. undertakings in the West Riding.

We publish herewith a map showing the principal transmissions of the company, the spots representing power stations at Dewsbury and Darton. A supply is also being given to Goole and district from a power station just outside the Goole area.

Electricity in Agriculture.—Mr. J. E. Davidson, of the Pacific Power and Light Co., in a recent paper on "Extensions of Electric Service in Rural Communities," points out that a company cannot afford to supply electricity in a rural territory unless the estimated yearly revenue is equivalent to 50 per cent. of the cost of construction of the extension, including the usual overhead expenses.

Contracts should be closed before construction work is started, and be for periods of 10 to 20 years.

The author recommends rates made up of a fixed charge based on the maximum peak demand for a season, with an additional meter charge based on the peak demand per month.

Irrigation pumping can be successful if a large installation is made to serve several land tracts in rotation; data from a number of installations of from 2 H.P. to 20 H.P. show an average cost of energy per acre irrigated of $6.6 a year. By installing motors for pumping and operating farm machinery in the Yakima Valley, Washington, the Pacific Power and Light Co. has provided itself with a load which brings in $50 per H.P.-year. The Noblesville (Ind.) Heat, Light and Power Co. is offering farmers the electric drive for filling their silos with ensilage. Using a hired steam traction engine drive, the total cost amounts to some $12.5 a day, and time is lost in getting up steam in the morning. The company hires out a 15-H.P. motor and transformers mounted on a truck, at $5 a day, inclusive of the cost of energy, and this portable power plant has been used for the general driving of machinery. The average energy required per ton is 1·17 KW.-hours.

Among the 150 farm-owners in South-Western Ontario receiving electric service from the Hydro-Electric Power Commission are several dairymen. The accompanying data were collected from

	Percentage of total KW.-hours.	Cost.	Unit cost.
Pumping water, four hours a day.	28·8	$17.75	$0.0011 per barrel.
Milking, 421 times—30 cows	23·7	14.98	0.0012 per cow per milking.
Separating cream, 316 times	8·2	5.20	0·011 per hour.
Heating water, 2,420 gals....	29·0	18.35	0.007 per gal.
Lighting	10·8	6.74	
Total	100·0	$63.02	

the records of one of these dairy customers for the period from March 16th to October 18th, 1913.—*Electrical World.*

Institution and Lecture Notes.—Royal Institution.—Commencing on December 29th, Prof. C. V. Boys will give a course of six experimentally illustrated lectures adapted to a juvenile auditory on "Science in the Home."

Institution of Municipal Engineers.—The report of the Council for the year ending June 30th, 1914, shows that the membership at that date numbered 895, a decrease of 20. The revenue was £917, and the expenditure £881, leaving a balance of £36. The accumulated balance was £392.

Association of Mining Electrical Engineers.—At the opening meeting for the session of the East of Scotland Branch, at Cowdenbeath, Fife, in his presidential address, Mr. N. A. Wilkie, Bowhill, dealt with the various accidents which during the year had occurred in connection with the electrical side of mining.

Institution of Civil Engineers.—On Tuesday a paper on "Concreting in Freezing Weather, and the Effect of Frost upon Concrete," was read by Mr. John Hammersley-Heenan, who stated that the freezing of concrete would not damage it if it had at first had a chance to set under favourable conditions for about two days. It was alternate freezing and thawing during the process of setting that caused the damage. To meet the foregoing conditions, when carrying out concrete work in winter, it was necessary to devise means of mixing the concrete with materials freed of frost, placing it in the forms before it had commenced to freeze, and then protecting and keeping it warm for about two days. After that it might be allowed to freeze without fear of its being damaged.

Institution of Electrical Engineers.—A meeting of the Scottish Local Section was held at Glasgow on Tuesday, December 9th, Mr. Lowson, chairman, presiding, when Mr. J. S. Nicholson read a paper on "The Magnetisation of Iron at High Flux Density with Alternating Current." A discussion followed.

Copper.—Messrs. H. R. Merton's statistical circular shows European supplies still well sustained. The figure given is necessarily relative, as the stocks at Hamburg and Bremen must be constantly fluctuating, and will, in any case, not be available for useful purposes for some time, while of those at Havre only an estimate is available. Subtracting these quantities, 49,509, we find stocks in England and afloat at 26,240 tons against 21,493 tons at the end of last November.

American supplies were under the average for the 12 months preceding August, Spanish low, Chile shipments the same, and Australian rather below the average. Australia seems inclined to pick up on the shipments, present quantities afloat being 3,900 tons, or considerably over the normal month's supply. December is, in the ordinary course, a much heavier month for supplies than November.

Fatalities.—Barnsley.—A second victim of a tramway accident at Barnsley died on Friday. At the inquest on the body of Miss Gladys Fitzgerald (21), of Monk Bretton, it was decided that her death was due to the accident caused by the carelessness of the driver and the conductor. The jury agreed with the coroner's suggestion that the driver should not leave a car without informing the conductor, and that the latter should not release the brakes until he saw that his driver was on board. The tramway company promised to frame rules in accordance with the jury's rider.

Portsmouth.—A local paper says that one of the staff of the Portsmouth electricity works met his death while engaged at the switchboard on December 1st.

Devonport.—At the inquest into the death of two labourers through a Devonport tramcar accident, the Mayor attended, and said that he "wished to express deepest sympathy with the two men who had so suddenly been killed."—(*Western Morning News*, December 1st.) A third death has occurred, and at the resumed inquest the jury found that the deaths were due to the car overturning, through faulty brakes, and expressed the opinion that the cars at times were greatly overcrowded.

Motor Repair Wagons.—The *Standard* states that six repair wagons have been attached to the transport department of the Australian Expeditionary Force, each of which weighs about seven tons, and cost, approximately, £5,000. All of them have collapsible sides, which may be supported on metal uprights, so that in case of need the ordinary floor space can be at least trebled. There are lathes, drills, milling machines—all electrically driven by a dynamo deriving its energy from the propelling engine—and there is a forge in each as well. In addition to the driving staff, the workshop cars will each carry six qualified turners and fitters.

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Late Legal.—Attorney-General *v.* Ilford Urban District Council.—This action, which was brought at the relation of the Ilford Gas Co. to restrain the Council from giving an alleged undue preference to those who used electricity to the exclusion of gas, and from supplying lamps, fittings, &c., was mentioned to Mr. Justice Sargant in the Chancery Division on Wednesday, December 9th.

Mr. Martelli, K.C., representing the Council, said he had to apply that the case should stand over until next sittings. If the case was to go on it would be necessary to call as a witness the treasurer to the Council to speak to certain accounts. He was on active service, and as yet it had been impossible to get at him. If necessary, however, it was thought that they would be able to communicate with him before the end of the year. The more important reason was that certain proposals had been made by the plaintiffs to the defendants which were under consideration, but it was not possible to call a meeting that week. Moreover, the matter required great consideration, and the exact terms of any agreement would have to be very carefully prepared. It was a most important case for the Council.

Mr. Mark Romer, K.C., for the plaintiffs, had no objection to the case standing over until next sittings if his Lordship could see his way to retain it before him.

Mr. Justice Sargant thought he ought to do so as briefs to counsel had been delivered. He would take it early next sittings.

It was ultimately arranged that the case should be in the list for hearing on January 12th next.

Appointments Vacant.—Switchboard attendants (30s.), for Luton electricity works; traffic superintendent for Yorkshire (West Riding) Electric Tramways Co., Wakefield; mains engineer (£4), for Walsall electric supply department; generating engineer, to take charge of a 4,000-KW. generating station; cable jointer (£2 2s.), for Neath R.D.C.; switchboard attendant (30s.), for Newport Corporation; shift engineer (28s.) for Morley Corporation; switchboard attendant for Heywood (20s.). Particulars are given in our advertisement pages.

The Conquest of the International Electrical Market.—Under the above heading, the *Revista Tecnica d'Elettricità* makes the following comments on the chances of success of the various competing countries seeking to secure Germany's foreign trade:—

Countries having a solvently organised industry are now seeking with all their forces to conquer the international market formerly dominated by Germany in every field of industry and commerce England, especially, has applied herself with all her energy to the preparation of a plan of operations which shall secure her establishment in many of the markets formerly the undisputed domain of Germany. With a view to guiding and helping English efforts in this direction, the Board of Trade has published a monograph containing statistics of the importations of the various countries of the world, on the basis of the most recent Consular reports. From these statistics it appears that in the case of 18 separate countries the German and Austrian exportations of electrical machines, motors and transformers amounted in 1912 to 64 million francs, while those of England to the same countries in the same period did not exceed 38 millions. It should be noted that among these 18 countries are two where England might expect to enjoy an unquestioned preponderance—these are the South African Republic and Australia. South Africa alone last year acquired 350 million francs' worth of electrical material of all kinds, which were drawn from the following countries in the proportions named:—70 per cent. from Germany, 20 per cent. from England, and 10 per cent. from the United States.

But the English are beginning to recognise that the conquest of foreign markets will not be so easy and agreeable an undertaking as it appeared at first sight; they will have, indeed, absolutely to abandon commercial methods which they formerly followed with a perseverance worthy of a better cause, in order to pursue those methods which have given such good results in the hands of the Germans. The English, however, have never understood the necessity of publishing catalogues in the tongues of the natives of foreign countries, and have always looked upon the sending of representatives, travellers and experts as a useless labour; nor have they troubled to consult the tastes or the exigencies of their clients, but have always thought it possible to impose English tastes and ideas everywhere.

The obstinacy with which English manufacturers have persisted in following their old commercial politics has brought about the incredible result that even in England itself they find themselves beaten by German industry. We confine ourselves to citing two examples only, to which we called our readers' attention a short time ago. These are arc-lamp carbons and metal-filament lamps, for both of which England is tributary to German works for its whole requirements.

England has consequently an exceedingly difficult part to play, for she has both to organise an industry and a commerce which are not improvised in 24 hours, the more so as this organisation presupposes a complete revolution in methods and systems which have prevailed for, maybe, more than a century.

It is possible that the United States in this special regard will find themselves in better conditions. Our [Italian] industry is of very modest importance, but we believe that, in this respect, we enjoy privileged conditions, be it owing to the greater adaptability of our genius, or that we have no traditions to preserve or change, and can more easily adapt German organisation to our industrial and commercial methods, even where they are not compatible with our natural bent.

The struggle which England has launched into is in any case very interesting, and we purpose following it with every attention. As the international organisation of information possessed by England is certainly the best that exists, after the German, of course, we shall make it our duty to peruse and extract from the reports of the English Consular agents such data and elements as may be of use to the manufacturers of our own country. Unluckily, from this point of view, we are much worse served, for our Consular officials occupy themselves almost exclusively with political questions, and possess neither the competency nor industrial and commercial education necessary. Therefore, not being able to make fire with our own wood, we are compelled to use that of others.

An Edinburgh Shock Claim.—The Court of Session disposed of an application, under the Emergency Powers (Courts) Act, in the action by a Fife miner against the lessee of a picture house in Lochgelly, in which the pursuer sought damages for injuries sustained by his son, arising from the fixing of an electric wire which the defender attached to the snib of one of the windows of his picture-house. The boy touched the snib and received a severe shock. At a previous hearing the defender maintained that the action ought to be dismissed, as the boy was a trespasser, but the Court sent the action to the Sheriff Court for proof, and gave pursuer expenses. The pursuer now asked for leave to proceed with diligence to recover £34 and expenses. For the defender delay was asked, as on account of the war the people of Lochgelly had no money to spend in going to picture palaces, and the effect was that the defender's business had practically ceased to exist. The operation of the decree was suspended for six weeks.

Re Electric Vehicles.—Referring to our article on this subject in last week's issue, Mr. F. A. Yebbury, of Westminster, writes saying:—"I would draw your attention to one point which, to my knowledge, has had an important bearing on the sale of electric trucks on the other side of the Atlantic. In some cities the local electric supply company have gone into the truck business, and sell these vehicles with an upkeep guarantee. If I remember rightly, the B.C. Electric Railway Co., in Vancouver, charge about $25 a month for garaging, battery charging, cleaning and guaranteeing a 3-ton truck to be ready for use, in first-class order, every morning. If for any reason the truck gets out of order, the hirer is provided with another truck in first-class running shape. This, of course, makes a very considerable difference to the business, as it costs at least $25 a month in Vancouver to have an ordinary petrol truck stored, and cleaned, without any guarantee as to its running condition. When this sort of thing is common in England there is no doubt the electric truck will make some headway."

Engineering Societies in Manchester.—Owing to the war, which has absorbed the energies of many who are interested in the co-operative scheme for providing a common meeting room and library for the engineering and technological societies in Manchester, it has been decided to defer the matter to a more convenient season.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—On Wednesday last week the wedding took place at St. Margaret's Church, Manchester, of Mr. G. A. Roberts, assistant manager and engineer of the Doncaster Corporation electricity and tramways department, and Miss Henrietta A. Owen, daughter of the (late) Mr. and Mrs. Owen, of Woodlands, Lawton.

Mr. James Jones, of Heywood, has been appointed shift engineer at the Stretford generating station in the place of Mr. J. W. Thomas, resigned.

Mr. C. W. Marsland has resigned his appointment as shift engineer at the Eccles electricity works.

On Saturday last, Mr. F. Riley, station superintendent to the Rawtenstall Corporation, was the recipient of an oak timepiece, subscribed for by the staff and employés, on the occasion of his leaving to take up the post of resident engineer at the new Whalley Asylum. Mr. Stewart, the borough electrical engineer, made the presentation.

General.—The Electric Lighting Committee of the Stoke Newington Borough Council has appointed Mr. W. H. Savery, J.P., C.C., chairman for the ninth successive year.

Alderman Kiley has been appointed chairman of the Stepney B.C. Electricity Supply Committee.

The marriage took place at Maxwell Manse, Glasgow, on November 28th, of Mr. Thos. Paton, electrical engineer, of Glasgow, and Miss Jean Sample, second daughter of Mr. John Sample, of Berwick-on-Tweed.

At Leigh, Councillor Dobb has been appointed chairman of the Tramways and Electricity Committee, and Councillor Pennington vice-chairman.

Councillor E. Chapman has been appointed chairman of the Crewe Electric Lighting Committee.

The marriage took place last week of Mr. Smith Morton, electrical engineer, of Cononley, near Skipton, and Miss Eva Maude, youngest daughter of Mr. R. C. Maude, of York.

Wills.—Mr. Edward Riley, a director of the Windsor Electrical Installation Co., Ltd., left £117,774 gross.

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NEW COMPANIES REGISTERED.

All-British Electrical Co., Ltd. (138,488).—This company was registered on December 3rd, with a capital of £10,000 in £1 shares (5,000 pref.), to carry on the business of manufacturers, exporters and importers of and wholesale and retail dealers in electrical fittings, lamps and other materials and goods, etc., and to adopt an agreement with Ben Hammond. The subscribers (with one share each) are: R. Macgillivray, 52, Arlington Road, N.W., gent.; E. C. Tonkin, 9, Members Mansions, Westminster, S.W., clerk. Private company. The number of directors is not to be less than three or more than five; the first are C. F. Smith, B. Hammond and N. Dickin. Remuneration, £100 each per annum and 10 per cent. of the distributed profits divided between them. Registered office: 36, Victoria Street, S.W.

Carville Site and Power Co., Ltd. (138,489).—This company was registered on December 3rd, with a capital of £10,000 in £1 shares, to take over from the Newcastle-upon-Tyne Electric Supply Co., Ltd., a piece of freehold land at Carville, Northumberland, to erect thereon a station for generating electrical energy suitable for distribution and sale, to erect further generating stations in any place where the company may think fit, to carry on the business of suppliers of electricity, etc. The subscribers (with one share each) are: T. Jameson, 6, Warrington Road, Newcastle-on-Tyne, cashier; W. H. Golding, 23, Heaton Grove, Newcastle-on-Tyne, company secretary. Private company. The number of directors is not to be less than two or more than five; the first are John Theodore Merz, John H. Armstrong, and Robert P. Sloan. Remuneration as fixed by the company. Registered office: Royal Exchange Buildings, Newcastle-on-Tyne.

Coniston and District Electric Supply Co., Ltd. (138,478).—This company was registered on December 2nd, with a capital of £2,000 in £1 shares, to carry on at Coniston and adjoining district the business of an electric light and supply company in all its branches. The subscribers (with one share each) are: C. H. Best, 72, Market Street, Bradford, incorporated accountant; C. Pullan, 80, King's Arcade, Bradford, electrical engineer; F. W. Poole, Ulverston, solicitor. Private company. The number of directors is not to be less than three or more than five; the first are to be appointed by the subscribers. Where there are only three directors, two of such directors shall be the holders of ordinary shares and one the holder of preference shares; or where there are five directors, three shall be holders of ordinary shares and two the holders of preference shares. Qualification £25. Remuneration as fixed by the company. Solicitor, F. W. Poole, Ulverston.

Wezdon Lamp Co., Ltd. (138,484).—This company was registered on December 2nd, with a capital of £3,000 in £1 shares (2,000 pref.), to take over the business of dealers in electric lamps carried on by J. Agerup at Vulcan House, 56, Ludgate Hill, E.C., as the "Wezdon Lamp Co." The subscribers (with 1,000 shares each) are: W. L. Anspach, 9, Palmeira Avenue, Hove, Sussex, gent.; J. Agerup, 56, Ludgate Hill, E.C., merchant. Private company. The number of directors is not to be less than two or more than three; the first are W. L. Anspach (chairman) and J. Agerup (both permanent, subject to holding £1,000 shares each). Qualification of ordinary directors, £100 shares. Remuneration (except managing director), 25 guineas per annum. Registered offices: Vulcan House, 56, Ludgate Hill, E.C.

Tredegars, Ltd. (138,475).—This company was registered on December 1st, with a capital of £10,500 in 10,000 pref. shares of £1 each and 10,000 ord. shares of 1s. each, to adopt an agreement with Sir Herbert H. Bartlett, Bt., and Perry & Co. (Bow), Ltd., for the acquisition of the business (consisting for the most part of the supply of electric fittings and electrical work for domestic purposes and the supply of decorative work and fittings of all kinds for private property), managed and controlled by the said company on behalf of the said Sir Herbert H. Bartlett, together with certain property held therewith. The subscribers (with one preference share each) are: H. A. Bartlett, 31, Albert Road, Regents Park, N.W., contractor; G. F. A. Norman, Carisbrook, Beechwood Avenue, Kew Gardens, S.W., manager. Private company. The number of directors is not to be less than two or more than five; the first are H. A. Bartlett and G. F. A. Norman. The said H. A. Bartlett is to be chairman and governing director, and may retain office so long as he holds 2,000 shares; but in the event of his ceasing to be a director, Perry & Co. (Bow), Ltd., shall have the right to nominate a director in his place, and such director is to be chairman and governing director. Registered office: 53, Victoria Street, Westminster.

Winco Manufacturing Co., Ltd. (138,464).—This company was registered on November 28th, with a capital of £1,000 in £1 shares, to carry on the business of manufacturers of electrical torches and batteries and all kinds of apparatus, fittings and appliances used in connection with electricity, electricians, mechanical engineers and manufacturers, workers of and dealers in electricity, etc. The subscribers (with one share each) are: C. H. Lowe, 285, Balsall Heath Road, Birmingham, traveller; E. A. Harrison, 16, Claremont Road, Smethwick, clerk. Private company. Table "A" mainly applies. Solicitors, Cochrane & Co., Birmingham. Registered office: 107, Pershore Street, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Naylorgraph, Ltd.—Debenture dated 18th November, 1914, to secure £250, charged on the company's undertaking and property, present and future, including uncalled capital (if any), subject to prior debs. Holder, J. M. Hunt, Fairlawn, Park Road, Southborough.

Telephos Domestic and Street Lighting Co., Ltd.—Issues on various dates from 25th February to 28th October, 1914, of £3,500 debentures, part of a series of which particulars have already been filed.

Salford Electrical Instruments, Ltd. (112,599).—Capital, £20,000 in £1 shares (10,000 pref.). Return dated July 9th, 1914. All shares taken up; £10,000 paid; £10,000 considered as paid. Mortgages and charges: Nil.

New Phonopore Telephone Co. Ltd. (44,654).—Capital, £19,000 in £1 shares (9,000 ord. and 1,000 fndrs.). Return dated November 13th, 1914. 7,141 ord. and 1,000 fndrs. shares taken up. £1 per share called up on 6,741 ord. shares. £6,731 paid, leaving £10 in arrears; £1,400 considered as paid on 1,000 fndrs. and 400 ord. shares. Mortgages and charges: £6,950.

CITY NOTE

Callender's Share & Investi

MR. T. O. CALLENDER (Chairman) presi general meeting of the company at Ha Dec. 3rd. The proceedings were purely ing report was adopted on the motion earnings in respect of dividends and up to the 31st August, 1914, amounted ing all working expenses, and writin preliminary expenses and cost of de gross profit amounted to £16,124. Fro interest on debenture stock £5,750, debenture stock trustees, being second pect of redemption fund, £1,800, leav plus £2,617 brought forward, making the rate of 5 per cent. per annum, less £7,770, and there is transferred to res ing to be carried forward £2,921. The hands of the trustees now amounts to

The directors report that the receipt and interest due from the various un company holds an interest continue to have every reason to believe that t be increased in the future as these areas and develop their earning power

The Zurich Bank for Electr

THE report of the Bank fur Elektr Zurich, which is probably the larg of its kind, states that the general si the close of the financial year, whi 1914, was as unsatisfactory as in the pressure was imposed on the busines of war in the Balkans, the threate between Turkey and Greece, the Mexico, and the economic crisis in then these apprehensions have bee break of the war in Europe, the cons be foreseen. On the return of peac duction of electrical working on fu special importance for the future engineering. In Switzerland the Gothard Railway had been decided electrical operation on State railway also making progress in Italy and countries were exercising a certain r The realisation of many schemes i other branches would be rendered i for a long time to come. Further been achieved in the transmission long distances, and in particular the up to 100,000 volts had now also fou These achievements were calculated of distributing current after the c withstanding many difficult circums associated with the Bank had made to the commencement of the war. T of trade in general had hampered t for industrial purposes, but it was p by reducing the cost of production of business. Although certain work places covered by the war area, n any material damage having been supply works had experienced a dec to the restrictions in general busin show the following figures for the

Share capital	
Loan capital	
Gross receipts	
Net profits and balance forwar	
Dividend, per cent. ...	

Among the numerous investment and applying to different countries, to the Constantinople Syndicate of June 30th, 1914, the Tramways et E with a capital of £720,000 for th electrical undertakings in the Tu working on the tramways had bee Ottomane d'Electricitié, which also nople Syndicate, had likewise con rent. The report refers further t in which the Bank is interested negotiations with the Finnish au proposed utilisation of the water been brought to a standstill in co

Aron Electricity Meter, L

porary says that the directors ar intention to pay an interim dividend

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Cape Electric Tramways, Ltd.

THE directors report that the profit and loss account for the year ending 30th June, 1914, shows a profit of £78,867, and after providing for debenture interest, redemption of debentures, and adding the balance brought forward, a net credit balance of £32,618 remains. The reserve fund has been credited with £8,000, leaving £24,618. The tramways in Cape Town carried 16,576,992 passengers, earning £155,472, as against 14,779,709 passengers, earning £144,222 in 1913. In Port Elizabeth 4,309,154 passengers were carried, earning £44,937, as against 4,155,711 passengers, earning £43,036 in 1913.

The labour troubles on the Rand, which resulted in a general strike in July, 1913, were followed by a recrudescence of the same trouble in January, 1914, and had a disadvantageous effect on the general business situation throughout South Africa, checking to a certain extent the otherwise satisfactory advance in revenue of the tramway systems in Cape Town and Port Elizabeth. In spite of these economic checks the receipts from the tramways show satisfactory advances during the year under review, but, owing to the increase in the cost of maintenance and operating charges, and to the provision for the income tax lately imposed by the Union Government, the net profit is less than that of the preceding year.

The additions to the rolling stock and to the power plant at Port Elizabeth have now been completed, and the new unit of power in Port Elizabeth is working most satisfactorily, and giving results of considerable economy in the consumption of fuel.

The prevalence of war throughout the greater part of the world, and more especially the rebellion now going on within South Africa, has created such a serious financial and trading outlook, both in that country and elsewhere, that the directors have decided to recommend the declaration of a dividend of only 2½ per cent. They have considered this a prudent course to adopt in view of the present condition of affairs generally.

The directors refer to the valuable services rendered by the local boards in Cape Town and Port Elizabeth, also by the general managers in Cape Town and Port Elizabeth, and the staffs under them.

Mr. J. A. Barkley, general manager of the Cape Town companies, reports that the total revenue was £155,472, and the expenditure £86,284, leaving a profit of £69,189. The figures for the previous year were: Total revenue £144,222, operating expenditure £77,859, gross profit £66,363.

Mr. W. H. Freemantle, general manager of the Port Elizabeth Electric Tramway Co., Ltd., reports that the new boilers and generating plant ordered at the commencement of the year are now in service, and are of ample power to do all that is required without assistance from the municipality, which has therefore been discontinued. The new boilers and generator have been in service since June 22nd and from the records available promise to considerably reduce the coal consumption, and will prove a most valuable addition to the company's power station plant. The total revenue amounted to £44,937. The traffic receipts show an increase of £2,134. The operating expenditure totals £27,716, or 61.678 per cent. of the revenue, and is an increase of £2,405 over last year. The passengers carried were 4,309,154 for 1914, against 4,155,711 for 1913, an increase of 153,443.

Hong Kong Tramway Co., Ltd.

MR. E. C. MORGAN presided recently over an extraordinary general meeting of the shareholders, held at the offices, 19, St. Swithin's Lane, when the resolution altering certain of the articles of association so that in future the meetings of the company shall be held in Hong Kong, which was passed at a meeting held on November 16th, was confirmed.

The CHAIRMAN said that the two following resolutions now had to be considered:—

1. That, in pursuance of Article 113, all the present members of the board of directors of the company be, and they are hereby, removed from the office of directors of the company, such removal to take effect from the time of the passing of this resolution. 2. That the Hon. Mr. David Landale (chairman), the Hon. Sir C. P. Chater, the Hon. Mr. E. Shellim, Dr. J. W. Noble, the Hon. Mr. Lau Chu Pak, Mr. Ho Tung, all of Victoria, in the Colony of Hong Kong, be, and they are hereby, appointed directors of the company, in place of the present board of directors.

He wished to say that as the present board desired to facilitate the arrangements for the transfer of the control, it was desirable for him on their behalf formally to "recommend" the new directors. In so doing, he wished to explain that he had no knowledge of the six gentlemen who had been nominated by the Hong Kong shareholders as the new board, and his "recommendation" must not be taken as implying any responsibility for the appointment, but he made the recommendation at the request of Messrs. Stephenson, Harwood & Co., the London solicitors acting for the Hong Kong shareholders, so as to avoid any question as to the legality of the appointment of the new directors, and to comply with the regulations of the company under Article 108 of the Articles of Association. Under the circumstances, he thought it would be best if Mr. Harwood and his friends would move and second the resolutions.

MR. HARWOOD then formally proposed the resolutions, which were seconded by MR MACKINTOSH, and they were carried, with the addition of the following words on the motion of the CHAIRMAN:—"And that such directors be on such removal paid their fees as directors on the scale authorised by the Articles up to the close of the financial year."

Globe Telegraph and Trust Co., Ltd.—Quarterly interim dividend of 2s. per share on the ordinary shares, income-tax already deducted.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—Interim dividend for the quarter to September 30th of 2s. 6d. per share, free of income-tax.

Melbourne Electric Supply Co., Ltd.—Final dividend of 5 per cent., making 10 per cent. for the year to August 31st, free of income-tax, on the consolidated ordinary stock.

Adelaide Electric Supply Co., Ltd.—Final dividend of 5 per cent., making 10 per cent. for the year to August 31st, together with a bonus of 2 per cent., both free of income-tax, on the ordinary shares.

International Light and Power Co., Ltd. — Dividend of 1¾ per cent., less British income-tax, upon the preference shares for the quarter to December 31st.

Consolidated Gas, Electric Light and Power Co. of Baltimore.—Quarterly dividend of 1¾ per cent., or at the rate of 7 per cent. per annum, on the common shares.

Anglo-Argentine Tramways Co., Ltd.—The directors have declared a dividend for the year ended December 31st of 2s. 9d. per share, less income-tax, on the 5½ per cent. cumulative first and 5½ per cent. cumulative second preference shares.

Alldays & Onions Pneumatic Engineering Co., Ltd.—The directors report that for the year ended August 1st, after providing for depreciation and all other outgoings, there is a net profit of £17,034, plus £17,443 brought forward. £3,590 is devoted to debenture interest, and, after paying the preference interest, a dividend and bonus of 10 per cent. on the ordinary shares is paid.

Continental.—ITALY.—A company has been formed at Rome with the title of the Società Anonima Telefonica Italiana Betulander, for the working of the Betulander telephone system in Italy and her Colonies and abroad. The capital is 200,000 lire, and the duration of the concern is limited to 25 years.

Under the style of Vestonese Elettrotecnica a company has been formed at Brescia, Italy, for the employment of hydraulic power and trading in electrical apparatus and machinery. The capital is 60,000 lire, in 600 shares of 100 lire each.

The Società Bresciana Autrotrasporti is a concern recently launched at Brescia, Italy, for the installation and working of provisional or permanent non-subsidised public services. Its capital is unlimited in 50 lire shares.

Manila Electric Railroad and Lighting Corporation.—The directors have declared a quarterly dividend of 1¾ per cent. on the common capital stock for the quarter ending December 31st.

Stothert & Pitt, Ltd.—A dividend of 5 per cent. (1s. per share), free of income-tax, is announced on the ordinary shares for the year ended June 30th last.

United Electric Tramways of Montevideo, Ltd.—Interim dividend at the rate of 4 per cent. per annum (2s. per share), less income-tax, is announced on the ordinary shares for the past half-year.

Eastern Telegraph Co., Ltd.—Third quarterly interim dividend of 1¾ per cent. on the ordinary stock, free of income-tax.

Western Telegraph Co., Ltd.—First quarterly interim dividend of 3s. per share, free of income-tax, for the year ending June 30th, 1915, being at the rate of 6 per cent. per annum.

STOCKS AND SHARES.

Tuesday Evening.

STOCK EXCHANGE markets show a good deal of firmness. It may even be said that there is more business about than there was at the end of last month. It has become evident that fortnightly settlements can take place without offering grave menace to markets or credit. The little excitement over the War Loan has unloosed the purse-strings of investors. Brazil Tractions, of the electrical sections, exhibit a marked vitality; the price has risen 4 points since last we wrote. Some of the Telegraph issues are firmer. The coming opening of new stations on the Bakerloo line has made no difference to Underground Electric Railway prices. Supply shares—in the language of the moment—mark time.

The death of a well-known member of the Stock Exchange, from pneumonia, at the beginning of the week, aroused afresh the demand for re-opening the House. Clients themselves are becoming impatient at what they regard as the incomprehensible attitude of the Stock Exchange Committee, although, as a matter of fact, the whole question now lies with the Chancellor of the Exchequer and the Treasury.

The Government seek to impose certain restrictions upon the Stock Exchange (as a condition of giving their consent to reopening of the House), which the Stock Exchange authorities are not at all disposed to accept. One of these is that, in the case of every sale, the seller shall furnish the distinctive numbers of the shares which he wishes to realise, or produce the certificate of the stock, as proof of his ability to deliver to the buyer. Little consideration is needed to see that such a condition would stultify Stock Exchange business to the point of paralysis, although the Government attitude is that such a state of affairs becomes essential if heavy sales are to be prevented on behalf of alien enemies, or of neutral operators instigated by them.

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The principle of applying to every market in the Stock Exchange the rule that below certain fixed prices members shall not be allowed to deal with one another, has had the double effect of killing business in the Consol market, while maintaining quotations; and this further restriction runs contra to the business instincts of the House. So many men, however, feel that it is the interest of the State which before all else has to be safeguarded, that they are not prepared to support the occasional agitations which spring up for re-opening the markets, until the financial outlook is so well secured that possible attacks might be awaited with equanimity.

Home Railway stocks are waxing in public favour. There is more inclination on the part of the public than has been noticed hitherto to buy the lower-priced varieties. Metropolitans and Districts are steady at 32½ and 19 respectively, but there is not a great amount of interest taken in either, so far. British Electric Traction issues, too, have been stagnant during the past week. One or two bargains were done in the Debenture stocks; otherwise, there seems to be scarcely anything moving in the Company's issues.

The Manufacturing group is one of the hardest in these sections. On all hands one hears of the way in which electrical manufacturers are full up with orders. Edison & Swan shares have again improved, those with £3 paid rising to 7s., while the fully-paid are ¼ higher at 1⅛. Some of the other electrical manufacturing shares, although in quiet demand, show no particular alteration in price. British Westinghouse Preference gained half-a-crown at 1⅜. Electric Constructions remain steady at 11s. and 20s. for Ordinary and Preference respectively.

It will be noticed by the subjoined list of electricity supply shares that City Ordinary have receded ¼ to 14¾, business having taken place on this basis; while the Preference changed hands between 11½ and 12. London Preference this week have been done at 4⅛. County of London new Preference were picked up at 11⅛. In the Indian group, Calcutta Supply Preference attracted support at 4⅛.

The following is a list of prices of representative stocks and shares in various electrical markets:—

HOME ELECTRICITY SUPPLY COMPANIES.

Brompton Ordinary	8⅜	Kensington Ordinary	7⅞
do. 7 per cent. Pf.	8⅜	London Electric	1¼
Charing Cross Ordinary	4¼	do. do. 6 per cent. Pf.	5
do. do. do. 4½ Pf.	4¼	do. do. 4 Deb.	89½
do. do. City Pf.	4¼	Metropolitan	8
do. 4 Deb.	86½	do. 4½ per cent. Pf.	4¼
Chelsea	4⅜	do. 4½ Deb.	91⅜
do. 4½ Deb.	91⅜	do. 3½ Deb.	81⅛
City of London	14¾	St. James' and Pall Mall	9
do. do. 6 per cent. Pf.	13	do. do. 7 per cent. Pf.	6¾
do. do. 5 Deb.	115	do. do. 3½ Deb.	88
do. do. 4½ Deb.	98	South London	3
County of London	11½	South Metropolitan Pf.	1⅜
do. do. 6 per cent. Pf.	11½	Westminster Ordinary	8½
do. do. 1st Deb.	99	do. 4½ Pf.	4⅜
do. do. 2nd Deb.	97		

MANUFACTURING COMPANIES.

Brit. West. Pf.	1⅝	Electric Construction	11s.
do. 4 Deb.	72	do. do. Pf.	1
do. 6 p. lien	98	Gen. Elec. Pf.	10
Callenders	11½	Henleys	18½
do. 5 Pf.	4⅜	,, 4½ Pf.	4⅜
do. 4½ Deb.	97½	,, 4½ Deb.	97½
Edison & Swan, £3 pd.	7/-	Telegraph Con.	36⅜
do. do. fully pd.	1⅛	Castner-Kellner	2¼⅛
do. do. 4 Deb.	60		
do. do. 2nd Deb.	60		

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pf.	104	Gt. Northern Tel.	29½
do. Def.	21	Indo-European	58
Chili Telephone	7	New York Tel. 4½	96½
Constantinople Tel.	4½	Oriental Tel. Ord.	2
Cuba Sub. Ord.	8½	do. Pf.	1⅞
do. Pf.	15½	Tel. Egypt Deb.	97
Eastern Extension	11¾	United R. Plate Tel.	6
do. 4 Deb.	94	do. Pf.	5
Eastern Tel. Ord.	122½	West India and Pan.	1½
do. 8½ Pf.	72½	Western Telegraph	12⅝xd
do. 4 Deb.	95	,, 4 Deb.	95½
Globe Tel. and T. Ord.	10½		
do. Pf.	12½		

FOREIGN TRAMS, &c.

Anglo-Arg. Trams 1st Pf.	4½	Bombay Electric Pf.	11
do. 2nd Pf.	4⅜	do. 4½ Deb.	96
do. 4 Deb.	86½	Mexico Trams.	50
do. 4½ Deb.	95½	do. 5 per cent. Bds.	70
do. 5 Deb.	88½	do. 6 per cent. Bds.	70
Brazil Tractions	58	Adelaide Sup. 6 per cent. Pf.	5⅞
		do. 5 Deb.	104

The Mexican group remains sickly. Nominally, the prices are unchanged; but, of course, with the Mexican Government holding a pistol at the throat of the Mexico Tramways Company, it can scarcely be expected that anyone will come along to buy either shares or bonds in this division. The Mexican Light and Power Company having passed the interest-payment on its second bonds, it is considered possible that the Pachuca Company may not be able to meet its next coupon; although, as this is not due until April, 1915, the view is certainly premature, if not pessimistic. The Monterey Light and Power Company suspended payment some time ago, of course; and although it has no physical connection with the Mexico tramways group, the company is naturally included, in the mind of the investor, in this division.

British Columbia Electric Railway Preference and Preferred stocks are both 95½; the Deferred has gone back a little to 100. Manila Electric Railroad shares at 82½ have come in for attention. The Cape Electric Tramways report is considered satisfactory. Canadian Electrics are dormant, as are also most of the other electric power and supply corporations connected with Canada, so far as stock markets are concerned. Th re-opens for cash business on Saturday have some reviving effect upon Canadi securities. The market in American r for the last fortnight in Wall Street, have mostly yielded, where they have is inferred that the Germans sell whe realise their stuff; and the risk of morton Street a dumping-ground for t shares is still the chief key which lock

Most of the leading Rubber shares the price of the commodity rising s do, it has shown a tendency to droop the principal companies are appeali disappointment of shareholders is refl decline has not amounted to mu amongst the higher-priced shares. during the past few days there has be mining shares, particularly those of c the Middle East.

MARKET QUO

OWING to the war, the prices give or less nominal.

Wednesday, Dece

CHEMICALS, &c.

a Acid, Hydrochloric	per c
a ,, Nitric	,,
a ,, Oxalic	per l
a ,, Sulphuric	per c
a Ammoniac Sal	,,
a Ammonia, Muriate (large crystal)	per t
a Bleaching powder	,,
a Bisulphide of Carbon	,,
a Borax	,,
a Copper Sulphate	,,
a Lead, Nitrate	,,
a ,, White Sugar	,,
a ,, Peroxide	,,
a Methylated Spirit	per g
a Potassium, Bichromate, in casks	per l
a Potash, Caustic (88/90 %)	per t
a ,, Chlorate	per l
a ,, Perchlorate	,,
a Potassium, Cyanide (98/100 %) (for mining purposes only)	,,
a Shellac	per c
a Sulphate of Magnesia	per t
a Sulphur, Sublimed Flowers	,,
a ,, Recovered	,,
a ,, Lump	,,
a Soda, Caustic (white 70/73 %)	,,
a ,, Chlorate	per
a ,, Crystals	per
a Sodium Bichromate, casks	per

METALS, &c.

b Aluminium Ingots, in ton lots	per
b ,, Wire, in ton lots (1 to 14 S.W.G.)	,,
b ,, Sheet, in ton lots	,,
b Babbitt's metal ingots	,,
c Brass (rolled metal 2" to 12" basis)	per
c ,, Tube (brazed)	,,
c ,, ,, (solid drawn)	,,
c ,, Wire, basis	,,
c Copper Tubes (brazed)	,,
c ,, ,, (solid drawn)	,,
a ,, Bars (best selected)	per
a ,, Sheet	,,
a ,, Rod	,,
d ,, (Electrolytic) Bars	,,
d ,, ,, Sheets	,,
d ,, ,, Rods	,,
d ,, ,, H.C. Wire	per
f Ebonite Rod	,,
f ,, Sheet	,,
g German Silver Wire	,,
h Gutta-percha, fine	,,
h India-rubber, Para fine	,,
i Iron Pig (Cleveland warrants)	per
j ,, Wire, galv. No. 8, P.O. qual.	,,
g Lead, English Pig	,,
m Manganin Wire No. 28	per
g Mercury	per
e Mica (in original cases) small	per
e ,, ,, ,, medium	,,
e ,, ,, ,, large	,,
c Nickel, sheet, wire, &c.	,,
b Phosphor Bronze, plain castings	,,
b ,, ,, rolled bars & rods	,,
b ,, ,, rolled strip & sheet	,,
c Platinum	per
d Silicium Bronze Wire	per
r Steel, Magnet, in bars	per
g Tin, Block (English)	,,
n ,, Wire, Nos. 1 to 16	per
p White Anti-friction Metals	per
k Zinc, Sh's (Vieille Montagne bnd.)	,,

Quotations su

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
k Edward Till & Co.

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AN ELECTRICAL ANEMOMETER.

This instrument, for the measurement of gas or air stream velocities, eliminates all moving parts at the measuring point and hence eliminates friction and inertia errors; further, it makes possible the indication of the results of measurements at a considerable distance from the measuring apparatus. The principle employed by the latter is not new, but it is now applied for the first time in a thoroughly practical instrument. The change in temperature of an electrically heated conductor placed in the gas stream is determined by electrical measurements, and this change forms a measure of the stream velocity.

Difficulties are encountered in the practical realisation of an instrument based on this principle. For instance, if a thin wire of a material with high temperature coefficient of resistance be arranged in a bridge circuit as in fig. 1 (to permit of delicate resistance measurements), the temperature coefficient of the circuit

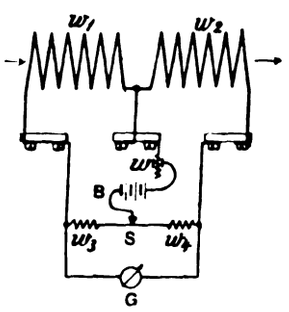

Fig. 1.—W_1 W_2 Hot Wire Branches; W_3, W_4 Constant Bridge Arms.

as a whole is such that a reasonably steady zero cannot be secured in the bridge instrument when the hot wire is loaded to yield suitable sensitivity. One means of overcoming this difficulty is to make the comparison and measuring arms of the bridge as similar as possible in dimensions and materials (and hence in electrical and thermal properties), the two hot wires then being mounted in the two compartments of a shell of good thermal conductivity. Through the chamber containing the measuring wire flows the gas stream under investigation, but the comparison arm of the bridge lies in gas at rest.

In the Siemens-Halske apparatus, however, a "single-chamber" arrangement is employed which is better in many respects than the above two-chamber arrangement. Referring to fig. 2, the two temperature-sensitive arms H_1 H_2 of the bridge are of thin platinum wire and are arranged symmetrically in the plane of symmetry of a thick copper shell K (chosen by reason of its good heat conductivity) so that the air or gas stream passes over the whole of one wire before reaching the other. The former wire is, therefore, cooled (by a stream of given velocity), to a greater extent than the second

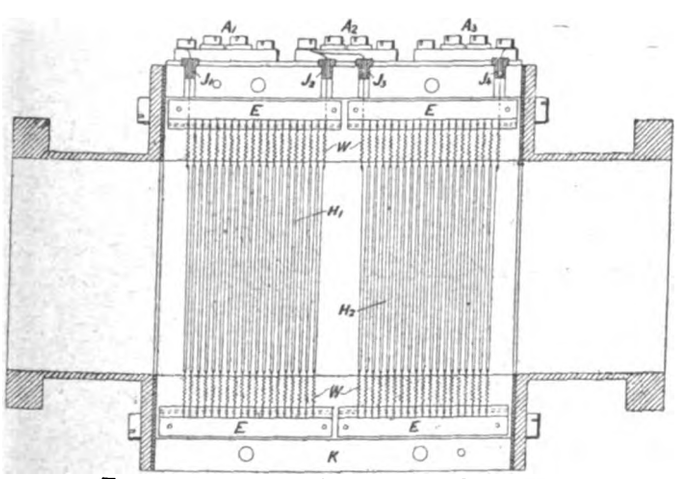

Fig. 2.—Section of Anemometer Chamber.

wire, which is traversed by air already warmed by passage over the first grid. The difference in temperature and hence in resistance between the two bridge arms then depends simply on the velocity of the air stream and, corresponding to a given current through the wires, the bridge galvanometer can be calibrated directly in velocity units. Tension springs W of platinum-iridium wire, attached to insulating supports of ivory, hold the loops of H_1, H_2 in the plane of symmetry (for which the apparatus is calibrated) independently of thermal expansion in the wires. By these it is secured that the zero of the bridge instrument is steady, even when the measuring arm is raised 50° C. above the air temperature; and that the thermal inertia of the hot wire system is negligible, so that instantaneous readings do not differ appreciably from those taken after the hot wires have been exposed for some time to an air stream of given velocity.

The curve between galvanometer deflection and air velocity has the form shown in fig. 3; above a certain velocity the second bridge arm is so strongly cooled that the difference between the resistances of the two measuring arms, having reached a maximum, commences to decrease. At very high air velocities the tendency is for both bridge arms to be cooled to the air temperature. The calibration curve of the instrument is naturally different for different gases, and by varying the size of the hot wires and the electrical loading of the latter, it is possible to adapt the instrument to any range of velocity measurement, but in each particular case the instrument should preferably be used within the range corresponding to the steep part of its calibration curve.

Since the thermal conductivity of gases is independent of pressure down to very small pressures, the sensitivity of the present anemometer is also independent of pressure; the cooling effect depends only on the mass of gas passing over the wires per second, hence the instrument indicates this quantity independently of pressure variations.

If measurements have to be made of the velocity of gas flow in large pipes or of wind in the open, the hot-wire apparatus may advantageously be applied in shunt to a portion of the pipe of known resistance to flow, or it may be piped up to a suitable thrust plate exposed to the air or gas flow. The pressure exerted on the front side and the suction on the back side of a suitably designed thrust plate are proportional to the square of the gas velocity, and under suitable conditions the velocity of flow through the hot-wire apparatus is proportional to the difference between the thrust and suction pressures, and hence to the square of the velocity to be determined. In the practical application of this principle, the greatest part of the resistance flow is concentrated in a temperature valve, which makes possible almost perfect compensation for the effect of temperature on the thrust pressure, internal friction of the gas and the electrical part of the apparatus.

The most important application so far found for the hot-wire anemometer is in the "Anemoklinograph," in which two hot-wire

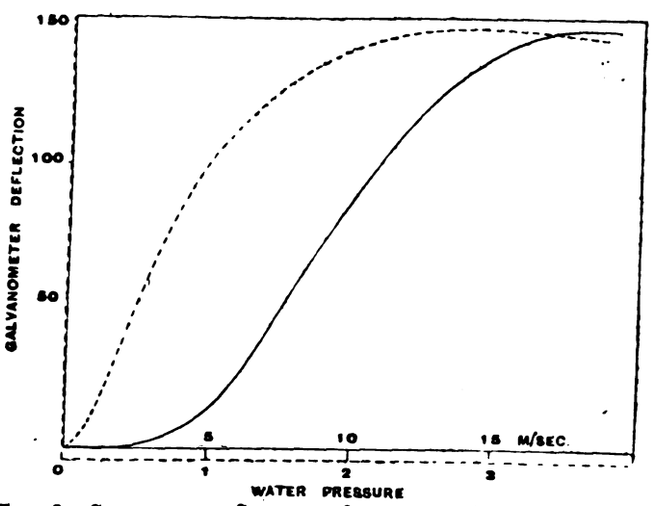

Fig. 3.—Calibration Curves. Ordinates—Galvanometer Deflection. Abscissæ—Full Curve, Velocity (m. per sec.); Dotted Curve, Pressure Difference at Thrust-Plate in mm. of Water.

apparatus are turned (by a wind vane) round a vertical axis, so that the thrust disk on one apparatus always lies normal to the wind. The second hot-wire apparatus is connected to a cylindrical body (also set automatically against the wind) in which are two slots, so disposed that this apparatus is affected only when the direction of the wind departs from the horizontal; its reading then depends on the direction as well as on the velocity of the wind. By taking simultaneous readings with both instruments, the inclination of the wind to the horizontal and its vertical component of velocity can be determined.

The rotary part of the anemoklinograph is provided with a simple electrical device for the remote indication of wind direction, so that all three components of the wind vector can be indicated at a considerable distance from the instrument itself. For the study of wind loads on structures continuous records are desirable, and these are best obtained by the use of three oscillographs recording on a strip of sensitive paper moving at the rate of several millimetres per second. There can be no doubt, says Dr. H. Gerdien in describing the above instruments in *Elektrotechnik u. Maschinenbau*, that these anemometers will prove of great value in investigating problems of aerodynamics and flight.

Electrical Contractors.—In the Parliamentary papers Mr. Boyton asked the Under Secretary of State for War whether he was aware that only a limited number of electrical contractors were being given the opportunity of tendering for Army contracts; and whether he would take steps to see that a wider opportunity was given for the distribution of contracts and consequent employment.—Mr. H. Baker said it was not clear whether the hon. member referred to contracts for electrical stores or for lighting installations. In either case he would be glad to receive from the hon. member the names of the contractors whom he had in mind, as there was every desire to distribute orders as widely as possible.

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ELECTRICITY ON THE FARM.

[COMMUNICATED.]

The present is a favourable time at which to extend the applications of electricity on English farms. The winter's work lies before farmers who find themselves short of men and horses yet with good crops and the prospect of a firm home market for all their produce for years to come. Central station engineers are at least no busier than usual, and there is a good opening for electrical manufacturers who are prepared to cater for the special requirements of farmers. Manufacturer, supply authority and farmer surely need each other more, and are better able to meet each others views and requirements than ever before. The writer ventures, therefore, to present notes on the subject which are likely to be of interest to all parties concerned.

The advantages and possibilities of electrical apparatus are fairly well known in a general way to town dwellers and industrial workers, but to the average farmer electricity is a terribly mysterious agency, and the elementary necessity for demonstrating to him that it is a form of energy which he can apply safely, conveniently and economically to his work must not be overlooked. The instant availability of energy in any quantity and the fact that energy is consumed only when actually working are points of special importance to farmers. It is not necessary to depend on empirical data to show the possibilities and advantages of electricity on farms. Many "full size" installations have been made on the Continent and in Canada and the States for serious practical work, and conditions are not so different that the favourable results there obtained cannot be repeated in this country.

Among the duties in which manual labour, horses or oxen, or steam power may conveniently and profitably be replaced by electrical energy are: Chaff and root cutting, pumping, sawing, shearing, milking, grinding, threshing, silo filling and ploughing. To expect a farmer to instal a complete electric power equipment at one fell swoop would be asking too much—unless the farmer happened to be blessed with unusual perspicacity and a fair amount of spare money. In ninety-nine cases out of a hundred the first thing to do is to extend the supply network to the farming area, either from an overland transmission line (of which there are already a respectable number in this country) or from a neighbouring town. This extension should be untrammelled by pettifogging local veto and wayleave questions, and State intervention in this matter and reform of the conditions governing high-tension transmission lines in general would be of immense assistance. Is it too much to hope that in these strenuous times a solution can be found by general consent to this problem which is indeed of national importance?

Assuming that electricity supply be available at the farm gates—and there is no reason why it should not be, if red tape be abolished and a bold policy made possible and followed—the next step is to persuade the farmer to adopt electric lighting and purchase or hire a small "handyman" motor (of 1 or 2 horse-power) mounted on a portable truck so that it can be quickly belted up to any of the machines or pumps already in use in the farm outhouses. The cost of this equipment need not be heavy. As in so many successful Continental and American schemes, the farmer could be supplied through a simple pole transformer, given a certain number of lighting points and a motor—all for a fixed payment—and then he can be told to go ahead. This "contract" system appeals to the farmer. He knows his exact liability and he knows he can use the motor as long as he likes on any work to which he can apply it. Generally speaking, he will not abuse the free hand granted to him (any more than cottage tenants as a class abuse contract lighting arrangements). From existing farm consumption data, from ordinary industrial power supply experience and from a few meters installed purely for checking purposes, any competent supply engineer can determine a contract charge remunerative to the station and fair to the consumer. Black sheep there are in every flock, and the station naturally incurs a little risk, but in return it secures consumers more readily than by any other means and encourages free use of energy at all times and for all purposes. These advantages are cheaply purchased at the cost of occasional losses (usually temporary) on individual consumers. Maximum demand can, of course, be limited as in any other case where contract tariffs are in force. After the handyman motor has been in use for a few months—the farmer's difficulties, if any, having been meanwhile attended to promptly—it will be an easy matter to sell an electric iron to the housewife, to put a small motor in the dairy and one or two stationary motors for pumping and driving countershafting in the chaff and root-cutting shed. A few neighbouring farmers who have thus been educated into the use of electricity should next be approached with a view to their co-operating to hire or purchase one or two large motors for threshing and possibly ploughing, and to lend one another their "right of demand" so that each farmer in turn can take five or ten times his normal maximum demand (the others temporarily taking no current) without incurring any penalty in the way of higher charge per unit. This degree of co-operation is greater than one would have dared to hope for in this country a few years ago, but farmers have lately learnt much of the advantages of co-operation in sugar beet production and the marketing of dairy produce, and the writer refuses to believe that the above scheme for electric farming is impracticable in this country. It has worked admirably in Canada and there is no reason why it should not do so here. The bringing together of hundreds of thousands of men of all classes in our Expeditionary Forces and their existence and fighting side by side for months or years will have a very potent effect in broadening the national outlook and facilitating co-operative movements in every field.

Power requirements for routine work of daily, or at least frequent necessity on farms, are small, and can be satisfied by small motors and a maximum demand costing little on a contract basis. Typical capacities of miscellaneous farm machinery and the horse-power required to drive the latter are given in Table I:—

TABLE I.—Duty and Power Requirements of Farm Machinery.

	Capacity per 10-hour day.	H.P. required.
Chaff cutter	10 tons	4 to 5
Root cutter	6–7 "	2 to 3
Potato crusher	20 "	1
Oat crusher	2 "	1
Miscellaneous pumps...	100-1,000 gal. per hr.	½ to 1½
Manure mill	30 "	2 to 3
Portable thrasher	200 bushels	3 to 8
Grain cleaner	8–16 tons	1 to 3
Winnower	7–10 "	½
Drum thrasher with cleaner complete	550 bushels	25
Hay and corn hoist	80 tons	1 to 2
Millstones	½–½ "	3 to 4
Band saw or shearing machine ...	—	1
Milking machine	—	½ to 2
Cream separator	1,300 lb. per hr.	1½

In America and on the Continent numbers of electric milking machines have been used for years past. The economic and hygienic advantages are obvious. A 1-H.P. motor is suitable for a byre with 10 cows, and the energy bill for a machine used two hours a day averages £4 per annum (at 1¼d. per unit). The time required to milk each cow cannot be much reduced (for physical reasons) but a number can be milked at once, and 10 to 15 per hour by a man tending three or more milkers at once. Often it is unnecessary to install a special motor for milking.

For threshing in the field the best arrangement is

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to take power direct from transmission lines through a covered-in transformer and switch wagon. A small 5-H.P. machine can be supplied with low-tension current through a trailing cable, but the transformer arrangement is much more workmanlike. Hook-poles can be arranged to make contact with the overhead lines, and a meter can be installed on the transformer wagon for checking purposes. Such an equipment should be a co-operative purchase by several neighbouring farmers. There is no real difficulty in making suitable provision for working and in providing adequate safety devices. Organisation, co-operation and departure from past practice are admittedly necessary, and there is no reason why they should not be forthcoming. They will be demanded in many directions in the immediate future, and on them will depend the industrial and economic welfare of the country.

Canadian tests with 25-H.P. threshing machine sets used on the syndicate or party system and working at 20 per cent. average load factor (annual) show a saving of 30 per cent. to 35 per cent. in total costs (including capital charges and depreciation) as compared with steam threshing. In these tests current was bought at 8s. per month plus £7 4s. per H.P. per year (corresponding to 2½d. per unit under the actual conditions—a price which could be at least equalled in this country). Similar economy is obtained by cutting ensilage and filling silos electrically, and the threshing set may be used for this work when not otherwise engaged. For small and isolated farmers the most economical system is to do threshing at odd times during the winter, using quite a small motor and working it when no other electric load is available. The practice of doing the season's threshing and silo filling all at once has grown up largely as a result of shortage of labour; the normal shortage makes it desirable to do all such work while the special harvesting labour is available. Ensilage cutting is an autumn load requiring 2 to 15 horse-power according to circumstances. Still larger equipments are in frequent use in Canada, where a 20-25-H.P. motor cuts and elevates 10-15 tons of ensilage (weighing 30 to 50 lb. per cb. ft.) through 30 or 40 ft., corresponding to from 1,000 to 2,500 lb. of material handled per KW. hour.

Ploughing is the agricultural duty requiring most energy, and hence offering to the farmer the greatest possibility of economy (for cheap power is the first essential to cheap production, and farmers more than industrial workers use manual and horse labour—(both costly), and to the central station engineer the most tempting load (for ploughing extends over five months or so per annum in late autumn and early spring, and is a day load). According to the depth of ploughing and the nature of the soil, horse-ploughing costs from £1 to over £2 per acre. Under favourable circumstances the cost of steam-ploughing should not exceed 15s. or 16s. per acre, but electric ploughing utilises a less expensive form of energy in a cheaper equipment costing less to maintain and often works out at 10s. to 12s. per acre, using current at 1½d. per unit. With current at 2½d. per unit electric ploughing costs 15s. or 16s. per acre, including all costs and charges. These figures represent several years' averages on Italian estates using current at the prices stated. A number of electric ploughing sets similar to steam equipments, except in respect to the driving agent, are in use in Germany, the largest having a 40-H.P. motor and costing little more than half as much as 70-H.P. steam sets, while ploughing practically as much ground per diem (25-35 acres). The lightness of the electrical equipment is a special advantage on soft or hilly ground. Lecler estimates the pull required per ploughshare to be 45, 155, 550 and 1,320 lb. for 2in., 4in., 8in. and 12in. ploughing respectively. The same authority suggests a 12-H.P. electric set, ploughing 2½-3½ acres per diem 12 inches deep, to be the smallest desirable.

Farmers and central station engineer alike must have some idea of the motor horse-power required, the working hours per annum, the amount of energy consumed, and the basis on which it is to be supplied. On all these points more views have been expressed and more data presented than can be dealt with adequately in the space here available. From returns compiled in the Canton of Frieburg it appears that the average working hours per annum per acre on farms of 25 to 90 acres in extent, are for water pumps 100 to 200 hours, stable pumps 40 to 50 hours, and fruit presses 30 to 40 hours. Over and above these demands for which the horse-power is widely variable, from 1,000 to 1,500 H.P.-hours per acre per annum are used in threshing machines (4 to 6 H.P. from 1 to 2½ hrs. per acre); chaff cutters (1 H.P., 60-75 hrs.); root cutters (1 H.P., 30-40 hrs.); potato crushers (2 or 3 H.P., 30-60 hrs.); circular saw, grindstone, corn hoist and so on. Certain farms in the States and those in Germany which use current only for lighting and small power applications, yield a central station revenue of from 7d. to 1s. per acre per annum, but the average German farm adopting electric working and paying say 5d. for lighting, 2½d. for general power, and 1½d. for ploughing supply yields 5s. or 5s. 6d. per acre revenue. This high figure is doubtless attributable to the dense population and intensive farming system, but there is no reason why it should not be at any rate approached in this country.

The total horse-power of motors installed on a farm of given size depends on the class of farm concerned and the extent to which electric working is practised. A 1 or 2-H.P. jobbing motor is invaluable on any farm; 5 H.P. is a useful size for heavier work, and beyond this we reach requirements which can best be met by the party motor and loaned "right of demand" system. Under the latter, a farmer contracts for 2 or 4 H.P. maximum demand (sufficient for the ordinary needs of a 25-75 acre farm, excluding ploughing), and has the advantage of fixed liability, unrestricted use of power (within a contract limit), and occasional use of a 20 or 30-H.P. machine when he needs it for heavy work. No farm is too small to employ usefully a small portable motor; the indoor power required rises in strict proportion to the size of the farm, and the co-operative party motor scheme is equally applicable to a group of small or large estates.

The acute agricultural problem is shortage of labour, and this problem is solved thoroughly and economically by the electric motor. The advantage brought to farmers by the steam thresher and tractor and the small oil engine is made available in more cases and to a greater degree where cheap contract electric service is available. Wind-power is suitable only for intermittent pumping work. Water-power need not be seriously considered in this country. Electric motors supplied from steam turbine stations are more efficient than isolated steam plant, but the small oil engine achieves very low running costs. Nevertheless, the electric motor under a contract tariff can compete even with the oil engine under most farming conditions, and is immensely superior in flexibility and convenience. It must not be forgotten that the number of oil engines in farming service, already great, is ever increasing, and with the improvements in small electric generating sets there is a marked increase in the number of isolated plants installed for electric lighting and small power requirements. Relatively inefficient as it is, when compared with central station service, once an isolated plant is installed it is doubly difficult to persuade the farmer-owner to accept the central station supply and reap the full benefit of electric farming. Even at the cost of a small temporary loss, the farming load should be secured now wherever practicable.

The central station which argues that agricultural loads are unfavourable and not to be courted deserves the worst that can befall it. Every possible

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outlet for energy should be sought, and, as a matter of fact, the annual load-curve of a group of farms is surprisingly uniform. Pumping and dairy machinery gives a very useful summer load; fodder cutting is a winter work; ensilage cutting is done in the autumn; and ploughing in late autumn and early spring. As co-operative supply and distributing schemes advance—as they must advance if agriculture is to prosper in this country—there is every reason to hope for the extensive use of the co-operative electric 'bus and lorry—preferably of the battery or petrol electric type, but of the rail-less trolley type on main inter-urban routes. Once electric supply is available to farmers there will be no difficulty in securing lighting and small power connections. Thereafter fresh connections will be chiefly for medium and heavy power applications; the lighting demand will be sensibly constant, but the power demand will increase rapidly.

Looked at from every standpoint, the present seems to be an admirable opportunity for advancing the interests of farmer, central station engineer and electrical manufacturer alike, and the benefit accruing to all parties, including the nation as a whole, will be one of ever-increasing magnitude.

ILLUMINATING ENGINEERING IN WAR TIME.

A general discussion on this topic by members of the Illuminating Engineering Society was opened by Mr. Leon Gaster on Tuesday evening, December 1st. After referring briefly to the important part being played by artificial illuminants in the field, Mr. Gaster took as the main lines of his address the possibility and desirability of learning, from present lighting conditions, lessons which should be applied to improved street lighting when normal conditions were resumed; the possibility of making up by improved interior lighting for the present wretched street conditions; the need for definite official regulations, and the possibility of civil volunteers, expert in illuminating engineering, rendering useful assistance to the police authorities.

The lighting industry did not appear to have suffered by the war as much as might have been expected; demand for "luxury" lighting had fallen, but in many instances this had been counter-balanced to some extent by increased military requirements. The lighting of camps and barracks for the new army represented a respectable total demand, in supplying which electric lamps were used almost exclusively. The improved lighting of rifle ranges was a matter of national military importance; uniform target illumination by concealed lamps was necessary.

To some extent reduced street lighting regulations and methods might be dictated by the desire to economise lighting materials, but chiefly they were designed as a measure of defence—on the one hand making it difficult to recognise streets and their width from above, and, on the other hand, by diminishing sky glow, making it easier to see aircraft from below. The efficiency of reduced lighting was proved by experience at Antwerp. Broadly, lighting had been reduced either by diminishing the power and number of lamps or by obscuring lamp globes so as to block out rays above and restrict illumination below. Great divergence existed between methods and results in various localities, and many speakers pleaded for greater uniformity; it should be remembered, however, that the more illogical the existing diversity, the more perplexing the result as viewed from above.

Anything approaching present lighting conditions had not been seen in London for fifty years past, and it would be a pity if some permanent record of them were not kept. With this end in view, Mr. Gaster announced that permission had been obtained to take an extensive series of photographs and photometric measurements. Leaving some unobscured and unused lamps in position was preferable to obscuring all or removing some, since the former practice provided for comparatively bright lighting in case of fog. Since the war would hardly be over this winter, it was still worth while to alter existing reduced lighting arrangements where desirable.

While emphasising the primary importance of public safety, Mr. Gaster asked whether this could not be secured in many cases by redirecting rays rather than by wholesale reduction in the amount of lighting. The present "spotty" lighting of streets was heinous from the illuminating engineer's standpoint, and was positively dangerous to drivers of high-speed traffic. It would be instructive to have detailed statistics concerning street accidents attributable to reduced lighting, but in interpreting such data, the effect of the reduced amount of traffic and greater care engendered, at least temporarily, by present lighting, must not be overlo
tions had done more than any other ev
bring home to the general public the imp
lighting and the characteristics of variou
illumination, particularly in shop windo
number of slides, Mr. Gaster showed
which the window was lighted as a stage
required only top and bottom blinds t
regulations while maintaining full inter
time, the lighting of practically all shop
to the police, but the enormous differenc
custom-drawing value of the actual lighti
must drive its lesson home to shopkeepe
ing was for the present taboo; when it
very desirable that it should be graded o
ably by extending the parade lighting
mediate candle-power. Some of the la
now extinguished did not represent th
of this form of illumination; many small
facias could still safely be employed,
shading.

The maintenance of lighting materi
largely received from Germany or Aust
important problem, in examining whic
must be taken into consideration; repres
been made to the proper authorities wi
possible shortage.

The Chairman, Mr. F. W. Goodenou
benefit which would accrue to supply a
if a system of full window lighting, acc
ties, were generally employed. In his
had used successfully covered lamps at t
windows and corresponding broad band
off pavement illumination and upward
peep-show effect with full window illum
and the only outgoing rays were horizon
however, good window lighting was no
parade lighting.

Mr. J. W. T. Walsh (National Physic
out that reduction in street lighting
danger to other traffic from glaring h
present use of tissue paper and simi
inefficient, and the special form of he
N.P.L.* with obscuration in one quad
It was applicable to any illuminant, and
undiminished C.P. was reduced to 14 C.P.
rant. Mr. Paterson had found that
between lamp and mirror reduced the
light without diminishing its directiven

Mr. Frank Bailey said that in the Ci
lamps were left unobscured for use in
and in working order, they were burn
lighting rifle ranges, the back and fore
perly illuminated as well as the target
for good work in lighting outdoor, long
done, this would almost double our
accommodation.

Mr. W. J. Liberty said that stree
reduced in number since the application
order, but to this result many cause
City there had not been one collision
the last three months. The 1¼ million
employed for public lighting in the Ci
about ¼ million effective C.P. Central
to restricted yet relatively efficient
lighting represented only about 5 per
panies' output, hence the private light
the more important. Under the Order
interior lighting was permissible up to
tage were generally taken of this, su
benefit, and the 2½ hours or so of ful
would do much to improve Christmas

Mr. T. Ritchie believed that the re
tions would show reasonable and rea
illumination to be preferable from a
the present spotty results. Even a n
mination or vertical illumination on
the width of the street and was, the
Using 10-amp. flame arcs normally,
alternate lamps unaltered, and had
half-power by altering their carbon
consumption. Either 25 per cent.,
cent. of normal lighting was thus p
efficiency being good in each case and t
reduced as compared with obscuratio

Mr. A. Cunnington (L. & S.-W.
requirements concerning the lighting
and shunting yards had been met by
of lamp globes up to 30° from the ver
to 10° below the horizontal. This cut
eliminated the very bright spots ben
not materially reduce the vertical i
edge of marshalled trucks, and that
mination) was what was important
point. Turning out alternate lamps
power 10° below the horizontal as
illumination, average electric lighting
still five times as good as in the flat-fl

* See Electrical Review, p. 11

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Mr. J. W. Willcox pointed out the inefficiency of the present system of obscuring lamps; it would be much better to replace arcs temporarily by metal lamps of lower c.p. The only shop windows at present lighted effectively were those using concealed reflector lamps; in such cases, window bands or the mere lowering of an awning complied with police requirements.

Mr. MacIntyre (Board of Works), while regretting his inability to discuss the measures taken by his Department, agreed that the results obtained in restricting lighting should afford valuable assistance later on in improving normal lighting. In connection with the lighting of rifle ranges, he pointed out that a man trained on a perfectly-lighted range might find his marksmanship imperfect under dusk conditions, hence imperfect range illumination was not an unmitigated evil.

Mr. R. C. Bussell emphasised the danger to motorists of incandescent gas lighting on the old short standards first on one side then on the other of suburban streets.

In replying, Mr. L. Gaster again urged the desirability of members in various districts being permitted to render assistance in illumination problems which were certainly outside the ken of the police.

INSTITUTION OF ELECTRICAL ENGINEERS.

On November 18th Dr. A. H. Railing, Chairman of the Birmingham Local Section, delivered his inaugural address, taking for his subject the position of electrical engineering in the world's social organisation. His aim was to show how and why the advent of the electrical engineer of necessity had been a late one, and how he therefore represented one of the most highly developed "organisms"; upon him there fell the duty of using the accumulated experience of the intermediate formations for the purpose of achieving further progress. With this object in view, the Chairman reviewed the history of mankind from the days when man's original occupation was that of a hunter, and his preoccupations were the finding of food and self-defence. The development of agriculture and the combination of individual households into tribes relieved the pressure of the above-named functions and enabled the individual to specialise and to develop arts and sciences. The trader came into existence, and provided means of communication which facilitated the efficient use of commodities by exchange, and mankind learned the use of materials, while the study of dynamics and the problems of matter prepared the way for the development of electrical engineering, by a logical progression from the physical properties of matter in bulk to the properties of the molecule, and onwards to those of the atom and eventually of the corpuscle. The knowledge of all these problems and the application of such knowledge went hand in hand, efficiency continually increasing, while development proceeded from visible matter and the energy of visible matter further and further into the region of the invisible and infinitesimal. Thus, "in engineering we came last to the science of the corpuscle, and its application, electrical engineering."

Having thus traced the origin of electrical engineering, Dr. Railing proceeded to inquire "In how far has electrical engineering already contributed to human development, by, shall we say, improving human progress and efficiency?"—and stated that it was a power for civilisation if it increased mankind's efficiency by making better use of matter and of available energy, by increasing the space that could be inhabited by man, by increasing the physical or mental power of each individual, and by increasing the efficiency of human society.

In proving that the influence of electrical engineering had been effective in all these directions, he first pointed out that the study of electricity had revealed the fact that all elements were either interwoven with or composed of a variety of corpuscles, and that all energies were reduced to one, namely corpuscular energy—electricity. All the other energies were variations, and electricity, the youngest child of natural science as we knew it, "must be recognised as the mother of all others—optics, dynamics, chemistry, perhaps of psychology, biology." The achievement of a common basis, together with the other results, enabled us to transform all forms of energy into one another, to transform combinations of elements, and, perhaps one day, to transform the so-called elements, besides enabling us to make use of available free energy at pleasure. For the latter purpose electrical energy was the most suitable form, owing to the ease with which it was "generated" at the source of energy, transmitted to the places where it could be usefully applied, and re-transformed into all the various forms of energy used by mankind, or stored for use at a different time. Thus the limited amount of free energy in our system could be most efficiently utilised independently of time and place.

Taking the four advantages above-named *seriatim*, Dr. Railing divides available energy into kinetic and chemical energy, and says that the transformation of kinetic energy, as in water and wind, into electrical energy is ideal. The efficiency of transformation of chemical energy is still low, and it is to be hoped that ways may be found to convert the energy of radiation direct into electrical energy without the intermediate steps of heat and mechanical energy. There are numerous industrial processes in which intervention of electrical energy results in higher overall efficiencies.

The transmission of electrical energy can be accomplished with a higher efficiency than that of any other form of energy. Transmission by electro-magnetic radiation may become practicable and offers an excellent field for research.

The applications of electricity to the efficient production of light and heat, without creating fumes, without delay in starting and stopping, and under easy control, are well known. The electrical production of exceedingly high temperatures in confined space has given us aluminium, calcium carbide, carborundum and graphite, besides enabling us to make high-class steel, to melt quartz, and to weld metals. The electrolytic refinement of metals, electroplating and other electrochemical processes, have had immense results, and from the nitrogen of the air we make fertilisers to augment the growth of plants which we can assimilate in our human organism so as to replace the free energy which we spend. "Only when we look closely into transformations of energy such as the one just mentioned, does it become clear to us that such a series of tremendously complicated transformations can only be performed by an extremely fine transmission apparatus, with energies highly concentrated in small masses, and that the dynamic energy of larger masses could hardly undergo such transformations without tremendous loss and consequent inefficiency."

The transformation of electrical energy into mechanical energy leads us into practically every sphere of human activity. We can concentrate or sub-divide it without limit, and control it with ease. Amongst the effects of these advantages are the cheapening of coal, iron and steel, cotton goods, etc., and, broadly, by cheapening raw materials and finished products, they have increased individual and average comfort of living, while the application of electrical energy for transportation has reduced the dead weight of material in motion, improved the mechanical conditions and increased the speed of transit, widening the area which can be inhabited by mankind. Electricity also enables us to equalise climatic conditions, to irrigate dry territories, to build canals and to reclaim swamps; and electrical engineering is a factor in civilisation by increasing the efficiency of the individual.

The knowledge of electrical matters, and especially the theory of the corpuscle, have enabled us to prove existing laws in organic matter, to ascertain how our senses respond to external and internal stimuli, and to establish the fact that in the human body the receiving and transmitting mechanisms are of partly electrical nature. Problems of memory, inheritance and telepathy have been attacked by means of the vibration of electric corpuscles. The uses of electrical engineering to diagnose and cure disease, and to enable us to see and reach internal tissues, must be mentioned. "Electrical engineering thus, in mastering matter, is trying to probe into the mechanism of living organism and problems which concern man's body and mind." These endeavours must result in the increased efficiency of the individual.

Electrical engineering has acted as a great democratising agent; it has replaced to an ever-increasing extent manual labour by the use of other available energies, setting free mankind to spend more in the form of mental energy; and by telegraphic transmission it has facilitated the dissemination of knowledge throughout the world.

"I think, though the picture is not complete, I have shown that electrical engineering has led to better understanding, a more extended use and a more efficient use of nearly all existing matter and energy. It has led to a better understanding of animal and human organisms and problems. It has bridged space and time and minimised their influence where they become resistance factors against energies mental and physical, it has increased the efficiency of individual and society, it has, therefore, established its claim to be one of the most valuable factors in the progress of mankind.

"For the electrical engineer, never mind how small and how apparently unimportant his specialised work may often seem to him, this knowledge should be a profound source of satisfaction and happiness and a spur to increased activity."

THE THERMOPHONE.

By M. de LANGE.

(*Abstract of paper read before the* Royal Society *on Dec. 3rd.*)

The invention has been made by me in co-operation with my friend Otto Fischer. Some of the models have been made in the laboratory of the University of Utrecht by the assistant, Mr. Stellema, under the supervision of Professor Zwaardemaker. I have been demonstrating with these models for over six months, and they do not show the slightest wear.

The origin of thermophones may be traced back to the invention made 34 years ago by Sir William Preece (Proceedings of the Royal Society for 1880, No. 204), who connected a thin platinum wire with a diaphragm and thereby succeeded in reproducing sound waves of the human voice on the diaphragm.

Sir William Preece, however, kept his invention connected

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with a mechanical operation of a wire which, by extending and retracting, worked upon the diaphragm and thereby made the diaphragm speak. The thermophone is not connected with a mechanical operation of a wire, but simply and solely rests upon a change of temperature in a wire which is not attached to any diaphragm whatsoever. In the thermophone the wire speaks without a diaphragm.

About seven years ago, the Russian engineer Gwozdz made various experiments with a thermo-telephone without a diaphragm and without an electromagnet. He placed a Wollaston wire in an insulating medium, and then treated the wire with acid. He obtained thereby a good thermophone, but (as far as I know) it was impossible by this process to obtain thermophones which conveyed the required volume of sound, and Gwozdz never succeeded in rendering the thermophone of any practical utility.

At the same time Professor Abraham, of Paris, made some experiments with a thin platinum wire which he connected with electrodes in a straight line, and then again with a transmitter. These experiments also did not meet with a practical result, because the stretched wire had no freedom, and thereby was exposed to too great a danger of breaking by the alternate extensions and retractions.

With my invention I follow the process of Gwozdz regarding the treatment of the Wollaston wire, but I claim that my invention is of the greatest practical value. By fixing a wire of a diameter of from 2 to 12 microns in a Gothic curve I claim to have succeeded in making the thermophone of practical every-day use, because the silver of the Wollaston wire is eliminated whilst the whole Wollaston wire is freely suspended in the acid in such a way that at any time such part of the platinum wire can be set free as is considered desirable, without its being liable to breakage.

Thermophones have value only if they have been made on this basis.

Prof. Zwaardemaker and myself have measured the volume of the sound with Lord Rayleigh's well-known mirror. In order to avoid currents of air which might originate by the increase in heat of the wire, we placed a glass membrane in a wooden or aluminium cover between the wire and the mirror. The size of the membrane was about the same as that of a membrane of the phonograph. Moreover, we placed a small tube in the cover of the membrane in order to prevent the system from working as an air thermometer.

The result of our measurement was that the sound increased with the increased number of platinum wires, but not in the same ratio. Thin wires of two microns have a greater acoustic effect than wires of 5 microns, the Joule heat remaining the same.

Everything depends upon the exact relationship between the telephone and the microphone.

The thermophone, listened to in the open air, sounds extremely weak.

As soon, however, as the platinum wire is placed under a cover which has a small opening, or several small openings, the sound at once becomes clear and distinct. The volume of the sound increases in accordance with the decrease of the size of the cover. Evidently the cover functions as a resonator. It is a telephonic advantage to make the cover as small as possible, because in that case the high notes and the sound consonants produce a better effect. The size of the opening in small covers should not be made too large, because in that case the resonance becomes too high and produces a curious sound in addition to the human voice.

The maximum size of the cover appears to range between comparatively speaking wide limits. The size which approximately agrees with the size of the human ear funnel seems to be most suitable. Metal covers are better than those of ebony, and by surrounding these with some cooling substance the acoustic effect becomes twice as great. In this case the sound is conducted through a rubber tube of small width.

It is quite possible to combine a number of these thermophones, but then it should not be forgotten that the whole space occupied by them should remain as small as possible, because the space which they take up together also acts as a resonator.

The acoustic effect appears to increase at least as about the square of the strength of the current.

Thermophones with four rows next to each other, each of 6 platinum wires of 7 microns with a resistance of 35 ohms give—measured with Lord Rayleigh's mirror—the following results, viz.:—

In the case of	6 volts	...	...	2½ points.
In the case of	8 volts	...	...	15 points.
In the case of	10 volts	...	...	25 points.

It is difficult from these items to construct the theory of the thermophone.

The most I can say is, that the decrease and increase of heat in the platinum wire of the telephone takes place isochronously with the vibrations in the microphone. The air surrounding the platinum wire is thereby heated or cooled in accordance with the increase and decrease of heat in the wire and, if that air is retained within a closed compass by the cover, the expansions and retractions will be noticed as sound.

Dr. GLAZEBROOK elicited that the thermophone was employed as a telephone receiver, an ordinary microphone being used as a transmitter, and, in reply to Mr. DUDDELL, it was stated that in the demonstration the battery was directly in the line circuit.

CABLES.

By C. J. BEAVER, I

(Concluded from pag

In the earlier stages of the investig tion of vulcanised bitumen insulat the physical changes were not due t of spontaneous or chemically induced light of experimental reproduction of duced by the combined agency of he hydrolysis of the glycerides of the contained in the vulcanised bitume The results of analysis of the softened sion thereof with the results obtain canised bitumen, confirmed this ind

The general nature of the decom similar to that by saponification, exce fatty acids are not combined with a not form soaps. This throws some li occurrence of the former type of so polarity and on alternating-current c of the latter type to negative contin

The ultimate object of the study was naturally to find and provide s them; and in view of all the facts br gations *in situ* and experimental wo which to work was obviously one in be afforded to the susceptible com Some form of colloidal filling havi properties to allow of its incorpora bitumen, of such composition as no position by hydrolytic action, and would exert a maximum protective small proportion, was clearly the id mental work it was found that high could be treated in such a manner requirements as regards incorporati men, and would in addition exert a tection against hydrolytic and sele used in small proportions. In fact, t kind of mutual protective action, softening under steam-pressure con combined substance than in either

Fig. 13 records graphically the res the degree of protection afforded b vulcanised rubber when subjected 40 lb. per sq. in., the softening per observation. It will be seen that th cent. of vulcanised rubber trebles th the softening, and that up to abou

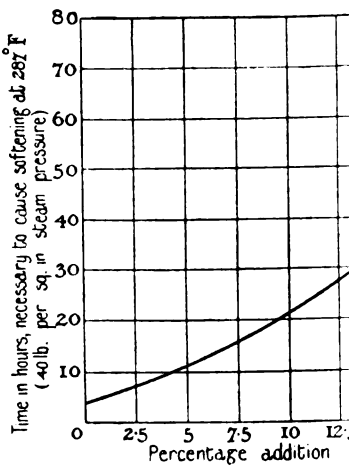

FIG. 13.

proportionately increased. When l the curve rapidly becomes steep, an protection from softening effects a membering that the softening actio conditions and requires five or s troublesome stage, the protection a of the rubber substance would app worst conditions of practice.

The author feels sure that there a neers who will derive some satisf that the troubles referred to are cable, but are attendant on fault seldom occur, and which would equ trouble on any other type of cable.

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POWER PLANT TESTING.

By W. M. SELVEY, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *November 26th*, 1914.)

In the early "electric light" days the largest item in the cost of power was the "interest and depreciation" in connection with the capital cost of the plant installed. At that time the correct policy was to instal cheap plant that was relatively inefficient, provided always the price of the plant was not cut down at the expense of reliability.

The experience that the more successful undertakings are now passing through is of another kind. Time has shown that owing to the rapid advances in thermodynamic efficiency of power plant an item, which is now termed obsolescence, was omitted from the old balance sheet. Recasting the balance it is now seen that this item stands out prominently compared with the real interest and depreciation, which are essentially of a different nature. This item is large, not only when compared with generating-station costs, but also with distribution costs.

It is the author's opinion that unless provision is definitely made for replacing obsolete plant out of revenue, no longer than eight to ten years should be allowed for complete

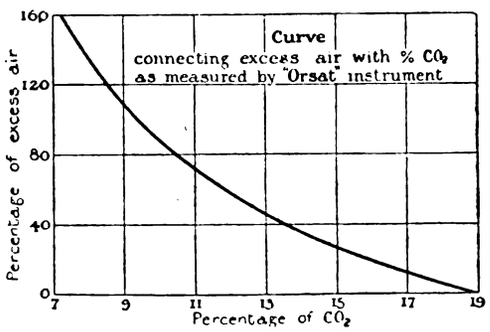

Fig. 1.

obsolescence of plant purchased at the present time and rated at less than 5,000 kw. in the case of turbo-alternators, or 30,000 lb. per hour for boilers.

Within the next ten years the past, and to a large extent the present, significance of load factor will have disappeared. Further improvements which will subsequently be obtained when the load factor is 50 per cent. will not be a vital matter in the cost of generating electrical energy. The expression

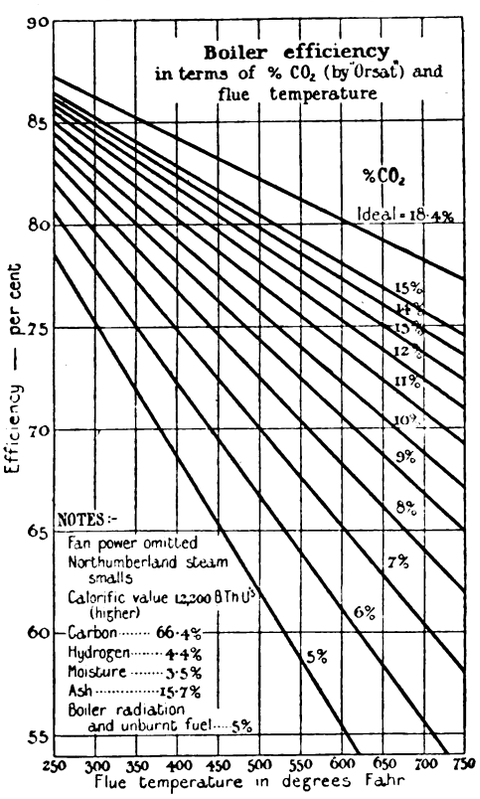

Fig. 2.

will still be of use, but its point of application, so to speak, will have moved even past the sub-station and be much nearer the consumer's terminals.

It is owing to these facts that the system known as the bonus or penalty clause has become the leading feature in the purchase of power plant.

Take a turbo-alternator set having a maximum continuous load of 10,000 kw. and a most economical load of 7,500 kw., and which is to be used on a system where on the average it will be loaded to 7,500 kw. for 8,000 hours per annum. The number of kilowatt-hours generated by this machine is 60 million per annum. A variation of 1 per cent. in this output, taken on a coal cost of 0.15d. per unit, is £375 per annum. Capitalised on the basis of eight years' life, this is equivalent to £3,000. Thus, of two competing machines, if one has a steam consumption of 12.5 lb. per kilowatt-hour and is offered at £25,000, and the other has a consumption of 11.5 lb. per kilowatt-hour, *i.e.*, 8 per cent. better, the second machine would be worth £24,000 more than the former. The actual difference in the cost of manufacture, however, would not be more than £2,000 to £3,000. These figures, though intentionally approximate, are near enough to compare with various bonus and penalty clauses which have been effected from time to time, and large sums of money now depend on the accuracy of test figures which may easily be from 3 to 4 per cent. wrong, while the actual sums are often given in terms of one-tenth of a pound of steam per kilowatt-hour—that is to say, less than 1 per cent. of the total consumption.

There are several firms who are endeavouring to utilise every possible advance in efficiency in the design of their machines, but are compelled at the present time to quote prices that do not in any sense take into account the actual efficiency obtained.

The value of 1 per cent. of the output must also be taken into account in the boiler-house.

Boilers and Economisers.

The efficiency of boilers has received much attention of late years. The ideal percentage of CO_2 in the flue gases varies with the ratio of hydrogen to carbon in the coal, but in most English coals the variation is not more than will cause the ideal amount of CO_2 to vary from 18 per cent. to 19 per cent.

A modified form of Orsat apparatus has been developed for readily analysing the sample taken. The method of collecting the sample shown in fig. 3 will be found to give reliable results. A considerable stream of gases is drawn through a

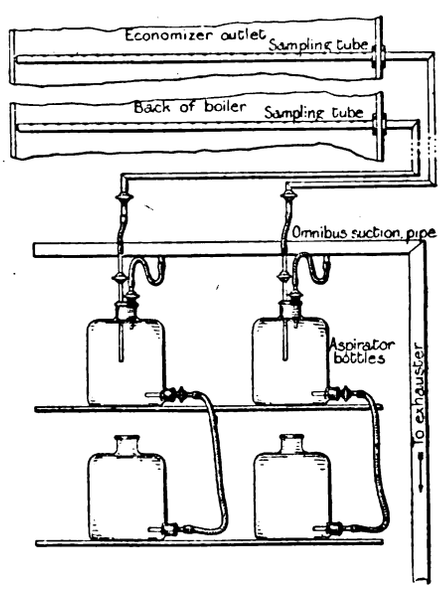

Fig. 3.—Apparatus for Sampling Flue Gases.

sampling pipe, perforated with many fine holes right across the flue, together with aspirators capable of drawing off a steady fraction of this main stream. A little Roots blower, or, what is still simpler, a small steam ejector, is employed for this purpose. The other main measurement which determines the efficiency of the boiler is that of the final temperature.

The author has for some years used platinum—platinum-rhodium couples for the higher temperatures, and copper—copper-constantan couples supplied by the Cambridge Scientific Instrument Company and checked at the National Physical Laboratory. The results have been entirely satisfactory, particularly when the wires are insulated with the Vitreosil product of the Thermal Syndicate.

These two measurements having been established, there are only two important unknowns, namely, radiation and unburnt fuel; these the author has studied in considerable detail.

As regards radiation, the loss is no more than 3 per cent. in a 20,000-lb. boiler well lagged, and it may be taken as 2 per cent. in a 30,000-lb. boiler and larger sizes. Excessive radiation is always easy to locate, and not difficult to remedy. The loss by unburnt fuel can certainly be reduced to 10 or 15 per cent. of the ashes, and may therefore be taken as 2 per cent. In fig. 2 5 per cent. has been allowed for these two losses.

The author has so far not seen a stoker and furnace construction that does not suffer either in efficiency or upkeep if the coal is either too bad or too good. If the boiler is designed for a good coal, giving anything above 12,800 B.Th.U. as fired, or below 8 per cent. of ash, it cannot maintain com-

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bustion at all with some coals. If, on the other hand, the boiler is designed for a bad coal (11,000 B.Th.U. or less as fired, or above 16 per cent. of ash) the temperatures attained when working at its best, and with good coal, are such as no brickwork will stand. The best working can only be got by keeping the quality as uniform as possible, and this is the real difficulty.

The author has, while testing a sample 10-ton truckload of coal on a 100-sq. ft. grate, found the amount of CO_2 to drop from 14 to 8 per cent., and the evaporation from 30,000 lb. to 18,000 lb. per hour.

With a stoker and furnace specially designed for coal with a very high proportion of duff, with which only 8 per cent. of CO_2 could be got with great effort, a run of good coal has softened the arch and made the walls "run in" in less than an hour.

It is comparatively easy to produce an amount of CO_2 ranging from 12 per cent. to 14 per cent. on a chain grate with a long arch when the duff is not above 30 to 40 per cent.; but when this rises above 60 per cent. it has an extraordinary blanketing action on the fire, and it is difficult to keep the amount of CO_2 up to 8 or 9 per cent., even under test conditions. To sum up, an average of 10 per cent. would be exceedingly good working at the boiler exit. The amount of CO_2 at the economiser exit is often 2 per cent. lower, and this difference is one that will repay close attention.

It is well to separate as far as possible the known bad coals, and to burn them on a specially arranged furnace adapted for such types of fuel. A scheme something like this has been adopted at Birmingham for the riddlings.

The size of the economiser has a large effect on the final temperature. The temperatures on full load should be taken, say, 24 hours after sweeping, and should be used as a standard. If at any subsequent time the boiler exit temperature is found to be 150° F. higher, or the economiser outlet to be 100° F. higher, the boiler needs cleaning.

Values of 600° F. for the former and 350° F. for the latter may be considered satisfactory. The lowest temperatures that the author has met with are about 450° F. for the boiler outlet, and 240° F. for the economiser outlet. A result of, say, 10 per cent. CO_2 and 300° F. final temperature at the economiser outlet may be considered a good test result. Close supervision in the boiler-house will pay, not during morning and evening peaks when conditions are at their best, but at the times of light load and during the night.

(To be continued.)

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

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22,887. "Telephone receivers." J. W. GREENWOOD. November 23rd.

22,893. "Magnetic clutches." F. NEWTON & NEWTON BROS. November 23rd.

22,897. "System of control for maintaining the relative speeds of a number of electric motors." F. C. ANDERSON & C. A. ATCHLEY (trading as Harland Engineering Co. November 23rd. (F. G. Warburton, Canada.)

22,906. "Telephone-call recorders." D. J. MCGAURAN. November 23rd. (Complete.)

22,913. "Illuminating devices." BRITISH THOMSON-HOUSTON CO., LTD. November 23rd. (General Electric Co., United States.)

22,914. "Operation of polyphase electric motors in connection with single-phase alternating currents." B. G. LAMME. November 23rd. (Convention date, December 26th, 1913, United States.) (Complete.)

22,915. "Electrically-heated shaving pots." A. J. MILLER & G. A. MILLER. November 23rd. (Complete.)

22,927. "Apparatus for operating electrical devices at a distance." SIEMENS & HALSKE AKT. GES. November 23rd. (Convention date, November 21st, 1913, Germany.) (Complete.)

22,930. "Shaving pots." A. J. MILLER & G. A. MILLER. November 23rd. (Complete.)

22,931. "Methods of manufacturing electric condensers. GALVANOPHOREN-WERKE (SYSTEM VOGT), S. SZBERT KOMMANDITGES, & VEREINIGTE ELEKTRICITATS-WERKE G.M.B.H. November 23rd. (Convention date, November 22nd, 1913, Germany.) (Complete.)

22,936. "Regulating devices for electric polyphase shunt commutator machines." O. IMRAY. November 23rd. (Siemens-Schuckertwerke G.m.b.H., Germany.) (Complete.)

22,937. "Repeaters for use in telephone lines." A. H. OLSSON & H. B. M. PLEIJEL. November 23rd. (Convention date, December 2nd, 1913, Germany.) (Complete.)

22,940. "Measurement by the use of sound waves." R. A. FESSENDEN. November 23rd. (Convention date, April 2nd, 1914, United States.) (Complete.)

22,950. "Air filter for turbo-dynamos and the like." ALLGEMEINE ELEKTRICITATS GES. November 23rd. (Convention date, November 21st, 1913, Germany.) (Complete.)

22,958. "Construction of direct-current dynamos required to generate approximately constant voltage when driven at variable speeds." W. D. HILLS. November 24th.

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23,050. "Looped-in system of electric wiring and fitting therefor." F. W. SUTER and BAXTER & CAUNTER, LTD. November 25th.

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29,504. DYNAMO ELECTRIC MACHINES PARTICULARLY MOVERS. H. Pieper. December 22nd. (Decembe

1914.

103. POLE COMPASSES FOR SHIPS. A. Jefferson.

390. DYNAMO-ELECTRIC MACHINES. British Thom Pollock. January 6th.

2,301. ELECTRIC SAFETY FUSES. H. H. Berry.

3,643. CONSTRUCTION OF ELECTRIC POCKET LAMP SHELL OR CASE CONTAINING THE AFOREMENTIONED DRY February 12th.

4,344. DYNAMO-ELECTRIC MACHINES. E. C. Ket February 19th.

5,587. MEANS FOR USE IN SUPPORTING SEPARA STORAGE BATTERIES. Electrical Power Storage Co.

16,839. TELEPHONE APPARATUS. E. A. Graham.

19,282. RECORDING APPARATUS. M. E. Leeds. A cation on 25,717/13. November 10th.) (November

19,283. ELECTRICAL POTENTIOMETERS. M. E. Lee application on 25,717/13. November 10th.) (Nove

21,968. MINERS' ELECTRIC SAFETY LAMPS. Noven tion on 25,210/13. November 5th. J. G. Patter

A Blackpool Exhibition.—Among firms who are exhibiting at the Blackpool E in progress, are MESSRS. BOTTOMLEY, FRAM JONES BROS., both of Blackpool.

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THE

ELECTRICAL REVIEW.

VOL. LXXV. DECEMBER 18, 1914. No. 1,984.

ELECTRICAL REVIEW.

Vol. LXXV.] CONTENTS: December 18, 1914. [No. 1,984.

	Page
Miners' Safety Lamps	805
A Board of Trade Electrical Exhibition	806
The Situation of the German Electrical Industry	806
Rubber	806
Foreign Supply Works in Belligerent Countries	807
Over-Pressure Protective Gear for High-Tension Circuits, by K. Edgcumbe (*illus.*) (*concluded*)	807
Power Plant Testing, by W. Selvet (*illus.*) (*concluded*)	809
Electricity in Mines (*illus.*)	811
War Items	813
New Electrical Devices, Fittings and Plant (*illus.*)	814
Correspondence—	
German Agencies	816
American Activity in the Australian Market	816
A Stereopyrometer Wanted	816
Legal	817
Business Notes	818
Notes	823
City Notes	825
Stocks and Shares	827
Electric Tramway and Railway Traffic Returns	828
Recent Advances in Electrical Crane and Lift Design (*illus.*)	829
Calculations Relating to Electrical Conductors	831
Electrical Accidents in Mines for the Year 1913	832
Trade Statistics of Switzerland	834
New Patents Applied For, 1914	836
Abstracts of Published Specifications	836
Contractors' Column	Advertisement page xviii

THE ELECTRICAL REVIEW.

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H. ALABASTER, GATEHOUSE & CO.,

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MINERS' SAFETY LAMPS.

THE rivalry between the electric safety lamp and the oil "safety" lamp has lately given rise to a great deal of discussion at meetings of mining engineers and managers. In this field we are witnessing a repetition of the process which has already been observed in the struggle between electricity and gas for ordinary lighting, heating and cooking; in the early days the advocates of the older agent, watching the gradual development of its young rival, were at first contemptuous of its qualities, and contented themselves with emphasising the drawbacks of the new-comer and the superior advantages of their own commodities and apparatus. But youth will be served, and the growing importance and appreciation of the electrical methods soon compelled the enemy to bestir themselves and to set about devising improvements in their own systems, incorporating in their apparatus, as far as possible, the qualities which marked those of the aggressor.

The latter replied with further advances, and, in spite of the remarkable progress thus induced in the gas world, the electric light now reigns supreme in every respect, including that of cost, the electric cooker is not only unexcelled, but unequalled in the quality of its products, and is on a par with the gas cooker in point of cost in many towns, and electric heating, though admittedly more costly, is, nevertheless, becoming exceedingly popular.

So, too, the makers of miners' lamps gave little heed to the growing efficiency of the electric lamp until a few years ago. Now they recognise it as a serious competitor, and they, too, have been spurred on to effect improvements in the oil lamp, which must be ascribed entirely to the advent of the electric type. While the electrical engineer can thus claim to be a public benefactor, by compelling reforms which might otherwise have been delayed indefinitely, it must be admitted that his luck is rather hard. However, he is not downhearted; he knows that he must win in the long run, and already he has many staunch and convinced adherents in the ranks of his customers. Amongst the latter Mr. W. Maurice, once President of the Association of Mining Electrical Engineers, and a manager of some 15 years' experience, has taken a leading part in repelling the aspersions cast upon the electric safety lamp by its enemies. It is alleged, for instance, that the lamp, though nominally giving over one candle, really yields only about ⅔ C.P., while certain oi lamps of a new type give twice that value, at the end of a shift; also that ignitions of gaseous mixtures have been obtained with electric lamps. But the official specification for the oil lamp only requires it to give 0·3 C.P., showing what the experts think of its capabilities; and the atmosphere in which an ignition was obtained consisted of air and coal gas, which is notoriously more easily ignited than methane.

That the candle-power of the electric lamps has fallen off, and the life of the batteries has been short, at some collieries is true, but the blame is not to be laid upon the

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lamp; it is too often the case that the electric lamp room is put in the charge of utterly incompetent hands, with the inevitable result that any electrician would foresee. It is the old story in mining work; we have again and again declaimed against the folly of purchasing expensive apparatus and expecting an unskilled labourer to keep it in first-class working order. That is the root of the trouble in connection with miners' electric lamps, just as it has been in the case of other electrical plant in mines, and until the managers realise that high-class apparatus demands, and must receive, skilled attention, the trouble will continue.

As for the future of the electric lamp, we have no fears. The colliers, once they have used the electric lamp, refuse to go back to the oil lamp, and therein lies the assurance that the electric lamp must win. Moreover, the latter is constantly being improved; the tungsten lamp has come, the half-watt miners' lamp is being perfected, and it will not be long before great strides ahead will be recorded. Moreover, the increased output of coal due to the better lighting benefits both the workman and the owner, and should be credited against the greater cost of the electric lamp, while the reduction or abolition of the cost of compensation to miners afflicted with nystagmus, which is confidently anticipated when the better lighting is adopted, alone will go far to cover the cost of the lamps.

A Board of Trade Electrical Exhibition.

We would urge British electrical manufacturers, traders and others who may have it in their power, to co-operate with the Board of Trade Commercial Intelligence Branch in its efforts to secure the success of the Exhibition of German and Austro-Hungarian electrical manufactures that is now in process of organisation. It is hoped to bring together as complete as possible a collection of electrical apparatus, appliances, accessories and what are generally known as supplies, that have in the past been imported into the United Kingdom from the countries with which we are now at war. Manufacturers have many a time come up against German and Austrian electrical goods that could easily be made in this country, and it lies in their power to ensure that the collection now being got together shall be as representative as possible. We have no doubt whatever that such a display, if complete, could be made most instructive and educative. Manufacturers or their responsible representatives from all parts of the country will do well to consider a visit to London (32, Cheapside, E.C.) to see this Exhibition, one of their definite engagements for early January. We hope to give further particulars later, but in the meantime we urge the matter upon their attention. Buyers must also be induced to gather together to meet the British manufacturers who desire to impress upon them that they are both able and willing to fill requirements for these articles in the future, and we believe that there is a well-organised movement on foot to that end.

The Situation of the German Electrical Industry.

The current statements made by the German newspapers on official authority are in general so extraordinary that they have to be regarded with great caution, if not with considerable suspicion. This contention applies equally well to the electrical industry in that country, which is referred to by the *Reichs-Arbeitsblatt*, published by the Imperial Statistical Board. This Labour organ, which deals with the situation of the electrical industry in October, stated at the beginning of December that although the activity in general is not so good as in the previous year, the workmen at disposal are in part better employed than in 1913, and there is no lack of unskilled labour. Concerning the month of October, the newspaper remarks that a further improvement took place in the construction of accumulators, in which the course of business was already good. It is submitted that confidence continues to return, and that not only are pressing repairs being executed, but extensions and new installations have also been ordered. A revival of b
tramway and insulating mat
received by the labour organ at
the construction of electrical
the additional work provided
case of measuring apparatus, t
engaged in this department
improvement as compared with
September, and in this instance
fidence in business has been
reductions in the length of th
unavoidable for a portion of th
of the war, are variously report
overtime is said to be frequent
some cases three shifts are work
workers exists.

It is further stated that t
departments were well employe
ceding month, in consequence
given by other authorities. In
firm is credited with the assert
ness with Government authori
has also taken place in priv
wages in the branches in qu
increased by from 10 to 15 per
ness in the production of ap
according to some reports, did
compared with the previous mo
states that orders for other tha
plentiful. The supply of unsk
also was abundant, whereas t
inadequate. After mentioni
installations for heavy curre
employment as in September, th
the branches engaged on cable
duction of insulating materials
business in accordance with th
one firm, which has no army o
in trade, although admitting
gradually coming forward. Th
on the October report is that i
speeches impending at the an
facturing firms, before accepti
the Government Labour organ,
speeches really represent the
that country.

Rubber.

Fluctuat
although not
have on the whole tended in
the tone has been a little
latex crepe at round 2s. 0½d.
smoked sheets at about 2s. 3d.
rubber is still held for comp
neighbourhood of 2s. 9½d. per
trade buying of a quiet charac
British grown material is gr
November the imports from
Straits Settlements and Ceyl
100 lb., while the rest of the
26,000 centals or so. For t
British grown rubber was ent
775,000 centals, and rubber f
of 565,000 centals. Of the
aggregated 112,000 centals, a
exported. This seems to be
moderate quantities for Britis
the case there can hardly be
going on. Of the exports,
United States and 10,000 ce
exports for the 11 months were
more than half went to the U
reason to believe that Germany
but less is being heard of th
obtain supplies by tortuous me
The export prohibitions now in
defence against the efforts of t
one of the essentials of modern
smallest likelihood of there b

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tions which are necessary to the well-being of ourselves and our allies. The fact that the British Empire produces something like 70 per cent. of the world's output of plantation rubber has by this time been brought home with crushing force to Germany. Germany of course robs and plunders wherever her troops set their feet, hence the scouring of Antwerp and, indeed, all the cities they have laid waste for rubber to be sent into Germany to replenish their sore needs. From information received, too, it is believed that they have plundered a quantity of rubber and ivory awaiting shipment in the French Congo, though what they can do with it, there is a mystery. They cannot eat it and they cannot ship it.

There has been some heartburning in America over the embargo placed upon exports from here by the British Government, for it was early recognised that the United States trades must suffer considerably unless the usual supplies of rubber were forthcoming. Failing these coming to hand, America would have to rely upon Brazil, which country exports about 40,000 tons of wild rubber a year, of which normally rather less than half goes to New York. The position appears to be easier in some respects now, and with consumption here active and a good deal being done by France and Russia, the market outlook contains certain favourable factors.

According to an official cablegram received from Kuala Lumpur by the Malay States Information Agency, the export of cultivated rubber from the Federated Malay States in the month of November amounted to 2,889 tons. The October export returns are, however, not yet to hand.

Foreign Supply Works in Belligerent Countries.

The existing state of war, taken in conjunction with the presence of a foreign electricity supply works in the city, induced the Moscow City Council a short time ago to appoint a special Committee to investigate the question of the relations between the Moscow supply works of the St. Petersburg (Petrograd presumably in future) Electric Lighting Co., of 1886, and Germany. As a result of the inquiry the Committee is said to recommend the sequestration of the local undertaking on the grounds that the majority of the shares are held by German-Swiss banks, that the working of the Moscow undertaking is technically dependent upon Berlin and that not a single penny out of the last large issue of shares made on behalf of the company by the Deutsche Bank has reached Russia. It appears that the Electric Lighting Co., of 1886, has a share capital of £5,000,000, in which the Petrograd works are represented by a book value of £1,908,000, the Moscow works by £2,474,000, and the works at Lodz by £793,000. In German interested circles the action of the Moscow Committee, which would be subject to the approval of the City Council, and would, it is assumed, also require the confirmation of the Ministry in Petrograd, is conceived to imply not an expropriation of the undertaking, but the suggested appointment of a committee to supervise the works so as to prevent any efflux of money to Germany, under existing circumstances. The allegation that none of the money realised on the last emission of shares was sent from Berlin to Russia is denied in Germany, where it is pointed out that the Teutons naturally retained the amount of the contract prices for the machinery and materials supplied for Moscow, and a portion for dividend payments, but that funds were remitted for the payment of taxes, salaries, wages, &c. The question now arises whether, as is conceivable, the Petrograd City Council will follow the example of that of Moscow. At any rate, the present case shows how the Russians are beginning to perceive the effects of German supply promotions in Russia, even when supported by German-Swiss financial institutions, one of which in the instance in question is very closely related to German manufacturing companies; whilst the result of the practical German monopoly of electrical manufacturing in Russia is another factor which will undoubtedly receive further consideration in the near future.

OVER-PRESSURE PROTECTIVE GEAR FOR HIGH-TENSION CIRCUITS.

By KENELM EDGCUMBE, M.Inst.C.E.

(*Concluded from page 777.*)

Having decided upon the form of spark gap, the question still remains of the resistance to be connected in series with it. The best value for such a resistance has been the subject of much discussion. It has been said, on the one hand, that unless it was of the order of 500 ohms or less the protection afforded was small, and that, on the other hand, if such low resistances were used oscillations and pressure rises would be set up.

The experiments of Schrottke, already alluded to, show conclusively that with the horn arrester, at any rate, no such rise need be feared, even with a much lower resistance than is advisable from other points of view. When an arrester is discharging the resistance is connected directly between the line and earth, and too low a resistance is clearly undesirable. On the other hand, experience has shown that a resistance of from ½ to 1 ohm for each volt of line pressure affords ample protection in the case of a cable system, and of say 0.1 ohm for each volt in the case of an overhead system.

It has sometimes been put forward as an advantage of the multi-gap, electrolytic and other quick break arresters that resistances of much lower heat capacity can be employed with them, since the circuit is opened much more rapidly, usually within half a period, so it is claimed. This is of little practical value, however, since in the event of a continued disturbance a number of successive discharges will take place before the over-pressure is relieved. It has been shown, moreover, that a further half period must elapse before the gap can again discharge.

The remarks made earlier, when dealing with resistance suitable for use against atmospheric discharges, apply equally in the present case. In fact, the question is an even more serious one, since the discharges due to internal disturbances, although usually less severe both as regards steepness and energy, are often of much longer duration. Hence the absence of liquids liable to evaporate and of inflammable oil is clearly indicated. Moreover, carborundum rods with their liability to disintegrate under continuous discharges are out of the question for all except the least important positions. The Brazil horizontal pattern of carbon powder resistance would therefore appear to be about the only one left.

Fig. 13 shows this resistance in fire-clay slab. Its general construction is similar to that of the atmos-

Fig. 13.

pheric discharger already described (see fig. 8), except that it is unnecessary that the path should be kept straight in this case, and as the resistance required is higher, a zig-zag form of groove is employed. Fig. 12 shows the horn discharger and resistance slabs suitable for a 12,000-v. system. For higher pressures the number of slabs in series is increased in proportion. The slabs themselves being fireproof and constructed of insulating material, no special precautions are necessary as regards erection; in fact, in most cases they can be placed direct on the floor.

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General.

Since prevention is always better than cure, it is essential that sources of possible over-pressures should be eliminated as far as ever possible. For this reason, in designing a system not only must the length, capacity and self-induction of the line and generator be considered, so as to eliminate resonance, Ferranti effect, etc., but care should be taken to avoid the placing of switches in such positions that they will have large capacities on either side of them, further, small machines at the end of long lines should be avoided, and so forth.

It is also essential that such over-pressures as do occur should have their origin quickly located, so that they may be eliminated in their early stages and before they become serious. To this end some form of over-pressure detector should always be installed at different points of the system, so that the ramifications of any over-pressures may be followed. Such an indicator, as designed by Mr. Brazil, is shown in fig. 14. B R represents a Brazil resistance

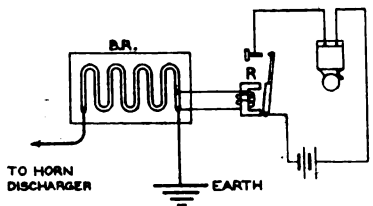

Fig. 14.

slab connected between discharger and earth. In parallel with a short length of the powder is a relay R, and so soon as a discharge occurs a current passes through the resistance to earth, the relay acts closing the local bell circuit and thus draws the attendant's attention to the fact that an over-pressure has been dealt with. Instructions should be given that particulars of every such occurrence are to be at once entered up, together with any details of plant running, switching operations in progress, or other factors likely to be of use in locating the source of trouble.

In order to make such indicators available in substations where there is no attendant, the bell can be supplemented or replaced by a graphic instrument, and a permanent record thus obtained of the moment at which an over-pressure occurred. Such over-pressure indicators and graphers have proved of great value by giving warning of incipient faults and sources of over-pressure before they became serious.

The "earthing" arrangements are a very important feature of all over-pressure protective systems. If an earth wire is employed on an overhead line this should be efficiently earthed at intervals. For this purpose an earth plate some 18in. square, buried in coke, will be found convenient.

For earthing at the station, either earth plates or tube electrodes can be used. When the ground is naturally fairly moist, non-corrodible plates some 5 sq. ft. in area buried vertically, with not less than three feet of soil above them, will be found to meet most cases. If the ground is dry 1in. or 2in. gas barrel 6ft. or 8ft. long driven vertically into the ground and filled over and over again with salt and water, can be employed. At least three such pipes should be connected in parallel. In many cases good earth connections can be made to structural metal buried in the ground. Metal in concrete is, however, useless.

Conclusions.

Briefly summarising the conclusions arrived at, it may be said:—

1. As a protection against static charges, all long overhead lines in exposed positions should be provided with "permanent leak" inductive resistances.

2. On all overhead or partly overhead systems plant should be protected by line choking coils.

3. As a protection against stee
due to lightning, condensers can b
are expensive and are of no use
against any other form of disturba
overhead or underground systems.

4. Consequently, if condensers
they must in all cases be supplement
of discharge gap capable of dea
forms of disturbance.

5. Discharge gaps installed in
line choking coils are quite capable
disturbances of both kinds, so tha
of installing condensers is seldom

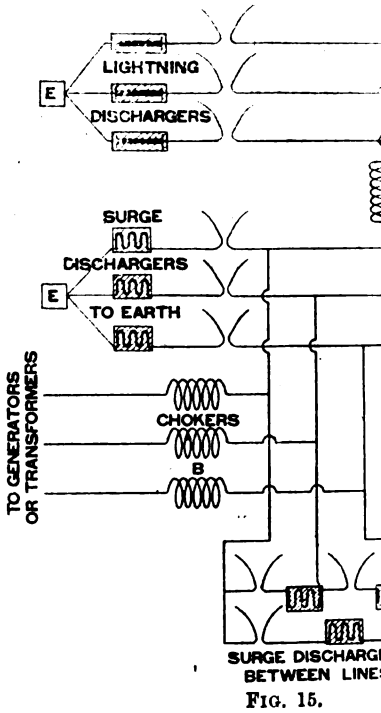

Fig. 15.

6. The discharge gap must not
too suddenly, and should be suffi
allow of its being connected directl
out the interposition of a fuse.
charger best fulfils these requirem

7. When acting, the discharger
tute a dead earth or short circuit, a
have a limiting resistance in serie

8. The limiting resistance shoul
inflammable, unaffected by heat o
to deterioration under long or rec

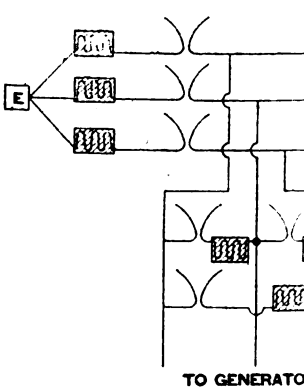

Fig. 16.

and should require no attention
The Brazil form of carbon pow
fulfils these requirements.

9. The ohmic value of the resis
enough to prevent undue disturba
and low enough to afford relief
ohm per volt for cable systems an
for overhead systems has been fo
tical conditions in every way.

10. For lines subject to atmos
the path to earth should be as s

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(fig. 8), and even for cable systems should be reasonably non-inductive (fig. 13).

11. With properly proportioned protective gear internal surge discharge gaps may be set as low as 50 per cent., and atmospheric disturbance gaps from 100 per cent. to 200 per cent. above the line pressure.

12. On insulated systems internal disturbances normally arise between lines, and the dischargers should be connected accordingly. At the same time it is best not to dispense with the earthed arrester on this account (see fig. 16).

13. Discharge indicators, with or without graphic attachments, should be installed at various points on the system.

Fig. 15 shows the connections for a complete set of protective gear for an overhead system or one partly overhead and partly underground. Fig. 16 gives the connections for an entirely underground system with insulated neutral. The three earthed arresters may, in this case, be omitted, although this is not recommended. If the neutral point of the generator is earthed the dischargers between lines can be dispensed with.

POWER PLANT TESTING.

By W. M. SELVEY, M.I.E.E.

(Abstract of paper read before the Institution of Electrical Engineers, *November 26th*, 1914.)

(Concluded from page 804.)

It is advisable that one boiler of a type should be set aside for testing work, and fitted up with measuring instruments. A sample truck or trucks of coal can then be run through the grates, and the actual evaporation measured. For ordinary commercial working the special boiler is by far and away the most effective calorimeter.

Fig. 4 shows an arrangement of tanks and weighbridge which has been found convenient for power-station work. By

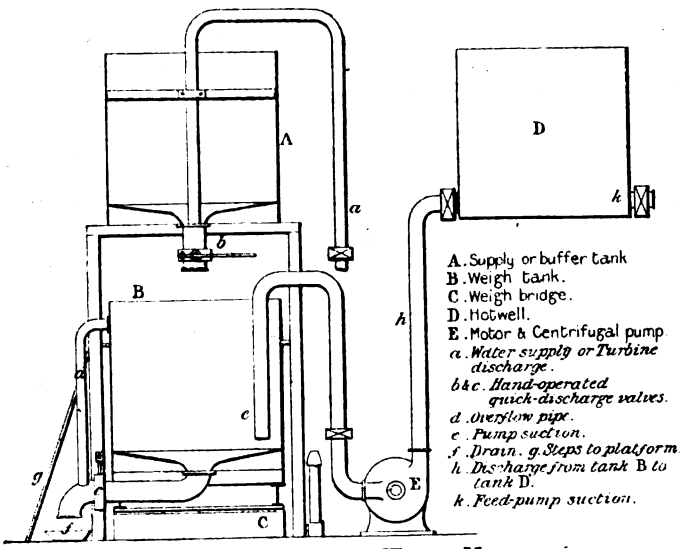

Fig. 4.—Arrangement for Water Measuring.

reversing the order of use and omitting the pump, it becomes of equal service for turbine testing.

For contractors' tests the author suggests for a standard practice that the boiler should be tested three days after being swept; the interior of the tubes being reasonably clean at the time, say not more than 1/32 in. of scale, the boiler to be on full load eight hours before the test starts, and during the last two hours to be fed with spare test coal, during which the thickness of fire may be adjusted. After starting on the weighed coal, the thickness must not be altered, any regulation being done on the speed of the grate.

Turbines and Generators.

As regards the steam end of the plant, measurements of the temperature of the steam have been greatly improved, both by the use of the Whipple indicator and by a specially adapted form of thermometer.

As regards pressure measurements, large pressure gauges are very satisfactory if used immediately after being checked on a "dead weight" tester. Highly reliable test gauges are also supplied by leading makers. In most cases this measurement is not of great importance, but in certain cases where defect in pressure reduces the output of the plant it becomes of first importance. The vacuum should be measured at the exhaust flange of the turbine—a difficult but most important measurement. The author has found it necessary to have a special aneroid barometer made.

The measurement of the condensed water offers little difficulty, thanks to the manufacturers of weighbridges. The accuracy of these can be easily made better than one in a thousand (0.1 per cent.), which is the ideal that the author thinks ought to be aimed at in each individual measurement in turbine testing if the final figure is to have anything like an absolute accuracy of 1 per cent.

The tank and the electrical meter measurements should be absolutely correlated by bell, light, and telephone signals, without the intervention of the time element at all. It should be purely a measurement of matter against energy.

Electrical Meters for Generator Outputs.

(*a*) *Continuous Current.*—Owing to the temperature coefficient of almost all large continuous-current watt-hour meters, it is a better policy to use precision voltmeters and ammeters except with extremely variable loads. It is well to re-check any instrument against its test-room calibration, by means of a potentiometer and standard cell, when the instrument is actually *in situ*.

The main shunt should be designed and fixed with more insight than is usual with shunts for ordinary switchboard instruments. Errors due to change of resistance, unequal heating, and thermo-electric effects, are quite appreciable if the temperature approaches 85° F. It is well to arrange to include thermometers inside test instruments, the bulb being placed close to the actuating part. Without excessive pressure-drop in the shunt the temperature coefficient of these instruments is likely to be more than 0.03 per cent. per 1° F.

(*b*) *Three-phase Current.*—It is the author's opinion that the only satisfactory method is to take in duplicate the whole set of pressure transformers, current transformers, leads, and meters, to the National Physical Laboratory—or, say, the Manchester University—before a test, and have them thoroughly checked, and then tally every lead on breaking circuit. All the gear should then be brought by hand to the user. The meters should be mounted in a remote control room, quite cool and free from vibration, the length and section of the leads having been pre-arranged to allow for this. By following this method results have been obtained that are quite consistent with the ideal 0.1 per cent. in regard to the comparative behaviour of two complete and independent sets of meters and transformers. Efficiency tests should always be run on unity power factor unless there are serious reasons for the contrary.

In turbine testing no measurement can under the best conditions yield happier results, or on the other hand more serious discrepancies. In a recent case within his own experience, a station engineer proposed to reject entirely a turbine plant on results obtained by using the mean reading of three meters which differed 7 per cent. among themselves.

Condensers and Air Pumps.

It is almost impossible to arrive at any just appreciation of a condenser performance without knowing at the same time the air leakage with which the air pump is dealing and the rating of the pump. In this direction the Scanes gauge will be a great educating force.

But for the unavoidable cooling of the condensate and the upkeep of reciprocating machinery, in no respect can the combination of a Parsons augmentor and an Edwards air pump be surpassed in reliability or capacity to-day, neither is there any other system so low in its power requirements. In spite of this they are seldom fitted to newer plants. This seems to be a most striking example of reciprocating plant being superseded by rotary plant.

The ability of a steam jet to handle large volumes of gases is unequalled, and the author thinks that the ultimate type of air pump will be a steam augmentor jet in series with a pump of the Kinetic or Leblanc type.

Air leaks occur, even in the best-regulated stations, at expansion joints and even the main casing joint.

In order to test the air pump it has now become usual to disconnect it from the condenser and to admit to its suction various amounts of air as measured by the in-draught, through calibrated nozzles. This is quite a fair test in comparing air pumps, but unless the air so drawn in is thoroughly saturated after expansion with water vapour at the temperature of the water used by the pump, it is not safe to assume that the pump would produce the same vacuum when actually attached to the condenser and dealing with the same amount of air.

To include provision for occasional leaks, the author would suggest that provision should be made for at least 1.3 lb. of air per 1,000 lb. of steam for plants of moderate size, and for 1 lb. per 1,000 lb. with large plants. Under these circumstances the vacuum maintained by the air pump when dealing with this amount of air, but disconnected from the condenser, should be within 0.3 in. (mercury) of the vapour pressure of the water that it is using.

The performance of the condenser depends almost entirely on the steam distribution. The buyer should specify the sur-

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face that he requires, especially if he is at all troubled with dirty condensing water; in this case it is well to arrange for 1 sq. ft. of surface for every 5 lb. of steam to be condensed per hour.

The author suggests, as a standard for testing, that a condenser having 1 sq. ft. of surface for 7lb. of steam, and a water velocity of 6 ft. per second through the tubes, together with the air pump already described, should be expected to have, three days after brushing the tubes, a value of "K" not less than 450. The onus of making the plant airtight would thus be left on the contractor. By "K" is meant the number of B.Th.U. transmitted per square foot of surface per hour per degree (Fahr.) mean difference between the temperature inside and outside the tubes, the temeprature outside being assumed to be uniform and measured at the inlet, and the water temperature to be the mean of the inlet and outlet temperatures. These temperature measurements are to be combined with an accurately calculated figure for the heat per lb. of steam condensed, which with modern plants is often found to be between 970 and 980 B.Th.U. per lb. of original steam.

Cooling Towers.

Considering that a difference of 1° F. in the temperature of the cooling water means about 0.3 per cent. in the consumption of the turbine plant, and bearing in mind the value of 1 per cent. as shown in the introductory remarks, it would seem to be a mistake to try and cut down the height of the chimney, since cooling towers are so cheap.

As regards the testing of cooling towers, very great care is necessary in taking the wet and dry-bulb temperatures. Delicate open-scale thermometers are used, and must be shielded from radiation and yet have a free stream of air passing over them. The radiation from the observer's face is quite sufficient to vitiate a reading that is not taken promptly.

The thermometers should be to the windward of the tower, and in the shade if possible. The observer should always keep to leeward when reading, and the stand should be watched all the day to see that no change of wind or bright sunshine can in any way affect the correctness of the readings.

The only fair way to take the temperature of the water before and after cooling is on the condenser inlet and outlet pipes. It is possible to get all sorts of temperatures by floating a thermometer on the surface at the base of the tower.

It is difficult to measure such large quantities of water as are cooled in towers, say, up to 250,000 gallons per hour. It can be done by a Venturi meter, or weir. Alternatively, it is much better done by the thermal method, in which the amount of water is calculated from the measured condensate, its known loss of heat per lb. in the condenser, and the rise of temperature of the circulating water. This test properly run is of considerable accuracy.

In testing large water turbines, a steady stream of concentrated salt solution is added to the incoming water, and the tail-race water is analysed for salt. The same principle is commonly used for finding condenser leakage where the circulating water is salt, and removes the necessity on a turbine test for having the condenser absolutely watertight.

Centrifugal Pumps.

It is seldom that a test of a circulating pump is required in power-station work. It seems to be a common mistake with these pumps to use too small a motor and too large an impeller. It is rather unfair to the motor, and an early test of the amount of power taken is always advisable.

The water leaving the pump has appreciable kinetic energy, part of which can be converted into head by an expanding nozzle. The specification should say whether the efficiency is to include this regained energy.

Fans.

It is seldom that fans have an efficiency much above 65 per cent., and the means of testing them have not been highly developed for ordinary commercial use. In the author's opinion the best way to test them is to discharge the air through a set of home-made wooden nozzles of suitable size which can be fitted in turn on the outlet of the fan.

The efficiency of fans will receive close attention in the future. In order to make the boiler as flexible as the turbine, condenser, and alternator, much greater fan power will be used, and the draught used will probably rise to 6 in. water gauge.

General Remarks.

The organisation of the personnel for accurate testing is a matter for concern. In no case is it advisable to undertake any permanent testing work unless there are at least three engineers, or two engineers and a chemist, in constant collaboration with each other.

In arranging a test it is advisable to have full instructions typed out and handed to every person engaged in a trial; and even then it is necessary to make certain that these instructions are read. The author has almost entirely abandoned sound signals in favour of lights, although sometimes a powerful hooter is a welcome assistant in a big station.

It is his practice to take all readings in triplicate, and in case of very important trials to have one power-station man and one contractor's man to take each particular set of readings in conjunction, so that any disagreement may be dealt with at the time and on the spot.

It is only fair to the contractor to
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commencing the test, so that in such n
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steady conditions may be obtained. Th
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higher rating immediately after the fi
It is very seldom except in the case of
further accuracy is obtained by runni
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than one or two parts in a thousand.
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by testing at such time of the year that
is superior to that on which the turbin
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the corrections do not amount to more

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finished the inside of the condenser s
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any small air leaks that there might
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Certain makes of turbine show quite
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In conclusion, the author hopes t
grounds for the following points:—
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The equalising of conditions under w
The value of the data gained from te

Discussion in Lon

Mr. R. A. Chattock, in opening th
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standard apparatus. The correction
vacuum, etc., should be specified t
the testing engineer; it was also abs
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showing the performance of the tow
tions. To obtain the desired result
drafted the specification to have as
testing engineer.

Mr. C. C. Paterson said he was
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obtain the electrical accuracy suggest
sidered, the limit. It was a question
would maintain their constancy, but a
could be obtained if precaution was t
links in the chain connecting the fu
the large power meter to be calibrate

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lous care would be necessary to ensure accuracy. Errors of several per cent. would creep in unless meters were tested with their transformers, and there was a very strong case for doing this. It was most fallacious to test three-phase meters on single-phase circuits, and it should be a rule to test them with three-phase circuits.

Mr. Robt. Hammond, referring to the question of bonuses and penalties, said he believed he was the first consulting engineer to correct a contractor's verbosity by making him back it by bank-notes. The author was much bolder, and his penalty was, apparently, some £24,000 per lb. of steam. He entirely agreed with him on the importance of attention to detail; it had been his practice to give clear instructions as to conditions of testing new plant some time before the event.

Mr. Scanes described his vacuum efficiency and absolute pressure gauge for surface condensers, which was intended for permanent fixing in the power-house. The author was rather hard on the rotary air pump and considered the steam jet better, but the rotary could be thermally as good as the other type. Fixing the surface area of the condensers might lead to trouble; one designer would do much better than another on the same surface.

Mr. W. B. Woodhouse said there were enormous differences between the results of overall tests and individual plant tests, and these were largely to be traced to the boiler-house. The fuel burnt should be tested on a working scale. Detailed investigation was necessary, and there should be someone qualified to carry it out. Many elaborate recording and testing devices were installed in central stations and they were often far from accurate.

Mr. Holehouse referred to the performance of cooling towers, suggesting that if it were possible to fix the upper temperature and quantity of water, then the contractor could give the desired cooling. The cooling tower should be arranged to work over temperature limits corresponding to the condenser, but with the modern turbine discharge at high temperature it was difficult to give reliable figures for cooling effect.

Mr. Horace Boot said it was usual to arrange previously exactly what was to be done on a test and to give curves of vacuum correction. He had found the great value of continuous-recording instruments in stations to keep the engineer in close touch with the working of his plant; he mentioned that he had found from experience the great accuracy of the V-notch for water measurements.

Mr. Whipple referred to the value of distance thermometer installations in the central stations.

The Author, in reply, said the necessary corrections were now often made in specifications. High boiler efficiencies unaccompanied by some explanation of the methods of obtaining them were misleading.

Discussion at Birmingham.

Mr. R. A. Chattock, in opening the discussion, said it was of the utmost importance from the buyer's point of view that tests should be carried out with proper accuracy. The carrying out of such tests necessitated the employment of trained observers who were experienced in such work and whose operations were carefully organised. It was usual to rely upon the contractor to supply the men required for this work, and to place with them men representing the purchaser to check the readings. It was obviously very much more satisfactory to employ an entirely independent testing authority. In connection with large power stations this plan would prove more satisfactory because the ordinary duties of the station staff would then not be interfered with. Mr. Chattock emphasised that testing of all kinds was practically useless unless the conditions and performance guarantees were clearly set out in the specification. With regard to Mr. Selvey's suggestion that water passing through cooling towers should be measured by the thermal method, it seemed to Mr. Chattock that an error might creep into this method. He preferred to measure the water by a weir whenever possible.

Mr. Scanes explained his gauge for measuring air leakage in condensing plant. After doing so he remarked that he thought Mr. Selvey had not done credit to the rotary air pump as compared with a steam jet., and described certain advantageous features of the rotary pump

Mr. Kaula thought that condenser tests should be carried out on site, and not in the manufacturer's works. He also drew attention to the necessity for more definite information regarding air leakage, as this was very important to the designer of condensing plant. In his opinion, purchasers should not specify areas of condensing surface but leave the determination of that to the designer. It was desirable that the purchaser should simply state the performance required from the plant.

Mr. Hollis thought it advisable to test plant at a specified load factor, as this enabled results to be obtained which corresponded to normal conditions. He also thought that during a test, sound signalling should always be used in addition to light signalling.

Dr. Garrard advocated the laying-out of stations with permanent connections between the switchboard and the instrument test room, so that the engineer could always easily calibrate his instruments. For A.C. stations he thought that instrument testing apparatus should be as complete as in D.C. stations, to avoid the necessity of periodically sending the instruments to an independent authority for testing. He stated there was no special difficulty in so doing.

Mr. Walsh pointed out the necessity for testing pressure gauges *in situ* owing to the liability of water finding its way into the gauge tubes and interfering with their action. He also urged that electric tests should be on working power factor and not unity power factor. In this connection he mentioned that a known apparatus consisting of a choking coil and resistance enabled a load of proper character to be obtained conveniently.

Mr. Mills thought that when the efficiency of a boiler was stated it should also be stated whether or not the power required by accessories, such as mechanical stokers, was included in the test. The station engineer should specify the surface required in condensers, as he knew better than the designer the conditions of his station.

The Chairman, Dr. Railing, in bringing the discussion to a close, dwelt upon the advisability of incurring extra capital outlay when it was justified by increased efficiency. He urged that capital cost should not be adhered to strictly as the determining feature in the purchase of plant.

ELECTRICITY IN MINES.

In a paper read before the North of England Institute of Mining and Mechanical Engineers on October 10th, and reported in the *Colliery Guardian*, Mr. George J. Ralph described a portable electrical gas-detecting device for use with miners' lamps, depending upon the effect of a gassy atmosphere upon the resistance of an initially-heated platinum wire. The alteration in the resistance of the wire is estimated by comparing it with a similar wire sealed up in such a manner that the surrounding gassy atmosphere cannot act upon it.

In the gas detector the galvanometer is of the moving-coil pattern; a very long pointer cannot be used to indicate the very small angular movement of the coil, and if a short pointer were employed, the divisions on the scale would be so small that it would be very difficult to read them with accuracy. Instead, therefore, of attempting to read the magnitude of movement of the galvanometer pointer, the bridge circuit is so arranged that when the pointer shows a deflection it may be brought back to zero by moving a sliding contact on a wire that forms part of the circuit. It is the magnitude of the movement of this sliding contact necessary to bring the galvanometer pointer to zero that is read, and this acts, as it were, as a multiplier to the length of the pointer. In other words, if the pointer of the galvanometer is 3 in. long, and moves 1-16 in. from zero, the amount of movement of the sliding contact may be as much as ½ in., or eight times as great, equivalent to a pointer 24 in. long.

The temperature at which the active wire gives the best result is about a dull red heat. This temperature is considerably below the ignition point of firedamp or methane. At this comparatively low temperature, the wire will last a very long time without burning out, and there will be little or no permanent change in its resistance.

Fig. 1 (p. 812) is a diagram of the arrangement of the device. A is a battery, D, E, F and G are the four arms of a Wheatstone bridge; H is a wire of low resistance compared with any of the four arms; and J is an electrical measuring instrument. The free ends of F and G are connected together to one terminal of the galvanometer J; the other terminal is connected to some part of the wire H through the contact arm K, which can be made to slide along the wire H.

Assuming that under normal conditions (that is, when no inflammable gas is present in the air) the electrical resistance of D equals E and F equals G, then the contact K must be resting on a point of the wire H exactly midway between D and E. Let it be assumed that D is the platinum wire exposed to the atmosphere, and that E is a similar wire shielded from the atmosphere, while F and G remain equal in resistance to one another under all conditions. If, owing to the presence of some hydrocarbon gas, the resistance of D increases, a current will pass through the galvanometer, causing the pointer to show a deflection. By sliding the contact arm K away from the central position towards D, a position can be found which will restore the balance and allow no current to pass through the galvanometer, which consequently returns to the zero position. The new position of the arm K is then noted. The positions which K must occupy in order to bring the galvanometer needle to zero are carefully marked when D is surrounded by air containing various measured percentages of gas.

The present form of the device is adapted either for use with a small separate battery of its own, or for use in conjunction with an electric lamp, whichever may eventually prove the more convenient.

There is every indication that the device will meet technical requirements, and that it can be produced at such a price as will render it commercially practicable for adoption by mining officials, deputies, and firemen. Its weight is about 1 lb. without a battery. There is no risk attending its use.

Actual trials have been carried out in a mine, and also with natural pit gas, as well as with artificially prepared methane, all the results of which agree

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Mr. ROBERT NELSON, H.M. Electrical Inspector of Mines, wrote stating that the principle upon which the detector was constructed seemed to him to be both scientific and practical. The most convenient form, if the detector proved to be a practical success—and he knew no reason why it should not—would, he thought, be that in which the detector was furnished with its own battery apart from any lamp.

Mr. WM. OLLERENSHAW, of Denton, wrote that the apparatus appeared to meet all the requirements necessary to make a portable electric safety lamp for miners an unqualified success and, if that object were achieved, it would do more, in his opinion, to lessen the loss of life in coal mining than any other invention of the present century. The increased light

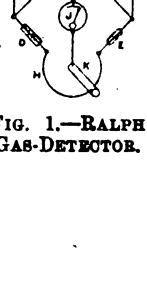
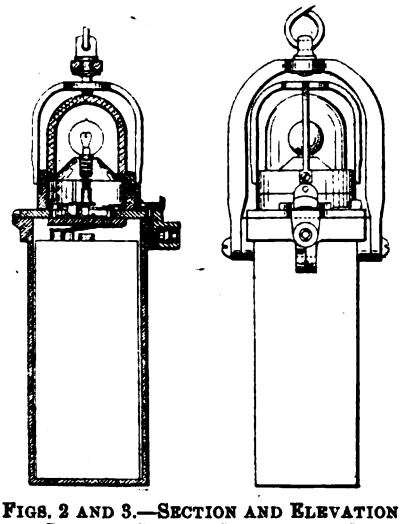


FIG. 1.—RALPH GAS-DETECTOR.



FIGS. 2 AND 3.—SECTION AND ELEVATION OF BRISTOL SAFETY LAMP, TYPE B.T.

of the electric lamp would enable the underground workman to detect the danger and prevent the occurrence of many of the accidents which now accompanied the industry.

Prof. P. P. BEDSON said that it seemed to him that Mr. Ralph had taken a distinct step forward. He had given them a means of fixing the percentage of firedamp, without the personal equation entering into it.

Prof. HENRY LOUIS said that at a low red heat coaldust ignited readily. If that detector were introduced into a very dusty mine, fine coaldust might find its way in, and they might have all the elements that would cause an explosion.

Mr. J. H. MERIVALE (the Secretary) said that he had noticed that the lamp was provided with a gauze, so that in the event of any ignition inside the lamp that ignition would

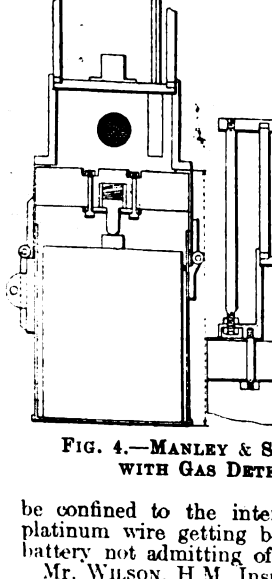


FIG. 4.—MANLEY & SANDY LAMP WITH GAS DETECTOR.

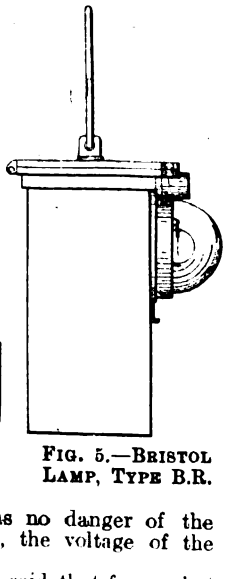


FIG. 5.—BRISTOL LAMP, TYPE B.R.

be confined to the interior. There was no danger of the platinum wire getting beyond red heat, the voltage of the battery not admitting of it.

Mr. WILSON, H.M. Inspector of Mines, said that from what had been said, he should imagine that the instrument was absolutely safeguarded.

The PRESIDENT proposed a vote of thanks to Mr. Ralph, and said that, assuming that the instrument was as reliable and perfect as Mr. Ralph said it was, it was a more accurate means of detecting quantities of gas in the air current than the ordinary safety lamp, into the use of which the personal equation entered, and rendered it so liable to mistakes and errors, which might have serious consequences.

Replying, Mr. RALPH remarked that Prof. Louis had mentioned the possible danger from coal dust. In the mine into which he went in South Wales, an exceedingly dusty mine, no trouble was experienced. He thought the gauze was a fairly good protection, and red-hot wire was certainly very much safer than a flame enclosed by gauze. Working platinum at that comparatively low temp resistance, if any, was very minute heaters to last for a very long tim

In a paper read before the Mi Civil and Mechanical Engineers, al *Guardian*, the case for the electric WILLIAM MAURICE. He stated tha in the use of electric lamps had was known that inspectors of min this direction.

In his opinion there was no k likely to have so beneficial an infl which was so clearly destined to i gave such bright promise of red ground work to anything like the able electric lamp. The oil lamp h nation which it provided was not than that which was obtainable th

Light was what a lamp was pr perty that a flame safety lamp mig nised as subsidiary to its main pu light" seemed to him to offer the many problems that had hithert technically or commercially inso mine meant:—

1. Cleaner coal.
2. Increased output per man, w road-work.
3. Less time lost in starting w
4. Less time lost in re-lighting
5. More effective supervision.
6. Enormously diminished risk underground fires.
7. Fewer accidents from falls of
8. Fewer haulage accidents.
9. Fewer miscellaneous accident
10. Reduction in the number of plete elimination of miners' nysta
11. Reduced cost of insurance an
12. More agreeable conditions o

That there would be less excus with coal when the light was goo it was already known to mine ma ment had actually been obtained. that miners could and did fill mo age on straight work, when using moreover, been the first to admi work with no perceptible extra e

In a pit employing 1,000 men, i working week the value of a los per shift was £3 15s., which was for the extra cost of maintenanc

There was quite a serious loss o to lamp stations to get their lamp from one cause or another gone flame safety lamps used undergrou shift—and he believed the official percentage than this—the numbe lost per day must be considerable to the coal owner and to the m lost a minute lost a farthing!

That more effective supervisio light hardly needed argument.

With regard to the contentio electric for flame safety lamps firedamp explosions, his persona more than 24 years' experience o safety and electric, some 15 year active colliery management. The evidence that flame safety lamps in the mine. Nothing could al lamp" was only a more or less ca Workmen had been known to bo lamp which they could not open in any case a broken glass, a bl omission of a washer, might co direct source of danger. Above the light given by even the bes adequate as a means of protecti gas. Falls of roof had taken a explosions; and therefore the gr general safety was "more light."

That more effective lighting w of nystagmus was now beyond necessary to say that those who the special purpose of eliminatin immediate results were likely to of improvement would depend standing of the cases, and on t dencies in individual cases amo mine. A really reliable opinion lighting conditions on nystagmu less than three years. In thi should be exercised between th and its useful effect in the pla ployed. The photometric value o sarily an indication of its practi

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of the electrodes in a cell, the particular point in the life of the cell at which the test was made, the density of the electrolyte, the rate of charge, the condition (as to cleanliness, etc.) of the contacts, the make and quality of the metallic filament lamp bulb, the number of hours that it had previously "burned," the quality and condition of the outer glass, and many other points, had all an important bearing on the photometric value of an electric lamp and the duration of its light. Only an average of many tests taken throughout the working life of a lamp would give reliable data. Many electric lamp installations were both costing more to maintain and giving much less satisfactory service than they would if they were cared for in a reasonably intelligent fashion.

A great deal more lay in the proper management of electric lamp cabins than appeared to be generally supposed. It was commonly said not many years ago that a coal owner would expend many thousands of pounds on electric plant, and then put a wooden-legged labourer in charge of it. The criticism was essentially true. Many thousands of pounds had been spent by coal owners on repairs and renewals to electric plant which would never have been required if competent men had been placed in charge. It had taken an Act of Parliament to effect a change that ought to have been dictated by common sense. Thousands of pounds were now being spent in providing electric lamps, and was it not a fact that the lamp room had been generally manned by the maimed and decrepit soldiers of the mining army? A well-organised electric lamp cabin was in itself still somewhat of a novelty. The successful management of one called for a higher degree of intelligence than had hitherto been considered necessary. The provision of that higher degree of intelligence made all the difference between success and failure; the omission of it was misplaced and most costly economy.

The elimination of nystagmus, the reduction of other insurance and compensation charges, the improved quality and quantity of output, the increased efficiency of the workers, and, not least, the greater comfort with which men worked when using electric lamps, must all tell in favour of this undoubted underground revolution—a revolution which was destined to affect radically the practice of mining, which would promote safety and efficiency in directions that were here only remotely indicated, and which would be so beneficent alike to owners and to mine workers that the mining engineers of the future would marvel if it should appear that, like the British Empire, "it came about during a fit of absence of mind."

The Home Office has issued a list of types of safety lamps that are approved for use in coal mines, entitled "The Safety Lamps Order of the 7th October, 1914." The electric lamps now approved for general use are the following:—

Bristol Safety Lamp, type B.T. 4V.—Metal case, unspillable accumulator, hinged cover, lamp and reflector under glass dome, flame-tight switch, and lead-rivet lock. Total weight, not more than 4¼ lb. Light not less than 1 C.P. in horizontal plane all round for nine hours, and not less than 1.5 C.P. over an arc of 45°. The lamp is illustrated in figs. 2 and 3, p. 812.

Manley & Sandy Lamp with electric gas indicator.—Sheet-steel case, unspillable accumulator, hinged steel cover, lead-rivet lock, cylinder on cover containing gas-testing device (the efficiency of which has not been tested by the Home Office), lamp and reflectors in glass cylinder, flame-tight switches for lamp and indicator. Total weight not more than 8 lb., candle-power as above (fig. 4).

Other lamps which have been previously approved are the B.A.C., Ceag, Turquand-Kingsway, Gray-Sussmann Nos. 3 and 4, Joel-Fors Type 403 M, Oldham, Thomson-Rothwell, Varta, and Wolf (Alkaline, Lead, and No. 2).

Approval has also been given for use by officials to the Bristol Safety Lamp, Type B.R., 4V. This is of the bull's-eye type, a modification of the B.T. type, weighing not more than 4¼ lbs., and giving 1.5 C.P. for nine hours (fig. 5).

Other lamps approved for use by officials or for special purposes are the Float, Joel-Fors, Types 303C and 403H, Oldham Emergency and Types A and B, Varta, Type 2 Et. 4, and Wolf Rescue No. 2.

WAR ITEMS.

Japan as an Electrical Manufacturer.—The "Japan Weekly Chronicle" has the following:—"Hitherto most of the dynamos and other electrical machinery in Japan have been supplied by the General Electric, Westinghouse and Siemens Schuckert Companies, American, English and German especially. The Tone Electric Company, however, is said to be making a notable departure, having ordered the construction of these dynamos of 6,000 kw. each in Japan. These machines are to be made by the Hitachi Works, and the iron pipes for the same power installation are to be supplied by the Shibaura Works. It is believed that these orders are the precursors of a large industry in Japan. It is certainly a good time to make the attempt, when the European trade is so badly interrupted, and there is a large supply of cheap copper in Japan."

German Trade with Canada.—In a special report on German trade with Canada, which has been prepared by H.M. Trade Commissioner for the Dominion (Mr. C. Hamilton Wickes), it is stated that Germany's efforts to expand her trade in the Dominion have been characterised by the same thoroughness and efficiency which have distinguished her trade campaigns in other countries. The value of German trade with Canada is small, however, as compared with that of the United States and the United Kingdom, the value of the German goods imported during the fiscal year ended 31st March, 1913 having amounted to only about £2,900,000 as compared with £28,500,000 from the United Kingdom and £90,600,000 from the United States. The most important branch of Germany's trade with Canada, apart from specialities (such as certain lines of chemicals, tyres for locomotives, and scientific instruments), consists of low-priced imitations or reproductions of British manufactures; the effect of these is seriously to reduce the value of the retailers' stock of the British-made article. It is the poorer classes which purchase these goods, being in many cases ignorant of quality and value, and their small means drive them to buy a low-priced article in the hope that it is really cheap from an economic standpoint. British manufactures, which are usually of higher price than the German goods, but of intrinsically greater value, require to be given greater publicity, as well as assistance by first-class selling methods, to enable them to compete with low-priced goods; it is well-known, however, that this side of the trade is neglected, and in many cases the British manufacturer handicaps himself further by indifferent knowledge of the local market conditions, ignorance of these conditions being a serious feature preventing him from obtaining a due share of the trade to which the excellence of his manufactures entitles him. Copies of the report, which also contains detailed statistics of Germany's trade with Canada during the years 1908-9, 1912-13, and 1913-14, may be obtained by United Kingdom manufacturers on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Trade Openings in Belgium.—The Belgian Chamber of Commerce in London (Incorporated), of 24, St. Dunstan's Buildings, St. Dunstan's Hill, E.C., writes to us as follows:—"Through the columns of your valuable paper may we draw the attention of English manufacturers to the splendid opportunity they have at present for making arrangements to be represented in Belgium. Amongst the good class of refugees there are a number who, before the war, acted for German firms, and who are wishful to replace these makers by English manufacturers of similar goods. These refugees are here unoccupied and would be very pleased to spend their time in acquiring the knowledge of the lines they will be called upon to introduce later on. The Belgium Chamber of Commerce in London is at the disposal of manufacturers to put them in communication with suitable applicants for such posts. We further take advantage of the present to invite all employers who have vacancies for foreign correspondents, etc., to let us have particulars of their requirements, as the enforced idleness is very irksome to our countrymen." The letter is signed by L. Godchaux, president, and P. Dorchy, the general secretary.

The Skilled Labour Problem.—The "Times" states that an important private conference, arranged between the Engineering Employers' Federation and representatives of the Amalgamated Society of Engineers and kindred societies, began at Sheffield on the 10th inst., to discuss in what way the skilled engineering labour now available, which is considerably less than in normal times owing to enlistments, can be best organised so as to hasten the increased work throughout the country. The conference discussed at length the question of a revision of some of the more stringent rules of the Amalgamated Society of Engineers with a view to allowing the temporary introduction of less skilled labour—that of labourers and women—in certain departments.

Salford Tramwaymen and the War.—Following the example of Manchester, notices have now been posted in the Salford cars indicating what the Salford tramways department has done in connection with the war. No fewer than 338 employés of the department, or 26 per cent., have joined the forces, and several have already been killed and a large number wounded. The amount paid by the Corporation per week to dependents of tramway employés on active service is £800; the amount contributed by the employés out of their wages for various relief funds is £300, and passengers travelling on the cars have contributed £532 for relief purposes.

America's Trade Campaign.—The United States Department of Commerce announces the following appointments: Mr. H. D. Baker as commercial attaché at Petrograd, transferred from Bombay; Mr. V. L. Havens, as commercial attaché at Santiago, after having acted as consulting engineer on railway, electric and irrigation schemes throughout South America; five commercial agents to study respectively trade openings for hardware, electrical machinery, furniture, and general machinery, including machine tools, in South America.

Xmas Gifts.—Liverpool Corporation Tramways Committee is providing a Xmas gift for each of its 700 former employés now serving with the colours.

Accrington Tram Shed.—The new tram shed at Accrington, which is nearly completed, is to be placed at the disposal of the Accrington "Pals" Battalion for drill purposes.

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Bath Electric Supply Men with the Colours.—The following is a list of the men from the Bath Corporation Electricity Department who have been or are now serving with the colours:—

Lambern, E.	Royal Artillery.
Carpenter, A.	Royal Artillery.
Kirkham, C. E.	Royal Artillery.
Wyatt, J.	Royal Engineers.
Brooks, F.	Royal Engineers.
Seal, T.	Duke of Cornwall's L.I. (killed in action).
Howell, J. C.	10th Devons.
Scane, H. G.	1st Batt. Somerset L.I. (killed in action).
Dixon, T. R.	1st Batt. Somerset L.I. (missing).
Mead, F.	1st Batt. Somerset L.I. (prisoner of war).
Lee, J. A.	1st Batt. Somerset L.I.
Holley, E.	6th Batt. Somerset L.I.
Froud, J.	7th Batt. Somerset L.I.
Parfitt, G.	4th Batt. Somerset L.I.
Jones, Knox.	4th Batt. Somerset L.I.
Sydenham, H. G.	4th Batt. Somerset L.I.
Woods, G.	R.A.M.C.
Howard, J.	5th Dragoon Guards.

Australia and the Metal Trades.—A Central News dispatch, quoted in the "Westminster Gazette," says that, "speaking in Parliament, Mr. Hughes said that German capital and influences monopolised the world's base metal industry. The war would be waged in vain if, when victory was won, Australia was compelled to pour into Germany's lap the wealth created by Australian enterprise. The Federal Government had communicated with the British Government requesting co-operation in protecting British and Australian interests, so that we might no longer build up the power and influence of the nation sworn to humiliate us."

Trade with Australia.—We have received from the Office of the Commonwealth of Australia, 72, Victoria Street, London, S.W., a pamphlet dealing with Australia's trade with Germany, which is issued for the purpose of assisting those who are trying to increase their trade with the Colonies. Statistical information is included showing German imports into Australia and Australia's exports to Germany in useful detail over a number of years. Many pages are occupied with names and addresses of exporters of Australia's principal products, and of the principal Australian exporters represented in Great Britain.

Germany and Copper.—A Reuter dispatch from Amsterdam says that the Germans concerned by the scarcity of copper are confiscating copper kettles and utensils at villages, etc., on the Belgo-German frontier. The price of copper in Germany is stated to be £150 to £160 per ton. It is said that gas and electric light fittings, shopfronts, staircases, etc., in Germany are being requisitioned for the copper that they contain so that the voracious Krupp appetite may be satisfied.

Northampton Tramway Manager.—Mr. John G. Cameron, whose appointment to the management of the Northampton tramways was alluded to on page 784 of our last issue, has been with the Northampton Corporation for 10½ years, during 6½ of which he has held the office of borough electrical and tramway engineer. We regret the error which appeared in our last issue.

Free Rides Cancelled.—In consequence of certain cars being crowded with soldiers, to the detriment of the ordinary passengers who had to walk to their destination, the Blackburn tramway authorities have cancelled all free-ride concessions to men in uniform, whether soldiers, policemen, or boy scouts.

Constantinople Telephones.—Owing to the war with Turkey the half-year's interest due 1st January on the six per cent. Obligation bonds of the Constantinople Telephone Company must be postponed. Advices from Constantinople state that the service is still being maintained under the direction of the British staff.—"Financial Times."

Mining Dispute.—The "Standard" states that last week the Hetton Colliery, in the Newcastle district of New South Wales, was rendered idle owing to the miners' refusal to work with a naturalised German employed on the mine as an electrician. The man was alleged to be anti-British.

Personal.—Private W. Shaw, a Blackburn tramway employé, in a letter to the manager of the tramways (Mr. J. H. Cowell), states that he took part in 13 bayonet charges before he was wounded. He is now in the culinary department serving General French's staff.

At Rochdale, amongst a number of Belgian refugees who are being taught to weave, is one who was formerly an electrician.

Private E. Brown, 1st East Yorks Regiment, who has been wounded in action, was, prior to the war, employed in the Rochdale electricity works.

Mr. George Wilkinson, borough electrical engineer of Harrogate, has received some interesting letters from his son, Lieut. Wilkinson, of the 2nd Battalion Lancashire Fusiliers, who was wounded at Cambrai, and is now a prisoner in the hands of the Germans. Lieut. Wilkinson has related many experiences, and told how he was wounded and picked up by the Germans, who put him in hospital and treated him well.

Mr. S. Hann, electrical engineer with the Stoke Newington B.C., has joined the Royal Naval Division, Public Schools Section.

Royal Naval Public School Battalion.—A Public School Battalion of 1,000 men is being raised for service with the Royal Naval Division, age 18 to 35. It will be strictly limited to public school and university men. Applicants desiring to enrol should apply at o
sion, 6, 7 & 8, Old Bond Stree
Regent 5515.

Roll of Honour.—Mr. Thomas
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who has been serving with the
front, has been killed in action.

NEW ELECTRICAL DE
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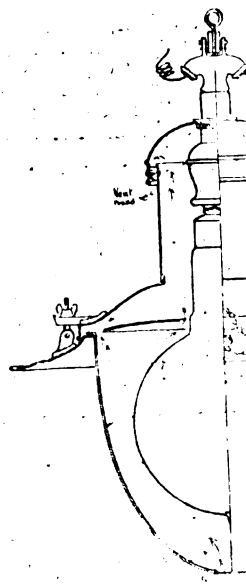

FIG. 1.—SECTION OF HA

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FIG. 2.—BRITISH-MADE LANTE
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"Sirocco" Air Washer.

MESSRS. DAVIDSON & CO., LTD., of Sirocco Engineering Works, Belfast, have just placed on the market an air washer, which we illustrate herewith. It consists of a galvanised iron tank kept filled with water by a ball cock, a sump at the end of the tank, containing primary and secondary filters, and the washer proper, mounted on the tank. The casing is open at both ends, and can be connected to an inlet and fan suction by suitable tapered connections; a glazed inspection door is provided, and the valves and pressure gauges are fixed on one side with all the water connections. The spray chamber is fitted with a number of atomising nozzles which fill the chamber with a thick mist of fine particles of water, with which the air is thoroughly mixed; on leaving the chamber the wet air impinges on a series of corrugated baffle plates, which are constantly flooded with water from a row of spray nozzles fixed over them, so that foreign matter deposited on the plates is washed down to the settling tank. The purified air then passes through triple eliminator plates of galvanised sheet-steel, set at an angle to the air current, so that the air is deflected from side to side, and caused to deposit suspended moisture, without, however, setting up any material resistance to its flow. The air leaves the washer with an average humidity of 90 per cent.

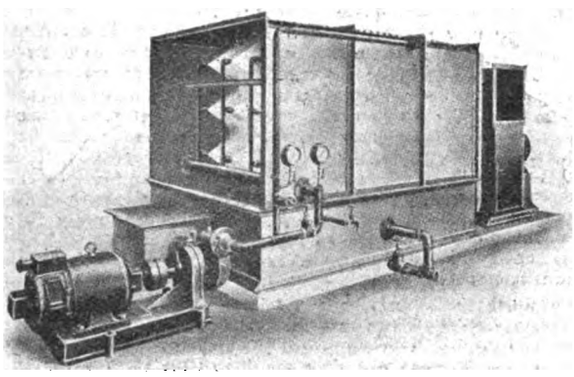


FIG. 3.—SIROCCO WASHER AND CIRCULATING PUMP.

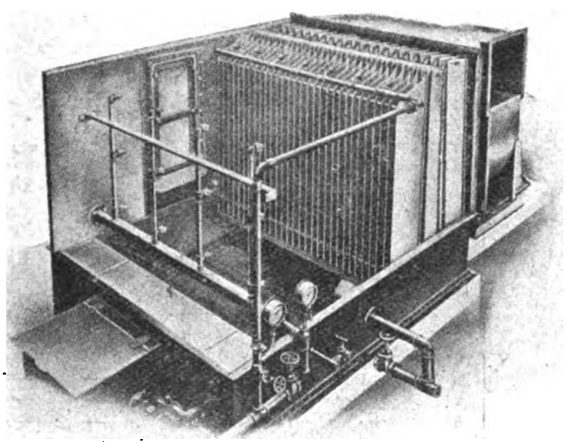


FIG. 4.—INTERIOR OF WASHER, SHOWING NOZZLES, SCRUBBER AND ELIMINATOR PLATES.

The water used by the sprays is constantly recirculated by a small centrifugal pump, drawing from the filter sump; a washer rated at 20,000 cb. ft. of air per minute is provided with a pump absorbing 4½ H.P. The Sirocco washer is made in 15 sizes, and is eminently suitable for use with electric generators.

Ferranti Electric Cookers.

MESSRS. FERRANTI, LTD., of Central House, Kingsway, W.C., have issued a new list of electric cooking appliances, amongst which is a series of ovens taking from 1,350 to 3,300 watts on the full heat, and reaching a temperature of 350° F. in 20-25 minutes. These ovens are fitted with the Ferranti element, which is illustrated in fig. 5. It consists of a heating spiral mounted on porcelain bars, clamped together. Each complete element consists of two or three such units fixed in an iron frame and protected by perforated sheet metal, a frame being fitted into each side of the oven behind the shelf racks. The frames have connections for three heats and earth, and are provided with plugs which fit into sockets mounted in porcelain at the bottom of the oven. Thus a frame can easily be removed and replaced. The ovens are of black enamelled cast-iron, lined with enamelled steel sheet, and packed with non-conducting lagging. Fig. 6 shows a complete cooker with ironclad switchboard, the top plate being equipped with two 2-heat boiling plates and a grill. The latter is also supplied separately, as shown in fig. 7, in which a similar heating element is used, under the top plate. The grill pan can be raised or lowered to adjust the intensity of the heat, and a guard under the heating element prevents accidental contact with the latter.

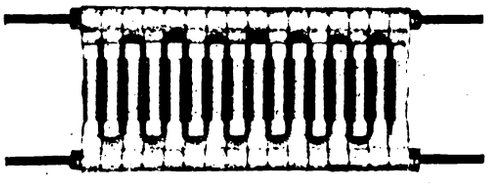


FIG. 5.—FERRANTI OVEN ELEMENT.

FIG. 6.—COMPLETE FERRANTI COOKER.

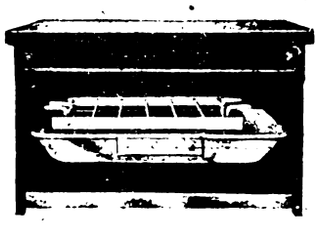
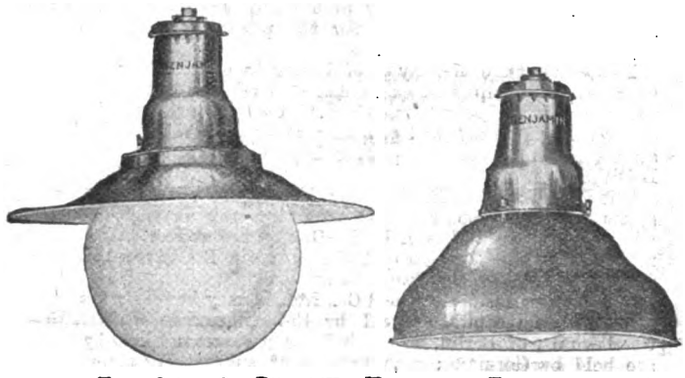


FIG. 7.—ELECTRIC GRILL.

Benjamin Half-Watt Fittings.

A new line of "half-watt" lanterns and reflectors has been marketed by the BENJAMIN ELECTRIC, LTD., of 1A, Rosebery Avenue, London, E.C. Fig. 8 is a black-enamelled steel or polished copper head with a 20-in. enamelled reflector and translucent globe;



FIGS. 8 AND 9.—BENJAMIN HALF-WATT FITTINGS.

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the lampholder is of the Benjamin Goliath pattern, and the fitting is suitable for use with lamps of 500 and 1,000 watts. Fig. 9 shows a lantern head without a globe, completely enclosing the lamp, and giving a widely distributed illumination. The head is well ventilated, and embodies the latest improvements.

Ediswan Traction Lamp.

THE EDISON & SWAN U.E.L. CO., LTD., of Ponder's End, London, have introduced a special traction lamp with drawn-wire tungsten filament, which we illustrate in fig. 10. The filament is supported in short lengths, to give the necessary rigidity, and is mounted in a pear-shaped bulb; the lamp is rated at 100 volts, 30 watts, and is suitable for all standard fittings on tramcars and electric trains,

FIG. 10.—"ROYAL EDISWAN" TRACTION WIRE LAMP.

as well as for use in mills and other places where vibration and rough handling are inevitable. A smaller lamp is made for train lighting from batteries, and other types are supplied for automobile lighting.

The Ediswan lamps are made throughout, from the glass bulb to the lamp collar, at the Ponder's End Works of the company.

Triangle Toaster Stove.

THE WESTERN ELECTRIC CO., LTD., of Woolwich, E., have introduced an extremely moderate priced electric stove known as the Triangle, 6 in. in diameter, 1¼ lb. in weight. The heating coils, arranged horizontally in a circular frame, are supported above the base, and toast can be made both above or below them, or the upper surface used for boiling and cooking, while the underside is reserved for toasting. This device is in sheet steel, nickel polished, and stands on fibre insulating legs. We gather that the heating elements are guaranteed "for ever."

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

German Agencies.

With respect to certain German firms trading in this country, it would be interesting to know whether the Electrical Co., Ltd., are still carrying on business, as I should have thought they would have been the first to close down altogether. Instead of this, I understand they are now posing as factors of English-made goods, and, consequently, any profits that are obtained by this means are being hoarded up for the purpose of assisting our enemies at the end of the war.

I note they are extremely careful never to enter into any correspondence in the papers, or to make the slightest answer to anything that is said concerning them. I expect they imagine by doing this that they will probably be overlooked, and it will be an easy matter to convince private buyers that they are a purely British firm.

The definition of an English firm is rather a curious one, as it seems to me to be perfectly easy for any firm, where the whole of the capital is held in Germany, but the company is registered in England, to call themselves a British firm, and, at the same time, to be speaking the truth.

In the case of the Electrical Co., Ltd., it may be taken that the whole of the capital is held by the Allgemeine Elektrizitäts Gesellschaft, of Berlin, as the balance of shares not held by them are held by Germans; such balance of shares only amounts to 40, so, strictly speaking, the Electrical Co., Ltd., entirely belongs to the A.E.G. Co.

It is only a week or so ago that the managing director of this concern made certain remarks respecting the English nation, and these remarks were in no way di
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December 11th, 1914.

American Activity i

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July	64	18
	40	4
	58	6
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August	76	7
	57	9
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	63	3
September	27	0
	9	1
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October	7	2
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Sydney, *November 3rd*, 1914

A Stereopy

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December 11th, 1914.

Electric Vehicle Man

MOSSAY & CO., LTD., announ
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These vehicles will be of
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in various sizes as lorries
capacity, and will be sui
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be placed in the hands of M
Road, Westminster, London

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LEGAL.

THE SOUTH LONDON ELECTRIC SUPPLY CORPORATION, LTD.

Undue Preference.

On Friday last, Mr. Justice Eve, in the Chancery Division, had before him a motion: "The Attorney-General, at the relation of the South Metropolitan Gas Co., *v.* The South London Electric Supply Corporation," in which the plaintiff company applied for judgment in an action against the defendants in consequence of admissions in the defence.

Mr. Mark Romer, K.C., Mr. Maugham, and Mr. Percy Wheeler appeared for the plaintiffs, while Mr. Tyldesley Jones represented the defendants.

MR. ROMER said he moved before his Lordship, under the provisions of Order 32, Rule 6, for judgment in an action between the parties in consequence of certain admissions made in the defence by the defendants. The action was brought for the purpose of restraining the defendant company from committing a breach of Secs. 19 and 20 of the Electric Lighting Act, 1882, which prohibited electric supply companies from granting undue preference to one customer over another. A similar case was recently before Mr. Justice Sargant, and had been before the Court of Appeal. The point in the action was this. The Electric Supply Co. issued a circular in which they proposed to their customers that they would grant a rebate of ½d. per unit for electric current supplied on the condition that the customer used the company's electricity, and that only, as an illuminant. In an area in which a gas company was a rival, the object of such a circular was apparent, and the case was very similar to the one in which Mr. Justice Sargant and the Court of Appeal held that the circular was an offer of undue preference and a breach of the Electric Lighting Act. The present action was started before Mr. Justice Sargant gave his judgment, and, since the statement of claim in this action was delivered, and before the defence was delivered, the Court of Appeal decided the other case. Then the present defendants gave notice that they would not defend the plaintiffs' claim.

His LORDSHIP: This offer was to a particular class of customers really to keep them from using gas?

MR. ROMER: Yes. In paragraph 5 of the statement of claim we set out the circular issued by the defendants.

MR. TYLDESLEY JONES said his clients did not attempt to justify the circular and the offer it contained in view of the recent decision of the Court of Appeal. He would, therefore, consent to judgment in the action, and the only question was the form of the declaration, and whether the plaintiffs were entitled to an injunction. This was a trade rivalry.

His LORDSHIP: Yes; and you are in the wrong.

MR. JONES: That is so, and since the Court of Appeal has decided the matter, we do not question it.

MR. ROMER then read the offending circular, which was issued on March 14th last, and was to the effect that in consequence of the continued high price of coal the price of electricity would be raised from 4½d. to 5½d. per unit, and it was intended to offer a rebate of ½d. per unit to persons occupying private houses provided they used defendants' supply, and that supply only, as an illuminant. Defendants ultimately carried out that promise to their customers, and made the rebate right down to December 1st, 1914, when it was discontinued. Defendants, in reply to the statement of claim, admitted that after the issue of the circular they allowed the rebate down to December 1st, and they admitted that in doing that they had committed a breach of Secs. 19 and 20 of the Electricity Act of 1882, and were willing to submit to a declaration to that effect. Therefore, he asked for judgment. The defence, added counsel, was singularly silent as to what the defendants would do in the future, and he suggested that the plaintiffs should be granted a declaration as in the notice of motion, viz., "That the defendants were acting in breach of Secs. 19 and 20 of the Electric Lighting Act of 1882 in allowing a rebate to persons taking a supply of electricity from the defendants on condition that only the defendants' supply be used as illuminant." That embodied in the declaration the point which it was intended to raise in the action, the question whether the defendant Electric Lighting Co. could supply current to customers at lower rates on condition that those customers used only the company's electricity for lighting purposes. He (counsel) proposed to leave the mention of the ½d. rebate out of the declaration, for such a rebate was illegal, whether it was a farthing, half-penny or three-farthings.

MR. TYLDESLEY JONES said he objected to the form of declaration. In all questions of undue preference it was permissible for the Electric Light Co. and similar undertakings to differentiate between two consumers when the circumstances surrounding each was different. In the case which was before Mr. Justice Sargant and the Court of Appeal, the parties had to stand or fall by the circular, and his clients were willing to do the same. They admitted that they could not justify the circular, and were prepared to fall by it, but they objected to a declaration which went further than it should. There might be cases in which the defendants might like to differentiate. For instance, supposing a man lit his living rooms with electricity and his bedrooms with gas, and the electric light company said to him: "You change your gas for electric light and I will give you better rates." That would be good ground for a legal preference, for the demand for light in the bedrooms would be at a different time to that for the living rooms. He suggested that the declaration should read: "That in making the differentiation referred to in the circular, dated September 25th, 1911, the defendants have committed a breach of the Act."

His LORDSHIP: You say that the differentiation made in that circular is the breach of the Act?

MR. JONES: Yes, that is the only point in the action. The general form of the declaration the plaintiffs ask for might include, say, many cases quite outside that in the circular, and I am not going to assent to anything which might hereafter be used to bind me in other matters I might have in contemplation, although they might not be in contemplation now, and to which I have had no opportunity of addressing my mind. Mr. Jones later said he would agree to the notice of motion as drafted with two alterations, and Mr. Romer said these alterations would be made.

His LORDSHIP said he would grant the declaration asked for, but he was not disposed to grant the injunction against the defendants, seeing that they had admitted their faults, and declaration would be sufficient. There would be judgment in the action for the plaintiffs with costs.

WORKMEN'S COMPENSATION.—SHOCK CLAIM.

On December 8th, application was made to his Honour Sir W. Lucius Selfe, in the Marylebone County Court, for an award in favour of John Robert Lupton, platelayer, 2, Essex Road, Willesden, the respondents being the Metropolitan Railway Co.

MR. C. DOUGHTY, barrister, who appeared for the National Union of Railway Servants, explaining the facts, said that applicant was one of a gang which, on February 10th, was working on the line between West Hampstead and Finchley Road, when the foreman warned them to "clear off the line," as two trains were approaching from opposite directions. In doing so he stepped onto the "live" rail and the electricity threw him down. The foreman seeing him falling caught him to drag him out of the danger. In this he was successful, but was himself caught by the train and killed. When the applicant, who had fallen clear of the line, recovered consciousness, he assisted the other workmen to carry the body of the foreman to a cabin. Subsequently he did light work, but still complained of pain in his hand. He was paid 13s. 4d. per week compensation till April 28th, and he was paid off, as there was no further work for him, on May 30th. He had done no work since.

APPLICANT bore out this statement, and said he had not been able to live on the half-pay allowed him, as he had a wife and four children.

Cross-examined by MR. BARRINGTON WARD, Applicant said he had resumed work for one month in May, but he felt that he was unable to do his work as he ought to—on several occasions he was told to stand by, and other men finished the job.

MR. WARD: Have you tried to get work since May 30th?

Applicant: No, I haven't, for I could not do it.

Medical evidence was led to prove that the applicant's neurasthenic condition was due to the electric shock, and for the respondents, doctors said that this condition was evolved by want of work and mal-nutrition.

HAINES, the foreman, said that when Lupton applied to be reinstated on June 2nd he seemed as fit for work as before. He then complained that he had been unjustly discharged owing to the accident—this was untrue.

DR. GRANGER STEWART, nerve specialist, gave it as his opinion that the applicant had recovered from the electric shock.

His HONOUR found that Lupton had not completely recovered from the shock of the accident, and awarded him full compensation to September 19th and 5s. per week afterwards till further order.

BARTON *v.* LANCASHIRE BRASS FOUNDERS, LTD.

At Blackburn County Court, on December 9th, Thos. Barton, electrician, sued defendants, of Blackburn, for £39 10s. 11d., representing balance of an account for goods supplied. For plaintiff it was stated that in April Mr. Gardner, defendants' managing director, ordered a 15-H.P. motor, to cost £40, but, on Mr. Barton's advice, saw a 20-H.P. motor, to cost £55. Mr. Gardner thereupon went to Mr. Barton's premises, saw a 20-H.P. motor, and ordered it. Some dispute subsequently arose, and until this was settled defendants refused to pay the account, which, with accessories, amounted to £78 0s. 11d. in full.

For the defence, it was stated that the claimant advised a 15-H.P. motor, and defendants relied upon his judgment. They ordered a 15-H.P. motor, and had not varied their instructions.

JUDGE STURGES, in giving a verdict for the plaintiff for the amount claimed, said that in the delivery-note, and in correspondence which followed, it was stated that a 20-H.P. motor was supplied, and yet defendants did not protest. Defendants accepted what was sent, and there was no evidence that the motor was unfit for its work.

THE OSRAM LAMP WORKS, LTD., *v.* CORONA LAMP WORKS, LTD.

An application for the postponement of this patent action was in the list for hearing, with the cross-examination of witnesses, before Mr. Justice Sargant, in the Chancery Division, on Monday, December 14th.

The application, however, was not made, as by arrangement the hearing was fixed for January 21st next.

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Claim against Edinburgh Corporation.

The First Division of the Court of Session disposed of an appeal from Edinburgh Sheriff Court in an action by a householder against Edinburgh Corporation for £100 damages for injuries sustained through missing her footing and falling while ascending the common stair to her house. She explained that the stair was at one time lighted by gas, but the defenders removed the brackets and substituted electric lamps, which could only be lit by keys in their possession or by automatic clock switch. The defenders, she said, were paid to light the stairs, but were in fault in negligently failing to do so on August 2nd.

For the Corporation, it was pointed out that owing to a latent defect in the clock it failed to work on the evening in question. They received intimation at 9.45 in the evening that the lights were not burning, and they at once had the clock repaired. They did not know until they received that intimation that the stair was dark.

The Sheriff dismissed the action as irrelevant, with expenses to the defenders, and it was against this decision that the householder appealed.

The Court of Session has now affirmed the interlocutor of the Sheriff, with additional expenses. The Lord President said that, so far as he could see, there was no relevant averment of fault on record. It was not alleged that the clock, having been out of order, and the defenders' attention having been called to that fact, that they neglected to put the clock in order, and so actuate the electric apparatus which lighted the stair. The pursuer being on her own stair, and seeing it was dark, was bound to take heed of her footsteps, and if she was unable to go up or down the stair without a light, to strike a light. The other Judges concurred.

British Thomson-Houston Co. *v.* The Electric Trading Co.

This patent action came before Mr. Justice Neville, in the Chancery Division, on Friday, December 11th, upon a motion for judgment in default of appearance by the defendants.

Mr. Ernest Lunge, representing the plaintiffs, said that every effort to serve the defendants with the writ had failed, and eventually the plaintiffs obtained an order for substituted service. That order had been complied with, but the defendants had not entered an appearance. The action was brought in respect of an alleged infringement of the plaintiffs' patent for electric incandescent lamps. Sale of infringing lamps was proved, and particulars of breaches had been filed with the statement of claim. By the minutes of the proposed order the Court was asked to grant an injunction, direct an inquiry as to damages, or, in alternative, an account of profits, delivery up on oath of the infringing lamps in the defendants' possession, and payment to the plaintiffs of the costs of the action.

His Lordship made an order in the terms of the proposed minutes.

Marconi Co.'s Memorandum.

In the County Court, on Tuesday, December 15th, Mr. Justice Neville had before him petitions by the Marconi Wireless Telegraph Co., Ltd., the Marconi International Marine Communication Co., Ltd., and the Wireless Press, Ltd., for the sanction of the Court to an alteration in their memorandum and articles of association.

Mr. Sheldon, who, instructed by Messrs. Coward & Hawkesley, Sons & Chance, appeared in support of the petition, said that it was presented under the alteration sections of the company's Act, and they were merely asking for confirmation of alterations by way of an additional clause which would allow the companies to establish a pension scheme, and to subscribe to charitable institutions.

There was no opposition, and his Lordship sanctioned the alteration as asked.

Slander Action.

Before Mr. Justice Coleridge and a Special Jury in the King's Bench Division, after some days' hearing, Mr. F. H. Haviland, of Bournemouth, has been awarded £200 damages against Mr. C. D. Willard only, judgment being given in favour of the other defendant, Mr. H. A. Treble, in respect of a claim for alleged conspiracy to libel and slander plaintiff in connection with a report to shareholders of the North-Eastern Electric Smelting Co., Ltd., of which they were all directors. According to reports in the *Financial Times*, the printed libel was to the effect that a director had been paid travelling expenses other than for the purpose of attending board meetings, and at a meeting it was said that Mr. Haviland's resignation had been asked for, and that he had resigned.

BUSINESS NOTES.

Desk Companion.—Messrs. Bruce Peebles and Co., Ltd., of Edinburgh, have again issued to their friends their annual desk companion. In the reference book which is again placed at the right of the blotting-pad, there is a diary for 1915, and a calendar for 1916; also abridged specifications, price lists and illustrations of the firm's manufactures. A complete and handy calendar for 1915 appears along the top border of what is undoubtedly a most serviceable and acceptable companion.

Catalogues and Lists.—The British Prometheus Co., Ltd., Salop Street Works, Highgate, Birmingham.—Two new catalogues containing illustrations, prices and brief particulars, of a variety of designs of electric heating apparatus. One of the publications (No. 150) contains 60
polished copper and brass, hand-
copper and brass, hammered iron
ing styles for all classes of servic
a lamp radiator section show
radiators. The second publicati
20 pages, a description of the Pr
"Noblechrom" and "Plebechron
elements being well illustrated.
fires are particularised—The
Balmoral and Holyrood.

Messrs. Alfred Herbert, I
trated pamphlet describing the

The Osram Lamp Works, L
what we consider the most eff
yet produced. The Navy is the
strikes home to the imaginat
stirring times. Several of our
ready for action. An Osram
minated, is suspended from the
Leading Light." The colourin
executed.

Messrs. Siemens Bros. & C
—Pamphlet No. A705, describ
indicator.

Western Electric Co., Ltd
illustrates and prices the Trian
electric iron.

Edison & Swan United E
End.—Leaflet No. F 3,082 is a
trical presents for Christmas a
Huntalite candle standards, adj
suction cleaners, electric kettl
flat-irons. Numbers of these l
the trade.

Messrs. Simplex Conduits
London, W.C.—The first copy c
contains, among other features
ing and giving prices of a va
electric kettles, toasters, electri
vibrators, curling tong heaters
Other features of the pamphle
ing and a description of the "
of Honour of employés of the
(66 in all) is enclosed.

Messrs. Davidson & Co.,
Belfast.—Bulletin No. 2,031 (S
trated description of the "Sir
generators and for purifying

Cie. Francaise Pour La
triques a Incandescence,
Circular showing particulars
their "A L A" metal-filament
existence for 14 years, and its
French throughout.

Messrs. Drake & Gorham
S.W.—The firm has issued a h
Russia, and Austro-Serbia. H
factures and a list of addresse

The Hotpoint Electric
Street, London, W.C.—Folde
prices in dollars of a var
appliances.

Messrs. Ferranti, Ltd.,
W.C.—Binder containing a
price lists of switches and
switches for up to 650 volts,
circuits, totally enclosed ir
interlocked ironclad switch
time-limit fuses, H.T. fuses
resistance cut-off.

The General Electric
E.C.—Catalogue Section "
purposes, including new pric
glass, the cost of which ha
Colliery and Mining Machin
in a later issue.

Dissolutions and

trical Co., Ltd.—The sta
and shareholders were held
the Board of Trade. Partic
issue.

Mr. W. J. Warley, Official
a proof of debt for £23,48
prepared to admit it at £1
meeting. Mr. Leitner clain
respect of contracts which
claimed £5,000 under his
employed as managing direc
salary.

Mr. Leitner's representa
being admitted at the mom

The chairman said it wa
to the Court that it would
as a going concern, but tha
and all that now remained
The business of the meetin
of a liquidator and a Comm
company had been printed

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shareholders, and having regard to the fact that some feelings of resentment had been exhibited by the various parties interested, he thought no good purpose would be achieved by dwelling upon matters of the past.

A creditor asked to be informed of the price obtained for the company's property at Woking.

The chairman explained that only a portion of the property had been sold, and some considerable trading of a sort was being carried on. The site had been taken possession of by the mortgagees, but he could not say whether it had been sold.

A creditor: It has not.

In reply to another creditor the chairman said the special manager, Mr. William Wyon, was appointed on July 28th, 1914. The subsequent trading showed a gross profit of £1,068, and a net profit of between £500 and £700. The orders in hand last July amounted to between £4,000 and £4,500. The question of the personal liability of the directors would be considered by the liquidator.

Mr. G. E. Corfield, chartered accountant, and the Official Receiver were nominated for the post of liquidator, and the chairman announced that the appointment would be made in due course by the Registrar.

The following are creditors:—

Accumulator Industries (in liq.)	£500
" "	328
Armstrong, Stevens & Son	84
Baird & Tatlock	11
Baxter, J. M., & Co.	10
Booth, J., & Co.	16
Brimsdown Lamp Works	126
British Xylonite Co.	57
Buck & Hickman	269
Callender's Cable Co.	289
Churchill, C., & Co.	1,449
Coan, R. W.	15
Concordia Elec. Wire Co.	31
Cope & Co.	21
Craven Bros.	63
Drake & Gorham	48
Drowley, G. F.	246
Dryers, Ltd.	86
E.M.F. (1914), Ltd.	26
Everett, Edgcumbe & Co.	14
Eversbed & Vignoles	82
Fuller Elec. Manufacturing Co.	21
Gerhard & Hay	967
Greenwood & Batley	1,992
Grundy, J.	202
Hasted, J., & Son	16
Hales Owen Steel Co.	26
Herbert, A., & Co.	663
Hill, F. A., & Co.	20
Hoffmann Manufacturing Co.	196
Humphreys, Ltd.	147
Lees, W., & Co.	23
Leyendecker & Co.	157
Locke, Lancaster & Co.	321
London Die Casting Foundry	130
London Electric Wire Co.	178
McLaren, W.	252
Micanite and Insulators Co.	£27
Midland Electric Wire Co.	68
Morgan Crucible Co.	77
Newtons, Ltd.	569
Peters, G. D., & Co.	2,186
Pilkington Bros.	162
Pirelli, Ltd.	58
Princes Street Estate Co.	109
Redfern, G. F., & Co.	287
Sankey, Joseph, & Sons	29
Sallers & Co.	14
Simmonds Bros.	188
Simplex Conduits, Ltd.	24
Skeet-Fookes & Jeffs	78
Skefko Ball-Bearing Co.	37
Sulley, J. & A. W., & Co.	126
Tagart, Morgan & Coles	44
Tylor & Sons	111
Veritys, Ltd.	65
Westinghouse Cooper-Hewitt	126
Westminster Engineering Co.	92
Willans & Robinson	89
Wilcox, W. H., & Co.	45
Woking Electric Supply Co.	52
Worsnop & Co.	11
Armstrong, A. A., Major	106
Leitner, H.	126
" "	826
" "	246
" "	1,370
Stone, J., & Co.	980
" "	8,070
Sturdy, P.	806
Hollings, P.	150
Leitner, H.	5,000
Ledward, H.	408
Colles, F. J.	87

ELECTRIC UTILITY CO., LTD.—This company is winding up voluntarily, with Mr. A. Jonckheere, of 9/10, King Street, E.C., as liquidator. A meeting of creditors is called for December 23rd.

READER'S PATENTS AND ENGINEERING CO., LTD.—This company is winding up voluntarily, with Mr. E. W. C. Whittaker, of 3, Portland Street, Southampton, as liquidator. A meeting of creditors is called for December 21st, at 50, Gresham Street, E.C.

Book Notices.—"The Dynamics of Surfaces." By Prof. L. Michaelis. London: E. & F. N. Spon, Ltd. Price 4s. net.

"Magnets and Electric Currents." By Prof. J. A. Fleming. London: E. & F. N. Spon, Ltd. Price 3s. 6d. net.

"The Elements of Electro-Plating." By J.T. Sprague. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net.

"The Colliery Managers' Pocket Book, Almanack and Diary for 1915." By H. Greenwell. London: *The Colliery Guardian* Co., Ltd. Price 2s. net.

"*Bulletin* of the Bureau of Standards," Vol. X, Nos. 2 and 3. "Flame Standards in Photometry." "The Silver Voltameter," Part IV. "Testing Potential Transformers." "Production of Temperature Uniformity in an Electric Furnace" "Combustion Method for the Direct Determination of Rubber." "Electric Lights for Use about Oil and Gas Wells." "Permissible Electric Lamps for Miners." "Factors Governing the Combustion of Coal in Boiler Furnaces." Washington: Government Printing Office.

"Science Abstracts." Sections A and B. Vol. XVII, Part 2. November 30th. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"American Handbook for Electrical Engineers." By H. Pender. London: Chapman & Hall. Price 21s. net.

"Electrical Engineering in India." By J. W. Meares. London: W. Thacker & Co.

"Magnetism and Electricity." By S. S. Richardson. London: Blackie & Son, Ltd. Price 4s. 6d.

"The *Mechanical World* Electrical Pocket-Book for 1915" (Manchester: Emmott & Co., price 6d.) contains new matter on electric circuits and switching, synchronising and phasing-out, troubles with A.C. machines and the remedies for them, &c., and existing sections have been re-written and extended. There is an extraordinary variety of information in this inexpensive book.

"*Journal* of the Institution of Electrical Engineers." Vol. LIII, No. 238. December 15th, 1914. London: E. & F. N. Spon, Ltd. Price 3s. 6d.

"Model Answers to Test Questions in Wireless Telegraphy." Series 2. London: The Wireless Press, Ltd. Price 1s. net.

Bankruptcy Proceedings.—WILLIAM HENRY WOOD, electrical engineer, Lorna Doone, School Lane, Hall Green, Birmingham, Warwick.—The first meeting of creditors was held at 191, Corporation Street, Birmingham, last week, when the statement of affairs showed liabilities amounting to £470, and assets estimated to produce £1,229, the estate disclosing an apparent surplus of £759. The debtor did not consider himself to be insolvent, but stated that owing to the action of a limited company, of which he was managing director, in refusing to pay his salary, and in making an illegal call on shares, he had been forced into such a position that he could not immediately meet his liabilities, but his assets more than covered them. It appeared that the debtor was formerly employed as a departmental manager of a firm of electrical engineers, his salary towards the termination of such employment being at the rate of £400 a year. In October, 1912, the debtor acquired the lease of half an acre of land at King's Road, Tyseley, and commenced to erect a factory thereon, mortgaging the building and plant in order to do this. In conjunction with another he promoted a limited company in April, 1913, to carry on the business of electrical engineers, with a nominal capital of £8,000. As vendor the debtor received £100 in cash and 500 fully paid up deferred shares of £1 each. He further subscribed for 1,000 ordinary shares, upon which he paid up £666, with the assistance of moneylenders. Debtor was appointed managing director at a yearly salary of £350. Disagreements arose, and in January of the present year the debtor ceased to attend the business, and subsequently brought an action against the company for breach of contract. The company raised a counterclaim, and although negotiations had been commenced for a settlement, they had as yet produced no result. In June of the present year debtor with another floated a small private limited company, with a nominal capital of £2,000, the objects of the company being the manufacture of motor fittings and metal work for the motor trade. In consideration for his services to the company debtor was allotted 130 shares, and was still acting as managing director at a weekly salary of £4 and 20 per cent. commission upon the profits. It was decided that an application should be made for the debtor's adjudication, and Mr. G. W. Blackham was appointed trustee, with a committee of inspection.

W. R. WEDGE, electrical engineer, The Arcade, Northampton.—The adjourned public examination of this debtor was fixed to be held at the County Hall, Northampton, on December 8th, but when the case was called the debtor failed to put in an appearance. The Official Reviewer stated that he had informed the debtor that it was likely that the case would be adjourned *sine die*. A letter had been received from the debtor in which he stated that he hoped to be employed at Bedford in the New Year, and he would then be in a position to attend the Court. The Official Receiver said that in an ordinary case he would have asked for further adjournment, but the debtor had been fencing. If a further adjournment were ordered he suggested that the debtor be informed that the case would be adjourned *sine die* unless an appearance was made. The Registrar agreed and ordered an adjournment.

HENRY H. OXLEY (Oliver Huxley), consulting engineer, Hanwell.—Last day for receiving proofs for dividend, December 30th. Trustee, E. W. J. Savill, 14, Bedford Row, W.C.

GEORGE EDWARD HIPKINS, 48, Wolverhampton Street, Dudley, Worcester, electrical engineer.—The receiving order herein was made on the debtor's own petition, and according to the accounts prepared the liabilities amount to £508, and the assets are estimated to realise £122, the estate disclosing a deficiency of £386. It appears that the debtor started trading on June 2nd, 1913, with a capital of £455, being the value of a house at West Smethwick £490, less the amount of his liabilities about £35. The deeds of the property were deposited with the bank, who agreed to allow the debtor an overdraft of £450. The property was sold for £490 in July, 1914, and the proceeds, less expenses, were used to pay off the bank overdraft. Debtor has kept day books and sales ledgers, but no cash book has been kept. The failure is due to loss on trading through the war, law costs, interest on borrowed money, &c., and debtor admits knowledge of his position since November 20th last. The first meeting of creditors in this matter was held at the Official Receiver's offices, 1, Priory Street, Dudley, last week, when the case was a summary one, and was left with the Official Receiver.

Dinners.—The annual dinner of the staff and employés of the WESTMINSTER ENGINEERING CO., LTD., was held at Willesden Junction Hotel, on Saturday evening last, Mr. J. O. Girdlestone presiding. A considerable number of the company's contingent now serving with the Colours were the guests of the evening, and naturally they had a most enthusiastic reception. A smoking concert followed. The evening was a great success, and we are assured that that success was largely due to the excellence of the musical talent provided by the Hon. Sec., Mr. F. G. Brown, and other members of the firm.

The staff of the instrument department of the BRITISH WESTINGHOUSE WORKS, at Trafford Park, held their eighth annual dinner recently at the Wheatsheaf Hotel, Manchester. Mr. J. Kennedy presided, and, following the dinner, an enjoyable musical programme was carried out by Messrs. Fred Hamer, Smith, A. Wilson, H. Compton, G. Hallam, R. Ogden, G. Wiseman, J. Clarke, E. Rodgers and W. Alcock.

Trade Announcements.—The registered offices of the CHURCH STRETTON ELECTRIC SUPPLY CO., LTD., have been removed to 1C, King Street, St. James's, London, S.W.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD, announce that their London telephone numbers have been altered to "442 and 443 Victoria."

MESSRS. SCHOLEY & CO., LTD., announce that on and after December 24th their address will be 56, Victoria Street, Westminster, S.W. Telegrams: "Scolanco Sowest London." Telephone: Victoria 6663 (two lines).

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Canada.—H.M. Trade Commissioner in Canada reports that a Montreal agent who has hitherto represented German and Austrian firms wants to secure the representation of the United Kingdom manufacturers of tungsten lamps and electrical fittings. A Winnipeg firm wants to represent British makers of porcelain telegraph insulators. Another Winnipeg firm wants to represent British makers of electrical supplies and specialities. The name and address in each case can be obtained from the Board of Trade Commercial Intelligence Department, in London.

Financier Wanted to Develop an American Scheme.—A correspondent in California is anxious to get into touch with some individual or syndicate or company prepared to undertake to develop a 25,000 to 30,000 hydro-electric power in one of the Western States, on the basis of, say, a 20 to 30-year lease of the said water rights, and pay a yearly rental for same on the basis of $1 per H.P.-year. "The company or syndicate could easily clear $50 per H.P.-year for all the power they could generate and transmit to the consumer. Transmission to excellent market at 60 miles, and many other points between."

LIGHTING and POWER NOTES.

Altrincham.—STREET LIGHTING.—Mr. R. H. Hooper held a L.G.B. inquiry on December 9th with reference to the application of the U.D.C. for sanction to borrow £675 for electric street lighting in Ashley Road, George Street, Kingsway, Railway Street, and Stamford New Road. It transpired during the inquiry that the Council had never had before it precise figures as to what the proposal would cost, although the work had been commenced, and this was described by Mr. Hooper as unbusinesslike. In the end, the clerk intimated that he would bring before the Council for decision the question whether or not the application should be proceeded with.

At a special meeting of the Council on Monday, it was decided that the application should be withdrawn, and the matter reconsidered six months hence.

Ashton-on-Mersey.—The Altrincham Electric Supply, Ltd., has notified the U.D.C. of its intention to apply for additional powers in the next Session of Parliament.

Ashton-under-Lyne.—The Electricity Committee has expressed approval of the I.M.E.A. proposals, but has deferred any further action pending information as to the number of other authorities likely to join in the promotion of the Bill suggested.

Barnes.—The Electricity Committee reports that it is proposed to give a supply of current to Messrs. Watney, Combe and Reid's Mortlake Brewery, at 1d. per unit on the basis of a supply of 80,000 units per annum, the maximum demand being 35 KW. and a contract for five years, and to light the dwellings the company proposes to erect in Marne Road, at 26s. each cottage per annum.

Barnsley.—The T.C. has sanctioned the purchase of an oil separator for use in conjunction with the turbine condenser at the electricity works, at a cost of £175.

Blackpool.—L.G.B. INQUIRY.—On December 11th, an inquiry was held into an application by the Corporation to borrow £5,400 for the purchase of property to enable extensions to be carried out at the electricity works. Mr. Furness, electrical engineer, said Blackpool was not favourably situated for the use of seawater for condensing purposes, which would require an outlay of something like £25,000. He further stated that the output of electricity had increased from 3,000,000 units in 1907 to 5,000,000 last year.

Bolton.—PLANT EXTENSIONS.—The electrical engineer has been instructed to report further as to the additional engine and boiler, switchgear and reservoir accommodation likely to be needed at Back-o'-th'-Bank, together with the cost.

Bradford.—RESTRICTED LIGHTING.—Local shopkeepers, who have for some time past been compelled to extinguish all outside lights at eight o'clock every evening, are now permitted to maintain them until 8.30 on Mondays, Tuesdays, Wednesdays and Thursdays, nine o'clock on Fridays, and ten on Saturdays, provided that they are hooded so as to reflect the light into the window and not on to the pavement.

Castletownbere (Co. Cork).—E.L. SCHEME.—A public meeting having approved of an electric lighting scheme for the town, the local Council has ordered steps to be taken in the matter without delay. Lamps of from 30 to 50 C.P. are to be used in the installation.

Continental.—ITALY.—The Cantonal authorities of Ticino have requested leave from the Swiss Federal Council to sanction the export of electrical energy to the extent of 10,000 H.P. into Italy. The Swiss Railways Direction has no objection, providing the rights of the Railway Direction are recognised, to draw such energy from the output of the Canton of Ticino, as may be required for the working of the Saint Gothard line.

Ealing.—RESTRICTED LIGHTING.—In view of the earlier closing of shops the T.C. has decided to reduce the annual charge for each pair of outside arc lamps, from £10 to £9 10s., in those cases where they are extinguished half an hour earlier each day.

Epsom.—SCHOOL LIGHTING to extend the mains in order to su subject to a three years' agreemen sumption of 3,000 units. When th the consumption will be from 15,0

Greasbro.—SUGGESTED E. to ask Earl Fitzwilliam whether Lordship supplying electric lightir

Greenock.—PROPOSED LO. tricity Committee proposes tha Secretary for Scotland for powe to meet the increasing requiremen of the supplies to local works, a town of Port-Glasgow, are expect

Hindley.—The U.D.C. ha obtaining electricity from the La their supply will be taken over by The prices suggested by the comp to picture palaces have been ado power, 2½d. for current supply f supervision of the electricity unde future meeting.

Hythe (Kent).—RESTRIC of the reduced lighting owing tricity Co. has allowed the T.C. a contract.

Keighley.—LOAN SANCTIO sanction was applied for by the ture on boilers and water tower a has sanctioned £443.

Lanarkshire.—BLANTYR Council has been notified by th Valley E.P. Co. that a suitable obtained in Blantyre. The Coun and agreed that an additional lighting, should that be required

Liverpool.—NEW PLANT at the annual inspection of th taking by the Tramways, Electri a new B.T.H. 6 000-KW. turbin Drive station by the chairman Taylor. Another machine of erected, and a further one is pro of increasing the plant capacity opportunity was also taken to various sub-stations, of which th usual custom, the inspection tool subsequently the company, wh S. E. Rayner, dined together During the evening Alderman Committee, proposed the toas in appreciative terms, referring ment had carried out recently. it all, he did not mind admittin Mr. Dickinson, city electrical en to the services rendered to Holmes, who had designed the had been able, without adding ing capacity with modern plant great scope for extending the p take time. Liverpool power us of electric driving in the past. new plant at Lister Drive so out of revenue. He was absolu come out all right. We hop illustrate the new plant referre

London.—RESTRICTED new order, which supersedes th which expired at the end of the —"The use of any lights wha the illumination of shop fronts "powerful" lights were prob what lights were powerful led

ELECTRICITY SUPPLY.—At day, the Parliamentary Comm London and District Electricit effect to the scheme contain November last. Details of th our pages. The representatio basis of assessable value, 27 rep which 18 will represent the L county and borough councils c

The Bill provides, however, need not be members of the Government Committee expre the very large financial and London in the scheme, an Authority should be members Committee, however, is afraid to criticism, and it further greater latitude in the choice Committee proposes, therefor representatives of the Council

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The maximum price for bulk supply or for power supply to any body, company, or person owning or working a railway, tramway, canal, navigation, docks, or waterworks is not to exceed a fixed sum of £3 10s. a KW. of the maximum power required, and 0·25d. a unit.

The Authority is empowered to expend not exceeding 10 million pounds. This, it is thought, would probably cover the outlay for capital purposes during a period of ten years after the works have commenced.

With the object of securing the ultimate unification of electricity supply within the area, the Bill provides that, after 12 months from the passing of the Act, it shall not be lawful for any authorised undertakers, except with the consent of the Authority, to extend any distributing system otherwise than in accordance with such standards of periodicity, voltages, and systems for the transmission, distribution and supply as the Authority may prescribe; or to erect any new generating station or to increase the generating capacity of any station beyond a certain limit.

The original scheme provided that the powers sought should lapse if, within five years from the passing of the Act, no contract was made between the Authority and a company, and no substantial steps were taken in respect of the new undertaking, but it is provided in the Bill that only those powers which would have been transferred to the company shall lapse.

At the meeting of the Council approval was given after a long discussion to the Bill. The scheme has been amended to provide that 14 out of the 18 representatives of the L.C.C. shall be members of that body. The Parliamentary notice of the Bill is also to be altered to give the authority itself power to work the undertaking.

St. Pancras.—Loan Periods.—The Electricity Committee reports that as a result of the interview with the L.C.C. Sub-Committee, it is very unlikely that the reduction of the outstanding loan periods as proposed by the County Council's Committees will be further pressed.

Lowestoft.—The T.C. has revised the charges for current for power as under:—Cinemas and similar shows, 2d. per unit up to 2,000, and 1½d. beyond; consumers over 50,000 units per annum, 1⅜d. per unit; all accounts to be subject to 5 per cent. discount for payment in one month.

Lytham.—Bulk Supply.—Negotiations are still in progress between representatives of the Lytham and St. Anne's Councils regarding the matter of the supply of electricity in bulk to Lytham. The proposed agreement is for 10 years, ending in 1925.

Newbridge (Co. Kildare).—Proposed E.L.—The Town Commissioners are considering as to the advisability of installing an electric lighting system for the town.

Newcastle-under-Lyme.—Loan Sanction.—The T.C. has received L.G.B. sanction to a loan of £1,350 for cable extensions, the provision of a storage battery, &c., without the holding of an inquiry.

Nuneaton.—The T.C. has reduced the charge for current supplied to the Hospital and benevolent institutions to 3½d. per unit, and will lay duplicate services to consumers' premises when applied for, providing the consumer agrees to pay 20 per cent. per annum for five years of the cost of carrying out the work.

Penistone.—Workhouse Lighting.—The B. of G. has received from the L.G.B. sanction to a loan for installing the electric light at the workhouse.

Riccall.—Prov. Order.—The Rural Council has been informed that the Yorkshire Electric Power Co. intends applying for a prov. order to supply electricity within the district. The company has been asked to send a representative to discuss the matter.

Sandgate.—Restricted Lighting.—The Folkestone Electricity Co. has allowed the U.D.C. a reduction at the rate of £120 a year on the public lighting contract owing to decreased lighting through the war.

Scarborough.—Restricted Lighting.—The severe restrictions as to lighting have been relaxed to some extent, a new order having been issued that until and including Christmas Eve shopkeepers will not be required to draw their blinds until 8 p.m., provided that their lights are shaded.

Sheffield.—Sale of Electric Fittings.—The T.C., by 33 votes to 15, has adopted the recommendations of the Special Committee as to a showroom and the sale of electric fittings, &c., particulars of which have appeared in these columns.

Southport.—Restricted Lighting.—The Electricity Committee, after further consideration of the restrictions of street lighting owing to the shortage of carbons, has decided to discontinue the arc lighting on the Promenade and to reduce the electric lighting in the borough by one-half.

Swansea.—The Corporation E.L. and Tramways Committee has arranged to supply current for lighting to the Rutland Street premises of the Mumbles Railway Co. A free supply of current is to be given to Sketty Hall, which is being used as a military hospital by the British Red Cross Society.

Taunton.—Street Lighting.—The T.C. has arranged to pay £2,700 a year to the electricity department for public lighting, this being the average annual cost for the past six years.

Walsall.—Loan Sanction, &c.—The Electricity Committee has given notice of a revision of the price of energy on the tramways leased to the company as from December 31st next. The L.G.B. has sanctioned the borrowing of the following amounts in respect of the undertaking:—£10,280 for buildings, canal intake and waterways; £20,605 for turbines, &c., and switchgear; £25,242 for boiler house plant, coal weigher, crane and station transformers. The Electricity Committee has placed an order with the British Westinghouse Co. for three sub-station static transformers for £790.

Wednesbury.—L.G.B. Inquiry.—Major J. Stewart, R.E., conducted an inquiry on Wednesday, last week, into the application by the T.C. for a loan of £2,146 for a rotary converter, transformers, the laying of cables and provision of a transformer station at King's Hill recreation ground. Electricity in bulk is to be purchased from the Midland Electrical Corporation. In the course of the inquiry it transpired that the Corporation plant was overloaded, and that inconvenience had been caused to local power users owing to deficiencies in the supply.

Whitworth.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of the following sums in connection with the electricity scheme:—£7,700 (for first installation—new works, land, buildings, mains, plant, &c.) £2,000 (for prospective expenditure on mains); £300 (services); £200 (meters); and £750 (sub-station).

Wolverhampton.—The Electricity Committee recommends that a motor converter be repaired at a cost of £250, and that a new modern steel roof, with asbestos slate tiling, be erected to cover the older portion of the generating station, at a cost of £1,800.

Woodford.—The Council has been informed that the County of London Electric Supply Co., Ltd., is applying for a prov. order for the supply of electricity.

Ystradgynlais.—E.L. Purchase.—The D.C. has decided to purchase the undertaking of the Glantawe Electric Supply Co., at an agreed cost of £17,000, each party to defray its own expenses.

TRAMWAY and RAILWAY NOTES.

Barnes.—Electrically-Propelled Dust Vans.—The surveyor to the D.C. reported that the trials of the two electrically-propelled dust vans have been very satisfactory, and showed that a large saving can be effected by their substitution for horse dust-carts. A full report is to be submitted at the next meeting.

Continental.—Italy.—Tube railways are the order of the day in most large cities, and among the latest adherents to the vogue is Milan. The retiring Municipal Council appointed a strong Committee to draw up plans and specifications, and the newly-elected Council has reappointed the same Commissione della Metropolitana, with the addition of certain new members, with a view to bringing its labours to a practical ending.

Edinburgh.—After considering the draft agreement between the Corporation and the Edinburgh and District Tramways Co. in regard to the conditions which shall govern the taking over of the rolling-stock, &c., of the tramways by the Council at the end of the lease, the Tramway Committee of the T.C. remitted the matter to a Sub-Committee and the town clerk, with a view to further negotiations.

Emley.—A meeting is being held to consider whether the Huddersfield Corporation should be asked to extend the tramways to the district. The U.D.C. will be represented at the meeting.

Greasbro'.—The Rotherham Corporation has intimated to the U.D.C. its intention to apply for powers to introduce a motor-omnibus service between Rotherham and Greasbro'.

Hindley.—Representatives of the U.D.C. and the Wigan Corporation are to hold a conference, to consider the question of running a tramway service up Market Street.

Ilford.—Year's Working.—There was a deficit of £3,567 on the working of the tramway undertaking last year, due to 'bus competition and increase in working expenses owing to extra mileage run. The tramway manager reports that the total working expenses are at the rate of 5·876d. per car-mile, or ·22d. less than in the previous year; nearly half a million more passengers were carried, but 54,000 extra miles had been run. The balance of the reserve fund had been reduced to £2,294, the 1d. rate in aid having only covered the withdrawals for special purposes during the year. The manager reports at the present time the receipts are now nearly £4,000 up, and he anticipates an increase of £5,500 on current year's takings. The increased expenditure on the Barking extension will be about £3,000, and extra expenditure on war allowances £1,000. The manager recommends abolishing the ½d. fares.

The Committee has instructed the manager to communicate with other towns where an alteration from ½d. fares had taken place and a universal 1d. fare adopted, with a view to ascertaining their experience.

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Lanarkshire.—PROPOSED TRAMWAY PURCHASE.—Overtures are proceeding between the County Council and the Lanarkshire Tramways Co., with a view to the former acquiring the tramways. The company has offered facilities for the inspection of the books, rolling stock and undertaking generally, at the request of the Council.

Lincoln.—RAILLESS TRACTION SCHEME.—The T.C. is applying for powers to run electrically-propelled railless vehicles along five routes in the city.

Liverpool.—ELECTRIC RAILWAY STOPPAGE.—The service of electric trains on the Liverpool and Southport Electric Railway, and the Liverpool and Ormskirk service, were interrupted last Friday night through a failure of current at the main power station at Formby. Steam locomotives were secured to move the trains, and a curtailed service was subsequently maintained.

London.—L.C.C. TRAMWAY STOPPAGE.—On Friday last, about 5 p.m., practically the whole of the L.C.C. tramway services were stopped owing to a breakdown at the Greenwich power station. The Forest Hill and Lewisham sections were not affected as they are supplied from the Deptford generating station of the London E.S. Co. The official explanation of the trouble so far given, is to the effect that a transformer blew up, throwing oil over a wooden staging which had been erected in connection with extensions now being carried out, and setting it on fire. The fire apparently burnt out the cable connections between the generators and switchgear, thus isolating the generating plant for the time being. The stoppage occurred at a time when the traffic is usually the heaviest, and the cars were left standing in the streets. One result was a period of heavy traffics for tube and underground railways, while additional 'buses were also called into service. On Sunday the car services had assumed a more normal aspect, although the complete service on all routes had not then been resumed.

Apparently the County of London E.S. Co. and the St. Pancras and Poplar municipal electrical departments also rendered assistance in restarting the services.

At Tuesday's meeting of the Council, the Chairman of the Highways Committee made a statement on the cause of the breakdown, pointing out that the transformer box had been in use some 10 years, and would have been discarded in another five days. The protective devices at the station adopted subsequent to the last accident had worked well, the only generators affected by surges being on the old reciprocating sets to be discarded, which had not been fitted with them. He added that the most effective way of preventing breakdowns would be the linking-up of London's electric supply undertakings.

LAMBETH.—The B.C. has been notified that the L.C.C. tramway scheme, *via* New Cut, to link up Waterloo and Blackfriars, had been abandoned, owing to its opposition.

HACKNEY.—The B.C. has decided to urge the Stepney B.C. to agree to the L.C.C.'s proposal to reconstruct and electrify, on the overhead trolley system, the tramway between the West India Docks, &c., and Hackney. Three of the four B.C.'s concerned have already agreed to the proposal.

Southampton.—The Electricity and Tramways Joint Committee has decided to reduce the charge for tramway current for power purposes by one-eighth of a penny per unit, commencing the next financial year.

Walsall.—TRAMWAY EXTENSION.—The Corporation Tramways Committee proposes to proceed with the construction of a new length of tramways, at a cost of £3,683.

Weston-super-Mare.—The B. of T. has been asked to prolong the time limit for the completion of the unconstructed light railway authorised by the order of 1910, until December 31st, 1915.

Wolverhampton.—TRAMWAY EXTENSION.—The Council has entered into an agreement with the Bilston U.D.C. with reference to the construction of a tramway track in the district of the Council, from Ettingshall Lane to Stowheath Lane.

TELEGRAPH and TELEPHONE NOTES.

German Pirates.—The esteem in which the *Emden* has been held in this country has been somewhat damped by the report that the force which raided the cable station at Cocos Island robbed the cable staff of private property to the value of over £160.

Secret Wireless Stations.—The Santiago correspondent of the *Times*, in a dispatch dated November 9th and published on December 16th, states that there is every reason to believe that the German cruisers in the Pacific were able to obtain wireless information continually at points along the Pacific coast, and that such information was withheld from British warships. The Chilian Government maintained a strict observance of neutrality, and the illicit communication was the work of private installations.

Telegrams in Code.—
following codes have been autho
previously authorised, subject t
already in force:—Bentley's Co
the separate Mining and Oil S
Combination Code (not includ
Meyer's Atlantic Cotton Code (3

CONTRACTS OP

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Australia.—SYDNEY.—
meter, for the Municipal Cou
the City Electrical Engineer, T
March 15th. Municipal Cou
Specification from City Electri
at the Board of Trade C.I. Bra
ADELAIDE.—January 20th.
Postmaster-General. See "Offi
January 27th. Accumulator
General. See "Official Notices
MELBOURNE.—January 6th.
formers. 7,230 yards of single
City Council. See "Official No

Bacup.—Tenders are t
and a 50-KW. transformer, and
tric lighting the municipal o
to various committees of the
an electric fire alarm for the
Mayor and Ald. Lord.

Birkenhead.—January
of electric motors and motor-
Corporation electricity supply.

Dundee.—Corporation
plete structural steel work for
Port generating station.

Dundalk.—December
Electric motors and accessories
copper wire, bitumen wires. S

Easington.—January
L.G.B.) for E.L. cables for pu
Wiggham, acting clerk.

Elmton-with-Cresswe
21st. Extension of street lig
P.C.; the Clerk.

Hong Kong.—January
K.V.A.), turbo-alternators with
E.H.T. cable, sub-station swit
North Point generating static

Hornsey.—December
E.H.T. three-core cable, for
"Official Notices" December
January 2nd. L.T. switchg
Notices" December 11th.

Johannesburg.—Jan
newals, &c., for tramway equ

Leeds.—January 22n
travelling crane, coal and ash-
Department. See "Official N

Leyton.—U.D.C.
for Lighting Committee. Se

Lincoln.—E.L. instal
the T.C.; Mr. W. G. Watkin

Manchester.—Decemb
reactance coils, for generat
December 4th.

Nottingham.—Decer
laundry plant for the B. G.
Street.

Spain.—December 28
Villel (province of Teruel) a
for the electric lighting of t
Tenders have just been i
Esguevillas (province of Val
tric lighting of the town du

Walthamstow.—Dec
turbo-alternator, 600-KW.
1,000-KW. rotary or motor-co
ber 4th.

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CLOSED.

Ashton-under-Lyne.—The E.C. has accepted tenders for the supply of coal for the electricity works during the ensuing 12 months, the New Moss Colliery Co., Ltd., to supply two-thirds and Mr. Herbert Johnson one-third.

Australia.—The following tenders have been accepted :—

P.M.G.'s Department, N.S.W.—
Telephone cable (Schedule 419).—Western Electric Co. (Aust.), Ltd., £1,454; British General Electric Co., £961.
Telephone Accessories (Schedule 408).—J. Paton & Co., £813; Western Electric Co. (Aust.), Ltd., £1,543; Laurahoe & Hanson Electric Co., Ltd., £214; A. J. Todd & Co., £359.
P.M.G.'s Department, Victoria.—
Cable distributing boxes (Schedule 1,065).—W. T. Henley's Telegraph Works Co., Ltd., £214.
Sulphate of copper (Schedule 1,142).—S. R. O. Allen, £4,456.
P.M.G.'s Department, Queensland.
Telephone accessories (Schedule 293).—Western Electric Co. (Aust.), Ltd., £238.
Melbourne City Council.—
Recording meters.—Ediswan & Swan U.E.L. Co., £521; Ferranti, Ltd., £196; Reason Manufacturing Co., £816; Standard Waygood Hercules, Ltd., £171.

Bacup.—In connection with the electric lighting of the Police Buildings, the tender of Mr. G. L. Adamson has been accepted.

Cunard Co.—The Edison & Swan United E.L. Co., Ltd., has received the lamp contract for the supply of Royal Ediswan lamps for the next year's requirements for the Cunard Steamship Co.

Heywood.—The T.C. has accepted the tender of Messrs. Blakely & Wild for extensions at the electricity works buildings, and that of Mr. Samuel Barker for the erection of a sub-station at Heap Bridge. Tenders for machinery required at the electricity works have been referred to a future meeting.

Keighley.—The Electricity Committee has accepted the tender of Messrs. Babcock & Wilcox, Ltd., at £132, for steam piping.

London.—BATTERSEA.—The Metropolitan Water Board has accepted the tender of Messrs. C. A. Parsons & Co., Ltd., at £3,634, for a high-speed turbine and a slow speed Gwynne pump to the Battersea pumping station.

In view of the present condition of trade, and the uncertainty as to future prices, the Works Committee of the Metropolitan Water Board has been considering the question as to whether the usual practice of inviting tenders for periodical contracts for stores, &c., should be adhered to, and has formed the opinion that it might be to the advantage of the Board to arrange for an extension of as many of the existing periodical contracts as possible. In accordance with this proposal the Committee has recommended the Board to extend for a further period of six months their contracts with the Maxim Lamp Works, Ltd., for the supply of lamps with wire drawn filaments in one continuous length, and the B.I. & Helsby Cables, Ltd., for tapes. The Board has accepted the tender of the St. Helens Cable and Rubber Co., Ltd., at £44, for a supply of copper cable required for portable electric lighting plant.

Nuneaton.—The T.C. has accepted the tender of Messrs. Callender's Cable Co., Ltd., for cables, for a period not exceeding four years, on the basis of copper at £52 10s. per ton, and lead at market price at the time of ordering.

Sunderland.—The T.C. has accepted the following tenders :—

Recording voltmeters.—Everett, Edgcumbe Co., Ltd.
Coal chutes.—J. W. Thompson & Co.
Control panel for feeder boos er.—Phœnix Dynamo Mfg. Co., Ltd.
Underfeed stoker.—Underfeed Stoker Co.

Swansea.—The tender of the British Thomson-Houston Co., Ltd., is recommended to the Town Council for acceptance at £37 for the overhauling of the turbo-alternators and condensing plant at the electricity station.

Walsall.—The Tramways Committee has accepted the following tenders for annual supplies :—

Brake blocks.—National Rail and Tramways Appliances Co., Ltd.
Tantalum lamps.—Siemens Bros. & Co., Ltd.
Pinion wheels.—Alfred Wiseman, Ltd.
Strand wire.—S. Peace & Son, Ltd.
Mechanical cars.—B.I. & Helsby Cables, Ltd.
Trolley wheels.—Anti-Attrition Metal Co., Ltd.
Pitch and creosote oil.—Brownhills Chemical Works, Ltd.
Point rubbers.—Dermatine, Ltd.
Varnish.—Docker Bros., Ltd.
Controller fingers.—Dyer & Young.
Best solder, emery cloth and sandpaper.—J. Gilbert & Son.
Linen frame tape and linen tape.—J. North Hardy & Son.
Paragon tape and Acme tape.—British Thomson-Houston Co., Ltd.
Malleable-iron castings.—H. W. Lindop.
Armature coils.—P. R. Jackson & Co., Ltd.
Poplar wood blocks.—E. W. Turner & Co., Ltd.
Oak floor lathing.—Brookes & Oxton.
Bearing metal.—Glacier Anti-Friction Metal Co., Ltd.
Carbon brushes.—Heap & Johnson.
Metal polish.—Matchless Metal Polish Co., Ltd.
Air-drying Voltalac.—Pinchin, Johnson & Co., Ltd.
Motor grease and lubricating oil.—Vacuum Oil Co., Ltd.
Linseed oil.—H. D. Hayward.

The Electricity Committee has accepted the following tenders :—

E.H.T. cables.—Callender's Cable Co., Ltd., £9,587.
Sub-station switchgear.—British Westinghouse Co., £3,267.
Rotary convertors.—Siemens Bros., £5,240.

Wolverhampton.—The City Council has been recommended to accept the tender of the Pulsometer Engineering Co., Ltd., at £137, for a 5-in. centrifugal pump, and 12½-B.H.P. three-phase enclosed ventilated motor and one motor panel. The Tramways Committee has accepted the following tenders :—

Copper cable.—Callender's, Ltd., £1,310.
Negative booster.—Bees Roturbo Manufacturing Co., Ltd., £235.
Four Albion 25-H.P. chassis.—Wells & Mayner.

FORTHCOMING EVENTS.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, December 18th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General meeting.

Wireless Society of London.—Friday, December 18th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment. Lecture on "The High-Frequency Resistance of Wires and Coils," by Prof. G. W. Osborn Howe, D.Sc.

Physical Society of London.—Friday, December 18th. At 8 p.m. Various experiments, including (No. 10) The Comparison of nearly equal Electrical Resistances, by Dr. G. F. C. Searle, F.R.S.

Association of Mining Electrical Engineers.—Saturday, December 19th. At 4.30 p.m. At Royal Technical College, Glasgow. Paper on "Experiences of Surface Earthing in Scottish Mines," by Mr. P. S. Glover.

Institution of Post Office Electrical Engineers.—Monday, December 21st. At 6 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Paper on "Power Circuit Interference with Telegraphs and Telephones," by Mr. S. C. Bartholomew.

Greenock Electrical Society.—Thursday, December 24th. At 21, West Stewart Street. At 7.45 p.m. Social Meeting.

NOTES.

Christmas Holidays.—Owing to the Christmas holidays and the consequent closing of the ELECTRICAL REVIEW offices on Friday and Saturday, December 25th and 26th, the issue for the next week will appear on Wednesday morning, December 23rd. Will readers, contributors and advertisers kindly take note of the following times for sending in matter, &c. :—

Editorial: All communications for the Editorial department, except the latest items of special news, should be sent in so that we receive them by Monday morning, December 21st.

Advertisements: The Advertisement department announces elsewhere in to-day's pages that all new advertisement copy and alterations to existing displayed advertisements should reach 4, Ludgate Hill, E.C., not later than Friday morning, 18th inst. "Official Notices" and small prepaid advertisements can be received up to 9.30 a.m. on Tuesday, the 22nd inst.

Censorship of Cable Telegrams.—While we are averse to occupying space with trifles, we cannot refrain from a further reference to the recent belated attack upon us which appeared in the columns of the *Electrician*. Although we stated, in our issue of December 4th, that we did not think it necessary to justify our course with regard to the Commercial Cable Co.'s actions in the eyes of our contemporary, the latter last week reprinted the concluding paragraph of our leaderette—prudently omitting the preceding paragraph—and professed to see in it an implied criticism of the company's action. We reproduce the paragraphs in question below :—

"We may add that we do not object to criticism, provided that it is sincere; but we do not accept as such that of our contemporary in this instance.

"The relations of that journal to the telegraph companies are well known. We may point out that our leaderette was published on October 16th; 14 days afterwards we received a letter from the London manager of the company, which we published on November 6th, together with a note in reply, repeating our protest. The attack upon us in the *Electrician* appeared on November 27th—after an interval of three weeks.

"The head office of the company is in New York, whence all important transactions are directed. The conclusion is obvious."

We repeat that the conclusion *is* obvious—even to the meanest intelligence—and to profess doubt as to our meaning is too transparent a subterfuge to mislead anyone. For the benefit of our artless contemporary, however, we may recall, with suitable modification, the explanation of the telegraph given to an Oriental potentate :—The telegraph is like a dog with its tail in New York and its head in London; if you pinch its tail in New York, the dog barks in London. *Hinc illæ lachrymæ.*

Fire at Edison Plant in U.S.A.—We are informed that the fire reported in our issue of last week affected only the phonograph departments. We are glad to say that the remainder of the buildings and machinery are intact, including those devoted to the Edison Storage Battery, which are working to their full capacity of 3,000 cells per day.

Appointments Vacant.—Jointer (£2), switchboard attendant (25s.), mains assistant (£91), for Wishaw electricity department; foreman of railway telegraphs (£250+), for Ceylon Government Railway; storekeeper (30s.), for Burnley Corporation electricity works. Particulars are given in our advertisement pages.

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The Electric Vehicle.—The first number of the *Electric Vehicle*, the new quarterly publication of the Electric Vehicle Committee of the I.M.E.A., was issued last week, and does credit to its producers. It consists of about a dozen pages of reading matter and as many of advertisements, together with a one-page supplement designed to demonstrate the inherent simplicity of the electric motor in contrast with the complexity of the petrol engine and gear box, and a sample set of "mail cards" issued by the Committee.

Pride of place is given to the electric commercial vehicle, which, as we have urged for some years, is the type with which the campaign must be opened. Other articles deal with the good qualities of the electric vehicle, the electric omnibuses at South Shields, vehicles in London, &c. The work of the Electric Vehicle Committee is outlined, and particulars are given of the plugs, &c., that have been standardised; and a list is given of 43 users of electrics, including, we are pleased to see, 15 municipalities, the G.P.O., and two railway companies. The total number of vehicles in the list, in use or on order in this country, is exactly 100; we hope a twelvemonth will put another cipher on this number. Corporations and others have contributed £185 in support of the Committee's work. The journal will in future be edited by Mr. A. Hugh Seabrook.

Fatalities.—PORTSMOUTH.—An inquest was held last week into the death of Frederick W. Hepworth, aged 31, a charge engineer at the Portsmouth electricity works, which occurred on 7th inst. Mr. Benjamin Handley, electrical engineer, said that he was summoned to the station at 7 a.m. on the morning in question and found deceased lying on the rectifying platform, near the switchboard, quite dead. He had been seen a little before in the act of putting in the plugs of the flexible leads on the platform. He was seen to fall, artificial respiration was tried, and a doctor was sent for.

In reply to the Coroner, Mr. Handley said the current that had passed through the deceased's body was at 3,000 volts. The palms and fingers of the deceased's right hand were badly burned. According to the report in the *Hampshire Telegraph*, Dr. Lysander Maybury advanced the opinion that the deceased committed suicide. The burns on the fingers showed that the deceased must have caught hold of the live end of one of the flexible leads. There were pieces of skin on the live end of the lead to show where it had been held. Had he held the insulated ends it would have been impossible for him to receive a shock. As a possible reason for the deceased taking his own life, Dr. Maybury said there were indications that he must have fancied that he was suffering from a disorder of which, however, the post-mortem examination showed no trace. R called, Mr. Handley said electrical engineers, from mere force of habit, always picked up the leads by the insulated ends. They never touched the live ends. He did not think it possible that the deceased could have picked up the live ends even accidentally. In summing up, the Coroner said it was unthinkable that an expert like the deceased should have even accidentally picked up the live ends of the leads. As against the suicide theory, however, he pointed out that the deceased was of a cheerful disposition, and that he had no trouble. The jury found that the deceased died from the effects of an electric shock, but they considered the evidence insufficient to show how the shock was brought about.

Institution and Lecture Notes.—Institution of Electrical Engineers.—At the meeting last week the President reminded the members of the loss of H.M.S. *Bulwark*, and stated that the commander, Captain Guy L. Solater, R.N., was a member of the Institution, and had perished in the service of his country, at the post of duty. He therefore called upon them to express their respect for the late member and their sympathy with his relatives by standing in silence, and this was done.

At the meeting of the MANCHESTER LOCAL SECTION on Tuesday last, the paper by Mr. E. B Wedmore on "Automatic Protective Switchgear for A.C. Systems" was read and discussed.

At the meeting of the BIRMINGHAM LOCAL SECTION on Wednesday, the same paper was read and discussed. The President, Sir John Snell, and the Secretary, Mr. P. F. Rowell, were present at the meeting.

Faraday Society.—The annual general meeting was held on November 23rd. The following officers were elected to serve for the year 1914-15:—President, Sir Robert Hadfield, F.R.S.; treasurer, F. Mollwo Perkin, Ph.D.

Royal Institution of Great Britain.—The following arrangements are announced for the Friday evening meetings before Easter, 1915:—

January 22nd.—Prof. Sir James Dewar, F.R.S., &c., on "Problems of Hydrogen and the Rare Gases."
January 29th.—Dugald Clerk, D.Sc., F.R.S., &c., on "Gaseous Explosions."
February 5th.—Prof. A. W. Crossley, F.R.S., &c., on "Science and Industrial Problems" (Experimentally Illustrated).
February 12th.—William S. Bruce, LL.D., &c., "Recent Advances in Oceanography."
March 26th.—Prof. Sir J. J. Thomson, O.M., F.R.S., &c., "Experiments in Slow Cathode Rays."

The afternoon lecture arrangements include the following:—

"Aerial Navigation, Scientific Principles": (1) The Requirements of Theory; (2) The Requirements of Practice, by Richard T. Glazebrook, C.B., F.R.S., &c. Two lectures on Saturdays, January 23rd, 30th.
"Recent Researches on Atoms and Ions," by Prof. Sir J. J. Thomson, O.M., F.R.S., &c. Six lectures on Saturdays, February 20th, 27th, March 6th, 13th, 20th, 27th.

MR E. P. HOLLIS, of Birmingham, gave an address on the electric drive to the members of the Wolverhampton Engineering Society, on Friday last. As showing the economies brought about by electric drive, Mr. Hollis mentioned an instance where coal formerly cost £5 per week at a certain saw mill, in addition to which the sawdust accumulated was bu
After electrification the cost of energy was
hand, the sawdust was sold, and realised £6 p
MR. R. STUART PILCHER, general manag
Corporation Tramways, recently lectured on
of Tramways at Home and Abroad." He
tion of private *versus* municipal ownership
municipally-owned system.

OUR PERSONAL COL

*The Editors invite electrical engineers, wheth
technical or the commercial side of the pr
also electric tramway and railway officials,*
ELECTRICAL REVIEW *posted as to their m*

Central Station Officials.—With
the services of MR. GLEN, mains superintend
electricity works (who has had an offer of
position), the Corporation has been recomm
salary to £3 10s. per week, as from April 1st
MR. T. R. MCCANDLISH, draughtsman and
Coventry Corporation tramways department
accepted a similar position in the Coventry
department.
MR. P. T. FORTH, who has for the past fiv
the Priestman power station at Blaydon Bur
resident engineer at the Bank Foot and
stations, Crook, and on leaving he was presen
staff with an umbrella, a case of pipes and a

General.—ALDERMAN C. JOHNSON
chairman of the Hammersmith B.C. Elect
COUNCILLOR G. T. H. STAMPER, vice-chair
MR. C. F. DE NORDWALL has resigned fr
following English companies of the A.E.
trical Co. of South Africa, Ltd. (managing
Ltd., the Electrical Co., Ltd., the British
(managing), thereby entirely severing hi
German electrical industry. Mr. C. F. de N
a naturalised British subject since 1890, has
Ltd., to direct the commercial side of their

Wills.—The late MR. J. M. A
estate of the value of £93,901. His bequest
Institution of Electrical Engineers—£250
and £250 to the Benevolent Fund.

NEW COMPANIES REG

Rex Accumulator Co. Ltd. (138,529).
registered on Dec. 5th, with a capital of £24,000
the British patent for an invention relating to
accumulator plates, and all rights relating there
dependencies, provinces, dominions and states
but with the benefit of, the licenses therefor gran
Storage Co., Ltd., by an indenture dated July 2
agreement with the last-named company. The
each) are: D. Willock, 9, New Broad Street, E
Leggett, 4, Great Winchester Street, E.C., compa
pany. The number of directors is not to be les
six; the first are Sir James Pender, Bart., J. Gra
to be nominated by Gaszynski Brothers & Co., w
shares, to be entitled to nominate one out of
Qualification, £200. Registered office: 4, Great

Hodgson Pump Co., Ltd. (138,581).
registered on Dec. 10th, with a capital of £20
over certain patents relating to the Sunturbo Pum
roffe and H. C. Hodgson, to adopt an agreeme
Woodroffe and H. C. Hodgson of the first part, E
part, G. W. Grimshaw of the third part, E. Lon
Inglis and E. C. Edgecombe of the fifth part,
F. K. Woodroffe and H. W. Boultbee of the si
of the seventh part, and to carry on the busine
engineers, manufacturers of pumps and mechani
and contrivances in connection with pumps and p
turers of pneumatic, power and steam hammers,
mine and mining machinery and accessories. The
each) are: G. W. Grimshaw, Bamber Bridge
director; W. Norris, Bamber Bridge, near Pres
roffe, 32, Clarendon Road, Egremont, consulting
Bamber Bridge, near Preston; J. Fearon, 35, D
N. Mason, 35, Dale Street, Liverpool, articled
Dale Street, Liverpool, solicitor. Minimum cas
The first directors (to number not less than thr
G. W. Grimshaw, W. Norris, F. K. Woodroffe
cation, £100. Remuneration (except managing
company. Solicitor, A. G. Inglis, 35, Dale Stre

Maud and Turner, Ltd. (138,596).
registered on Dec. 11th, with a capital of £1
over (1) freehold works, land and premises kn
at Gibbet Street, Halifax, and the business ca
plant and machinery models and goodwill of th
agreement between Harriett Maude and E. Bo
Evison of the other part, to carry on the busin
mechanical and electric engineers, manufacturer
carriages and vehicles, etc. The subscribers
G. Stirk, 23, Lentil Field Street, Halifax, engi
36, Elmfield Terrace, Halifax, engineers' tool
Street, Halifax, engineers' tool maker; J. G. S
Halifax, engineers' tool maker. Private compa
is not to be less than two; the first are G.
J. G. Stirk. Qualification, £100. Registered
Gibbet Street, Halifax.

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OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

North-Eastern Electric Smelting Co., Ltd.—Particulars of £4,500 first mortgage debs., created 13th November, 1914, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Edison and Swan United Electric Light Co., Ltd.—Capital £88,071 in 150,000 "A" and 26,436 "B" shares of £5 each, and 23,564 "B" shares of 5s. each. Return dated Nov. 30th, 1914. 116,400 "A" and 23,564 "B" shares taken up. Ten shillings per share called up on 89,261 "A"; £44,630 10s. paid; £344,738 considered as paid, being £5 per share on 17,139 "A," 5s. per share on 23,564 "B," £2 10s. per share on the above 89,261 "A," and £3 per share on 10,000 "A" shares. Mortgages and charges, £449,474.

Lithanode, Ltd.—Capital, £3,000 in £1 shares. Return dated Nov. 30th, 1914. 3,000 shares taken up, of which 225 have been forfeited. £1 per share called up on 2,275 shares; £2,340 paid, including £65 paid on 225 forfeited shares; £500 considered as paid. Mortgages and charges, £1,700.

Oliver Arc Lamp, Ltd.—Capital, £2,000 in £1 shares. Return dated Oct. 28th, 1914. 1,407 shares taken up. £7 paid; £1,400 considered as paid. Mortgages and charges, £15,000.

Pacific and European Telegraph Co., Ltd. (36,863c).—Capital, £100,000 in £10 shares. Return dated Nov. 24th, 1914. All shares taken up. £4 per share called up; £40,000 paid. Mortgages and charges, £68,400.

Western Telegraph Co., Ltd. (6,886c). — Capital, £2,500,000 in £10 shares. Return dated Nov. 25th, 1914. 207,930 shares taken up. £10 per share called up on 130,000 shares; £1,300,000 paid; £779,300 considered as paid on 77,930 shares. Mortgages and charges, £818,675.

CITY NOTES.

British Columbia Electric Railway Co., Ltd.

The directors express regret that the report for the year to June 30th, 1914, is not of so satisfactory a character as in the past, and that, in order to maintain the usual dividends, it will be necessary to supplement the profits by a transfer of £10,000 from the reserve. They recommend this course with some hesitation, in view of the extremely unfavourable outlook for the current year caused by the war, but they desire to avoid throwing any additional hardship upon the stockholders at this time, and for that reason propose to draw upon the reserve. At the last annual general meeting it was pointed out that the earnings for the year, now under review, were being adversely affected by the conditions then prevailing. The depression in trade in Canada, to which reference was then made, unfortunately became accentuated as the year advanced, and rigid economy has been necessary to achieve the results shown by the accounts. Further economies are still being effected wherever it is possible to put them into force. The following charges have been made against the revenue account for the year:—Provision for renewals maintenance £149,921, added to capital amortization £2,455. The net profit amounts to £393,956, plus £9,519 brought forward and £10,000 transferred from reserve, making £413,475. Deduct interest on debentures and debenture stock to June 30th, 1914, £132,990, dividends already paid on 5 per cent. cum. perp. pref. stock for the year to June 30th, 1914, £72,000; on preferred ordinary stock for the year to June 30th, 1914, £86,400; on deferred ordinary stock for the six months to December 31st, 1913, £57,600; leaving available for further distribution £64,484, from which a dividend on the deferred ordinary stock at the rate of 8 per cent. per annum for the six months ended June 30th, 1914, is to be paid, making 8 per cent for the year, leaving to carry forward £6,884. Owing to the depression, the large employers of labour in British Columbia have been temporarily forced to postpone all new work, and as a result it is reported that there has been a decrease in the population of Vancouver and the neighbouring districts of approximately 20,000 inhabitants; and there has consequently been a decrease of over 8,500,000 in the number of passengers carried during the year. The financial effect of this decrease in passengers would have been even more marked but for the small advance in fares put into force in September, 1913. The directors anticipated some improvement during the latter half of the present year, but these hopes were extinguished on the outbreak of war. All companies operating in a new country have at times to face periods of severe reaction in the development of their business. As a result of the war commercial conditions in British Columbia could not well be worse than they are at present, and the revival in trade may be greatly retarded. Stockholders must consequently be prepared for a drastic reduction in future dividends, but the directors believe that the halt in the development of the Province will, in the end, result in more stable conditions.

During the past year the expenditure on capital account has been reduced to a minimum. A public utility company must continuously incur certain capital outlay to comply with its franchise obligations, but the policy of limiting expenditure to absolute necessities will be rigidly followed until the return of more prosperous times.

In reviewing the work which has been accomplished, the chief engineer reports that the company's plant is in a satisfactory state of efficiency, and that the company is in an excellent position to profit by the improvement in the business conditions of British Columbia when it takes place.

It is with the greatest regret that the directors announce that Mr. Buntzen, who retires at the annual general meeting, has decided not to seek re-election, owing to his continued residence in Denmark. Mr. Buntzen has, however, consented to accept the position of adviser to the directors, and they intend to appoint him. The benefit of his invaluable advice and experience will thus be available to the company. During the first eight years of the company's existence Mr. Buntzen was general manager in British Columbia, and the company owes him a debt of gratitude for his many years of close devotion to its affairs and for the benefits secured by his clear judgment and foresight.

In order to be kept in the closest touch with the conditions prevailing in British Columbia and with the details of the company's business, the board has appointed Mr. R. H. Sperling (who has for the past nine years held the position of general manager in British Columbia) as assistant to the chairman, and has elected him a director in succession to Mr. Buntzen.

The board has appointed Mr. George Kidd to succeed Mr. Sperling as general manager. Mr. Kidd was formerly secretary and recently controller to the company. The board are confident that they have secured a very capable successor to Mr. Sperling.

The directors again have pleasure in expressing their appreciation of the loyal and satisfactory services rendered by the management and staff in British Columbia

The directors recognise that the immediate future must be a period of adversity, during which a large reduction of dividend will be necessary, but they see no reason to lose confidence in the future of the company's undertaking.

The meeting is to be held to-day (Friday) at Liverpool Street Hotel, E.C.

Year ended June 30th.	Income after charging renewals maintenance.	No. of passengers.	No. of lamps in use.	Balance available for dividend.	Rate of div. paid per annum. Pref. ord. stock.	Def. ord. stock.	Amount taken to reserves.
1911 ..	£385,846	69,154,166	785,426	£257,670	6 %	8 %	£197,391
19-3 ..	401,896	71,978,622	930,916	258,244	6 %	8 %	196,411
1914 ..	413,229	64,429,093	921,628	260,955	6 %	8 %	154,920

Metalite, Ltd.

An extraordinary general meeting of the company was held on Tuesday at the Institute of Chartered Accountants, Moorgate Street, Mr. E. C. Vincent presiding.

The Chairman said the meeting was purely for the purpose of passing a resolution to sanction the new reconstruction agreement which had been necessitated by the satisfactory completion of the negotiations which had been carried out by the liquidator during the past month. The main alterations were that the parties to the first mortgage were now Messrs. Arkwright & Saunt, in place of the London City and Midland Bank; while the debenture holders were now taking shares instead of cash. The new prospectus had been duly filed and signed by the new directors. The liquidator's letter of 5th December issued to the shareholders, fully set out the reasons for the meeting, and dealt with the alterations in the agreement. He might say that he had received numerous letters from shareholders asking for information on various points and, as far as possible, he had supplied it.

A shareholder asked whether, supposing the present shareholders did not exercise their option in regard to taking up shares in the new company, they would lose all.

The Chairman said that any shareholder who did not exercise his right to apply for the new shares became a dissentient under the Act, and he was entitled to have the value of his shares assessed by an arbitrator. He might remind them that, in accordance with the reconstruction agreement, if there were dissentients representing more than 2,000 shares the new company need not carry out its bargain, and it would not do so. There could be no doubt that had it not been for the new company coming forward the original shareholders would have lost every penny of their money, as would also the debenture holders. What it came to was that those shareholders who did not exercise their rights under the agreement were not likely to receive anything. The alteration in the agreement was very favourable to the new company, because instead of having to find cash to the extent of £11,000, those mortgages were now taken in shares. The new company was under the control of men who thoroughly understood the business. One of the directors was connected with one of the biggest wire filament manufacturing businesses outside the ring, and that inspired the debenture holders with sufficient confidence that they were prepared to take shares in respect of their mortgages. If the scheme was carried, the shareholders would have to provide 6d. per share within a certain time, but he thought it might be left to the directors to deal as leniently as possible with any shareholders who might want an extension of time for paying their calls.

Mr. Walton Lee then moved the following resolution:—

"That the agreement submitted to this meeting dated the 3rd day of December, 1914, and expressed to be made between this company and its liquidator on the first part, W. H. Gatty Saunt and W. L. T. Arkwright of the second part, Herbert Samuel Golding and James McDougall of the third part, William Plato Oulton of the fourth part, R. C. J. Goodrich of the fifth part, Herbert Samuel Golding of the sixth part, Bryant Trading Syndicate, Ltd., of the seventh part, International Filaments, Ltd., of the eighth part, and Derby Lamp Works, Ltd., of the ninth part, be and the same is hereby sanctioned and the said liquidator be and he is hereby authorised pursuant to section 192 of the Companies (Consolidation) Act, 1908, to carry the same into effect."

He remarked that he ought to mention that he had some interest in the new company. He did not wish to disclose any trade secrets, but it was common knowledge that since the outbreak of the war this country was now in the position of having a monopoly in the electric lamp trade. Previously, much of the trade was in German hands. He was not going to prophesy that the new company would make enormous profits and pay large dividends, but it would interest them to know that the new directors were backing up their opinions by their money, and they would not do that unless they thought the thing was going to be a success. The management was the keystone of the whole position. The directors

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were getting the very best men to manage the new company and, talking to one of the directors recently, he said he was of opinion that within a short time the shares in the new company would be worth £1. He hoped the shareholders would exercise their option and take up the shares to which they were entitled.

Mr. WILLIAM STEWART, in seconding the motion, said that notwithstanding the difficulties through which the company had passed he hoped the shareholders would rally round the new board and make the Derby Lamp Works the most powerful and progressive lamp works in the country. There was no reason why that should not be done. They had men of unimpeachable qualifications on the board who possessed a technical and practical knowledge of the trade—an experience which none of the directors in the old company possessed.

Mr. HOUSTON, in supporting the resolution, said he thought the shareholders of Metalite would be very foolish if they did not take advantage of what was almost a gift. The conditions now prevailing owing to the war were all to their advantage, and the present scheme was evidently a genuine effort to save something out of the wreck.

The CHAIRMAN, in reply to questions, said that the old company had a special lamp—the Boran—which was in the experimental stage. That lamp had, however, been quite superseded in so far as efficiency was concerned by the ordinary drawn-wire lamp. It was now intended to manufacture lamps from drawn wire, the materials for which were to be supplied from one of the largest firms outside the ring. The new company would compete in the open market with other manufacturers, and the board had come to the conclusion that that could only be done successfully by producing a lamp at a cheaper price than that now ruling with the Tungsten Lamp Association. The new works manager was Mr. J. L. Green, who had come from the Osram Works, at Hammersmith. They were obliged to go to the enemy's camp in order to get the right men. The position with regard to the works at Derby was that there was a certain quantity of obsolete machinery which would be disposed of, and a certain amount of small machinery for bending wire would be purchased. It did not look as if the new company would have to spend much money on new machinery, because they would receive a certain sum for old plant. The new manager was of opinion that the factory was capable of turning out three million lamps per annum, but they were working on the basis of one million for the first year. He might say that he had received proxies representing 46,700 shares in favour of the agreement and none against.

The resolution was then carried.

Mr. LEE proposed a vote of thanks to the Chairman, which was seconded by Mr. ROSENTHAL, who remarked that the shareholders were deeply indebted to Mr. Vincent for the way in which he had worked to pull the company out of the mire and put it on a firm basis.

The resolution was carried, and briefly acknowledged by the CHAIRMAN.

Melbourne Electric Supply Co., Ltd.

THE directors' report for the year ended 31st August, 1914, states that in January last they offered for subscription at 97½ per cent. a further £150,000 five per cent. consolidated debenture stock, the whole of which was applied for and allotted.

To provide for future expansion a resolution will be submitted at the meeting on Monday next for the increase of the capital of the company by £300,000, divided into 20,000 seven per cent. first cumulative preference shares of £5 each to rank equally with the existing preference shares, and 200,000 ordinary shares of £1 each, the latter to be converted, when fully paid, into £200,000 consolidated ordinary stock to rank equally with the existing ordinary stock. It is proposed to issue on February 1st next 75,000 ordinary shares of £1 each at par, to be converted, when fully paid, into £75,000 consolidated ordinary stock, and to be allotted as nearly as possible *pro rata* (i.e., 1 in 4) to the holders of the existing £300,000 consolidated ordinary stock whose names appear on the register at the close of business on the 23rd January prox. The directors also propose to issue, as and when required, a further £25,000 five per cent. consolidated debenture stock. It is estimated that the proceeds of these issues will suffice for the capital requirements of the company at Melbourne and Geelong for the next twelve months.

£5,000 has been applied during the year in writing off certain items in the Melbourne plant account; and the capital accounts at Melbourne and Geelong now stand as follows:—

	Expenditure to Aug., 1913.	Expenditure during the year.	Total written off to Aug., 1914.	Balance of expenditure at Aug. 31, 1914.
Melbourne	£693,553	£166,482	£11,512	£848,523
Geelong .. .. (including trams)	147,071	18,963	3,775	162,259
	£840,624	£185,445	£15,287	£1,010,782

The area of the suburban districts in Melbourne covered by the company's statutory powers is approximately 74 square miles; and a supply is now available in 482 miles of streets, being an increase of 72 miles during the year. 5,495 new consumers were connected to the mains during the year, bringing up the total number connected to 19,066, being an increase of 40 per cent. as compared with the previous year. The power supply has increased by 30 per cent., the electric motors now connected being equivalent to 12,444 H.P.; the total connections, including lamps, motors, heating, and other apparatus, have increased by 32 per cent.; the total units sold by 43 per cent.; and the gross revenue by 30 per cent.

The profit and loss account shows that the gross revenue for derived during the year from the Melbourne and Geelong undertakings amounted to £104,040, as compared with £77,082 for the previous year, an increase of 35 per cent. After payment of debenture interest, and management and general expenses at the London head office, and after making the following allocations, viz.:—

To first debenture stock sinking fund £2,500, sinking fund £2,609, income certificate service f (raising the latter to £65,000) £5,000, suspense writing off sundry items of plant at Melbourne a off the balance of cost of issues of consolidated 1914 £10,561, dividend equalisation account £10,0 furniture £50,

there remains a credit balance of £43,8 forward, making a total credit balance ing the seven per cent. pref. dividend cent. on the cons. ordinary stock, £7, ried forward.

Date	Consumers.	Lighting in KW.	Motors in rated H.P.
Melbourne—			
Aug. 31, 1912	8,696	8,232	7,458 H.P.
Aug. 31, 1913	14,671	12,189	9,581 H.P.
Aug. 31, 1914	19,066	16,113	12,444 H.P.
Geelong— (including trams)			
Aug. 31, 1912	1,099	1,458	1,380 H.P.
Aug. 31, 1913	1,456	1,784	1,848 H.P.
Aug. 31, 1914	1,989	2,050	2,085 H.P.

Mr. F. W. Clements, the company's local engineer, came home on leave during the year advantage of personally conferring with him in prospects of the company in Australia.

Adelaide Electric Suppl

THE directors, in their report for the y 1914, state that the capital account n Total expenditure to 31st August, 191 expenditure during the past year £14 ten off £12,074, making £738,349.

The capital necessary to keep pace with the pany's business has been provided for by the foll shares issued in July, 1913, at a premium of during the past financial year; 9,635 preference at a premium of 5s. per share; £25,000 five pe

The area of the districts covered by the co miles; and a supply is now available in 361 m 59 miles during the year. 2,992 new consumers bringing up the total number connected to 1 cent. as compared with the previous year. Th by 17 per cent., the electric motors now conne H.P.; while the total connections, including lamp apparatus, have increased by 24 per cent.; th cent.; and the gross revenue by 25 per cent.

The profit and loss account shows t the year amounted to £111,986, as co the previous year, being an increase payment of debenture interest, and n expenses in London and Adelaide, an to debenture stock sinking fund, there of £40,492, plus £9,865 brought fo credit balance of £50,357. Deducting for the half-year ended 28th February ordinary dividend of 5 per cent., free 1st June, 1914, there remains an avai The directors recommend the dividen ence shares for the half-year ended 31 1st September, 1914), £5,042; final free of income tax, on ordinary shar for the year, £12,500; to bonus of 2 tax, on ordinary shares, £5,000; leavi £10,815.

Date.	Consumers.	Lighting in KW.	Moto rated
Aug. 31, 1912	7,869	5,724	5,187
Aug. 31, 1913	11,854	7,752	6,270
Aug. 31, 1914	13,192	10,107	7,347

Mr. F. W. Clements, a member of the local on leave during the year, and the directors h conferring with him in regard to the progress

The meeting is called for Tuesday

India-Rubber, Gutta-Percha a Co., Ltd.

THE directors report that for the yea 1914, the accounts show, after prov a net loss of £18,922. Transferring fund, adding £7,455 brought forward dividend on the preference shares p and accrued to 30th September, and dend on the ordinary shares paid disposable balance of £13,534, which proposed dividend on the ordinary to carry forward. The directors reco of the half-yearly dividend of 5s. pe 5 per cent. per annum, be made to th and that a dividend of 5s. per share, f ing to £12,500, making with the i July a total of 5 per cent. for the ye of ordinary shares; both these divid 1st January prox. The directors mu such a disappointing statement. Th of causes. The war caused a dimin and the entire stoppage of manuf German army went within a couple the works had to be closed and a serious losses incurred have not be

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loss due to faulty organisation at the French factory, previously reported, fell on this year to a considerable extent, though that organisation has, the directors believe, now been put on a thoroughly sound basis. Then their foreign agencies have incurred a serious loss, partly through bad trade in Australia, South America, Africa and Japan, and partly through certain unprofitable contracts. As the main causes of the company's trouble are believed to be at an end, and the works at Persan have been re-opened, the directors recommend to the shareholders the bold policy of taking £50,000 from the reserve and paying a dividend of 2½ per cent., making 5 per cent. on the ordinary shares. The directors regret to report the complete loss on the coast of Madagascar of the ss. *Buccaneer* while employed by the French Government on cable repairs. The ship was fully insured and the insurance has been paid. The ss. *Dacia* has been employed for a portion of the year, but the amount of submarine cable manufactured has been small. The works and machinery at Silvertown have been efficiently maintained. Mr. G. W. Smith, the company's late manager at Persan, has been appointed an extraordinary director.

The meeting will be held at 106, Cannon Street, E.C., on December 22nd.

Prospectus.—*Derby Lamp Works, Ltd.* — Fortune assuredly smiles at last upon the shareholders of Metalite, Ltd. Readers of the ELECTRICAL REVIEW do not need to be reminded of the unfortunate history of this concern, but those who have followed its proceedings from the early demonstration at Highbury, when the most brilliant prospects were reported both for the lamp and for the shareholders, to the closing of the Derby Lamp Works, will, we are sure, be interested to know that a prospectus now lies before us of the Derby Lamp Works, Ltd. It gives Metalite shareholders an opportunity to take their courage in both hands, and when they have done that to put one of the said hands in their pocket. In other words, they alone are entitled to 187,081 ordinary shares of 5s. each, issued as paid up to the extent of 3s. 6d. in Derby Lamp Works, Ltd.; that is, with a liability of 1s. 6d. per share payable within two months. If they do not thus pay they are "not likely to receive anything." Though the prospectus is more modest than that of the original concern that it seeks to save, inasmuch as it only refers to £15,000 as the net profits for the first year, and £29,000 for the second, it guardedly mentions without making any promises, that "a dividend of 22 per cent. per annum on the preference and 15 per cent. per annum on the ordinary shares would, if the whole capital were issued and fully paid, amount to £13,905." The prospectus says that the works, including equipment, were valued as a going concern in December, 1911, at £28,377, but as our readers know, the factory has long been closed, and it is stated that the machinery and plant have been "kept cleaned and oiled during the period the factory has been closed," and these assets are practically in the same condition now as in 1911. At the meeting, reported on page 826, reference is made to "a certain quantity of obsolete machinery." It is stated that arrangements have been made for opening the works, administration and management have been reorganised, a British works manager with experience with a rival concern has been engaged. The chairman at the Metalite meeting stated that he came from the Osram Works. It would be interesting to know in what department and in what capacity he was engaged. The premises are said to be of sufficient area to enable the manufacture of 2½ million drawn wire metal-filament lamps to be produced per annum, but for the first year after re-opening an output of one million lamps, and 1½ millions in the second year, are promised, with financial results mentioned above. We are assured that this factory and its equipment, which is being "kept cleaned and oiled," but which admittedly contains obsolete machinery, constitutes "one of the best and most complete works in this country, and .... should .... become one of the foremost all-British lamp works in the country." The purchase price payable is £70,104, which includes the 3s. 6d. per share, which shareholders in Metalite, Ltd., are entitled to claim. The prospectus before us also offers for subscription 8,000 7 per cent. profit participating cumulative preference shares of £1 each. We hope that the company may succeed. War-time is a factor in its favour, but it has much to live down.

Automatic Telephone Manufacturing Co., Ltd.—The share and transfer books are closed from 17th to 24th inst. for the purpose of preparing the dividend warrants on the 6 per cent. preference shares for the half-year ending 31st inst., on which date the warrants will be posted.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—A financial daily states that the directors have decided to pay a final dividend of 3 per cent. (at rate of 6 per cent. per annum) on account of dividend accrued on 6 per cent. cumulative preference shares.

Power-Gas Corporation, Ltd.—The report for the year ended September 30th, 1914, shows a total profit of £20,510, plus £3,549 brought forward. This is dealt with thus:—To reserve fund, £4,100; dividend at 5 per cent. per annum upon the ordinary shares, £12,481; carried forward, £7,479.

Continental.—ITALY.—A "Societa Idroelettrica Anonima" has been formed at Marcellinara, Province of Catanzaro, Italy, for the construction and working of hydroelectric works. The capital is 50,000 lire, and the duration of the concern fixed at 30 years.

Blackpool, St. Anne's & Lytham Tramways Co.—The annual report states that the traffic receipts show a considerable decrease, caused entirely by the outbreak of war. At the end of July the prospects were better than last year, and had it not been for the war there is every probability that this year's balance-sheet would have been a most satisfactory one. Under these circumstances the trustees for the debenture-holders have decided to make no distribution of interest on the debenture stock. The traffic receipts were £29,571 (£35,284 last year), and out of this £5,790 (£6,895) was paid to the Corporation. Advertising and sundry receipts and rents receivable brought the net revenue to £24,637, as compared with £29,146 in the previous year. There was a saving of over £1,700 in expenditure, but the balance available for the profit and loss account is only £2,274, against £5,056 a year ago.

Stock Exchange Notices.—Application has been made to the Committee to allow the following securities to be quoted in the Official List:—

Victoria Falls and Transvaal Power Co., Ltd.—£650,000 5½ per cent. second mortgage debentures, Series "B," Nos. 11,441 to 18,940 (£100 and £20) (renewed application).

The undermentioned securities are to be quoted in the Official List:—

Consolidated Gas, Electric Light and Power Co. of Baltimore.—Further issue of 1,562,300 dols. common stock.

Marconi's Wireless Telegraph Co., Ltd.—Further issue of 222,688 ordinary shares of £1 each, fully paid (Nos. 1,250,000 to 1,472,688).

Montreal Light, Heat and Power Co.—Further issue of 1,800,000 dols. capital stock (Montreal certificates).

Electrical Securities Trust, Ltd.—The report for the year to November 14th, 1914, to be presented at the meeting at Edinburgh on 15th inst., states (says the *Financial Times*) that the results, after charging all expenses and the interest due and accrued on the debentures, amounting to £2,500, show a loss of £858. No credit has been taken in the accounts for interests or dividends which may have accrued, and which have not been paid within the period of the accounts. The directors regret that they have been unable to dispose of any of the investments held by the Trust during the past year, and so enable the trustees for the debenture-holders to make a further distribution. Some of the investments have paid increased dividends during the year, but it is impossible to say whether these will be maintained, owing to the abnormal conditions created by the war.

Manx Electric Railway Co., Ltd.—The accounts for the year ended September 30th, after payment of debenture interest, show a credit balance of £3,325, which is to be carried forward.

Shawinigan Water and Power Co.—A dividend of 1½ per cent. on the common shares for the quarter ending December is declared.

New Issue.—The Metropolitan Railway Co. is inviting applications for an issue of £500,000 5 per cent. preference stock at 99 per cent.

Marconi International Marine Communication Co., Ltd.—The directors have declared an interim dividend on account of the current year of 5 per cent., equal to 1s. per share.

STOCKS AND SHARES.

Tuesday Evening.

STOCK EXCHANGE markets show noticeable strength, and it looks as though the year were going to end up with a good tone in most departments. The re-opening of the New York Stock Exchange, for dealings in shares as well as in bonds, sufficed to give a fillip to the whole of the American list; and this, in its turn, reacted upon other divisions. The Paris Bourse is open, though there is not much trade going on between the French capital and London. One or two of the provincial Exchanges have started business again under shelter. Why London should be condemned to deal in the wet and cheerless mud of Throgmorton Street day after day is a matter with which the Treasury is chiefly concerned.

Negotiations were opened at the end of last week between the Chancellor of the Exchequer, the Stock Exchange and the banks, but resulted in nothing save further adjournment of the question. A far-reaching scheme is in course of evolution, however, which will probably enable the Stock Exchange to get going inside its own doors early in the New Year, when dealings will be permitted under such restrictive rules as will make it virtually impossible for the alien enemy to obtain money or to transact any sort of business in the London Stock Exchange.

The principal strength is displayed in American Rails and nearly all the mining shares. Amongst the latter, copper descriptions are especially prominent. Rio Tintos may be instanced, having come up from 49 to 56 within a week or so. The fear of a famine in chemicals, for mining work, is now disregarded, and gold mining shares are being run up day after day.

The London County Council brought forward its scheme for the electrical supply of the Metropolis just on the day when a fresh order from the Secretary of State insisted upon a further darkening of London streets. The L.C.C. met to-day (Tuesday) to consider its wide and somewhat complicated London and District Electric Supply Bill, 1915, which seeks to give control to a Central Authority, in connection with electricity supply over a far-flung area. Details of the scheme have been published here and elsewhere, but they have had no influence at all upon prices in the

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electrical supply market. Business there is as quiet as ever; and, naturally enough, the new lighting order for London has not quickened interest in the shares.

St. James's have been done between 8¾ and 9 since we last wrote, and City of London Ordinary changed hands on the basis of 14½-15. There are a few sellers about of County Ordinary, but in other high-class shares there is scarcely a mention of quotations. Charing Cross City Undertaking Preference have given way a little, being now back to 4. Otherwise, prices are unchanged.

Animation is apparent in shares of the manufacturing group. British Westinghouse Preference developed further strength, and jumped up to 36s. 3d. Both the Edison & Swan issues are better, the fully-paid hardening to £2. A good deal of sympathy has been expressed with Mr. Thomas Edison at the fire which broke out at the end of last week and destroyed the main works of his Phonograph Company. The shares in this concern, by the way, are all in the hand of Mr. Edison himself, and are therefore not known in the markets. Electric Constructions are a little better at 11s. 6d. Cromptons remain at 5s. for the Ordinary and 11s. for the Preference. Not much interest is taken in General Electrics, of which the Ordinary continue at 11¼ and the Preference at 10.

The Metropolitan Railway has just made an issue of 5 per cent. Preference stock, offered early this week at 99. The security, unlike that of the South-Western issue made for the purpose of electrification, is an irredeemable stock. According to the prospectus, there is plenty of margin for the interest. Jobbers are not anxious to make prices until the allotments appear, but, nominally, there is a small premium quoted on the stock. This issue had the effect of putting down the price of the Ordinary to 31½, a fall of ½.

Districts keep about 18½. Underground Electric Railways met with a little demand, because of the breakdown of the trams, which threw an enormous increase of temporary traffic into the omnibuses and tubes. Underground Electric Incomes hardened to 80¼; the fully-paid shares are £2, and the shilling shares stand about 6s. 3d. Those whose perambulations depend principally upon the omnibuses must have felt thankful at their lot when they surveyed the pitiful crowds which waited for the trams that did not move. The seriousness of the breakdown was seen in the time that it took to get the full service re-started. London United Tramways Debenture stock is supposed to be in the neighbourhood of 55, but to get a bid for it is not an easy matter. London and Suburban Tractions are 5s., 10s. and 75 for the Ordinary, Preference and 4 per cent. Debenture respectively.

The following is a list of prices of representative stocks and shares in various electrical markets:—

HOME ELECTRICITY SUPPLY COMPANIES.

Brompton Ordinary	8⅜	Kensington Ordinary	7⅞
do. 7 per cent. Pf. ..	8⅜	London Electric	1⅛
Charing Cross Ordinary ..	4⅜	do. do. 6 per cent. Pf.	5
do. do. do. 4½ Pf...	4¼	do. do. 4 Deb... ..	89½
do. do. City Pf.	4	Metropolitan	8
do. 4 Deb.	86½	do. 4½ per cent. Pf. ..	4¼
Chelsea	4⅜	do. 4½ Deb.	91⅛
do. 4½ Deb.	91½	do. 3½ Deb.	81½
City of London	14⅝	St. James' and Pall Mall ..	9
do. do. 6 per cent. Pf.	13	do. do. 7 per cent. Pf.	6⅞
do. do. 5 Deb.	115	do. do. 3½ Deb. ..	83
do. do. 4½ Deb... ..	98	South London	3
County of London	11½	South Metropolitan Pf.	1⅛
do. do. 6 per cent. Pf.	11⅜	Westminster Ordinary	8⅜
do. do. 1st Deb. ..	99	do. 4½ Pf.	4⅜
do. do. 2nd Deb. ..	97		

MANUFACTURING COMPANIES.

Brit. West. Pf.	1⅛	Electric Construction	11/6
do. 4 Deb...	72	do. do. Pf. ..	1
do. 6 p. lien	68	Gen. Elec. Pf.	10
Callenders	11⅜	Henleys	1⅛
do. 5 Pf.	4⅛	,, 4½ Pf.	4⅜
do. 4½ Deb.	97⅛	,, 4½ Deb.	97⅛
Edison & Swan, £3 pd.	8/-	Telegraph Con.	96⅜
do. do. fully pd. ..	2	Castner-Kellner	2⅛
do. do. 4 Deb. ..	60		
do. do. 2nd Deb. ..	60		

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pf.	104	Gt. Northern Tel.	29½
do Def.	22	Indo-European	57
Chili Telephone	7	New York Tel 4½..	97
Constantinople Tel.	4¼	Oriental Tel. Ord.	2
Cuba Sub. Ord.	8½	do. Pf.	1⅛
do. Pf.	15½	Tel. Egypt Deb.	97
Eastern Extension	11½	United R. Plate Tel.	6
do. 4 Deb...	94	do. Pf.	5
Eastern Tel. Ord.	122½	West India and Pan.	1¼
do. 8½ Pf.	71½	Western Telegraph	12⅜
do. 4 Deb.	95	,, 4 Deb.	95½
Globe Tel. and T. Ord.	10¼		
do. Pf.	12½		

FOREIGN TRAMS, &c.

Anglo-Arg. Trams 1st Pf. ..	4½	Bombay Electric Pf.	11
do. 2nd Pf.	4⅛	do. 4½ Deb.	96
do. 4 Deb...	86½	Mexico Trams.	45
do. 4½ Deb.	95½	do. 5 per cent. Bds. ..	70
do. 5 Deb...	88½	do. 6 per cent Bds. ..	70
Brazil Tractions	63	Adelaide Sup. 6 per cent. Pf. ..	5⅛
		do. 5 Deb... ..	100½xd

The Melbourne Electric Supply Company is taking steps to increase its capital by £300,000, with Debenture stock for £25,000. The Company's profit rose to £43,804, as compared with £39,930, and the Ordinary shares again get 10 per cent. dividend. The Adelaide Electric Supply has also issued a fine report this week: the Ordinary shares receive 7 per cent., and the profits show substantial increase.

In the foreign group, the British Columbia Electric Railway Company's report has had virtually no effect upon the prices of the stocks. The company m
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Between the prices of W
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quarter of the year, makin
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7 per cent. Yet Eastern C
Westerns cost nearly £13 s
tions should be reversed.

New York Telephone Bon
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improvement, and Anglo-A
Constantinople Telephone s
issued a notice stating tha
of war, the interest on the
postponed. The telephone
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Marconis are a better ma
price hardening to 1⅞, with
4s. and Americans to 9s. 6d.

The India Rubber, G t
declared a dividend of 5s.
cent. for the year on the
net loss of £18,922. but t
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business is passing.

ELECTRIC TRA
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Locality.	Month ended (4 wks.)
Bath	Dec. 9
Blackpool-Fleetw'd	,, 12
Bristol	,, 11
Chatham and Dist.	Dec. 3
Cork	,, 10
Dublin	,, 4
Hastings	Nov. 25
Lancashire United	Dec. 9
Llandudno-Col. Bay	Nov. 27
Tyneside	Dec. 9
Anglo-Argentine ..	Dec. 9
Auckland	Nov.
Calcutta	Dec. 12
Kalgoorlie, W.A. ..	Sept.
Madras	Nov. 30
Montevideo ..	Nov.
Dublin-Lucan Rly.	Dec. 4

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RECENT ADVANCES IN ELECTRICAL CRANE AND LIFT DESIGN.

[COMMUNICATED.]

One of the most apparent features at the present day with regard to electrical engineering is the specialisation which has ensued as a natural outcome of the wide diversity of purposes for which electric power has shown itself to be available, and an outstanding case in point is to be found in the way in which the application of electricity to the problem of crane and lift operation has developed both as regards the motor itself and the control apparatus for regulating the current. The subject is a vast one, and no attempt will be made in the present notes to completely cover the ground. It is, however, of interest to examine one or two ways in which the requirements of this service have developed special applications and modifications of electric design, and this will be the purpose of the present notes.

It will be found that such specialisation has extended not only to the switching appliances for crane control, which is a feature to be at once expected, but it has also had a radical effect upon the requirements imposed upon the motors which have to operate the lifts. At the outset, it will be interesting to briefly outline the salient features of this development. Considering first of all the direct-current motor, it has been found that the ordinary series, shunt or compound-wound motor was not altogether suitable in its standard form for the special requirements of crane and lift work, as this is very largely intermittent, and consequently the conditions of load are such that an adjustment has been found necessary in the relative relations of copper and iron in the motor. Hence crane-rated motors are, as a rule, lighter than the ordinary machine designed for continuous service; and, moreover, it will usually be found that the copper in the circuit is greater in proportion to the iron than in the ordinary type.

It will be found that among modern manufacturers, for instance, Messrs. Mather & Platt, Ltd., the design of crane motors has had considerable attention and ingenuity devoted to it, as will be seen from fig. 1, which

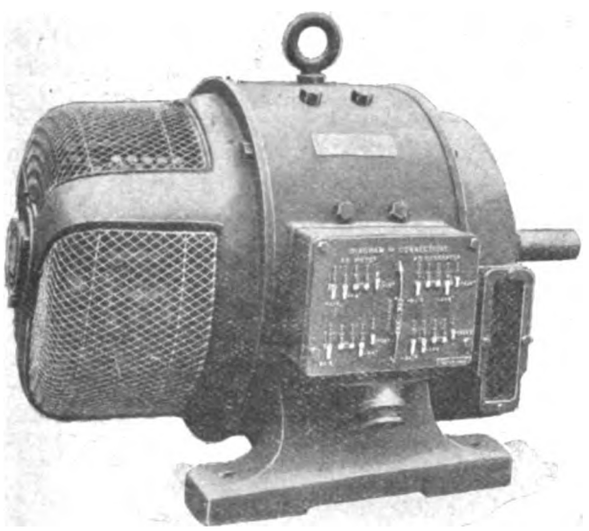

Fig. 1.

shows a standard direct-current crane motor of their latest type. It will not be out of place to enumerate some of the special features embodied in this design, as it has only been adopted after an extended period of experiment. The combination of a ball bearing at the commutator end, with a bush bearing at the driving end in actual practice, has more than justified its adoption. Not the least practical advantage derived by this method is the centralisation of the commutator which prevents sparking and other commutation troubles. Further, by having the bush bearing of extra length with duplicate oil rings, a steady drive is obtained, which is especially valuable where gears are employed.

As is clearly indicated in fig. 1, a considerable amount of care has been expended in order to reduce, what is in many instances a complication, into a very simple matter; as, by means of the diagram on the terminal cover and the simple arrangement of the connections, it is possible for the most unskilled attendant to make or alter the connections correctly. This is a very valuable feature when one considers the endless complaints and troubles caused through unsightly connections and main leads. As every user is aware, one of the greatest sources of weakness is to be found in the brush gear, but it is claimed that in the latest system by which radial acting box-type brushes are employed, all troubles in this respect have been overcome—a statement borne out by users all over the world who have given the system an extended trial. At no time during the lengthy period (more than 30 years) which this firm have been manufacturing electrical machines has more attention been paid to the insulation of the machine itself than at present, as it is fully recognised that not only for crane work, but in all cases, success depends solely upon the quality of the insulation and the care which is expended upon its application.

Fig. 2 illustrates the type of motor for use in dusty and damp atmospheres, which is therefore specially applicable to foundries and ironworks. An extremely interesting feature of this design is the type of commutating end cover adopted,

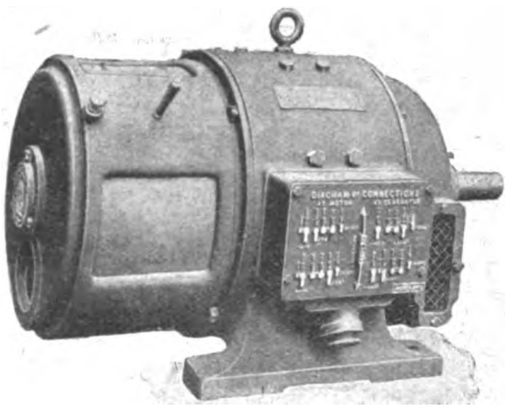

Fig. 2.

whereby it is possible to examine the brush gear with one movement of the encircling ring. The latter is so constructed as to protect the interior of the motor from dust and dirt, and is sufficiently massive to withstand the rough handling to which cranes and their motors are subjected.

It will be noticed that apertures are arranged in the end covers, so that pipes may be connected, thus allowing a supply of clean cool air to enter the interior of the motor and this is of assistance where cranes are driven by stationary motors. The features outlined in connection with fig. 1 are equally applicable to this design.

An important point in connection with crane motors is the intermittent application of very heavy overloads, and in the earlier designs of motors this was frequently a source o trouble owing to sparking on the commutator, due to displacement of the neutral axis owing to armature reaction This has led in recent times to the adoption of the interpole motor with commutating poles, which ensure sparkless running on all loads up to 100 per cent. overload. In the motors made by the firm just mentioned, heavy overloads can be given momentarily without sparking by virtue of the interpole construction, and they are, therefore, especially valuable where the load is irregular. Moreover, commutating poles enable the motor to be made reversible without altering the position of the brushes, and permit of a wide range of speed variation when this is required.

It is, of course, a difficult matter to design a test specification for a crane motor which will adequately meet all the conditions of service, inasmuch as these conditions themselves vary very largely according to the actual work which the crane or lift has to do. For light, quick-running lifts, for example, the load might be very short and frequent, while for traversing motors on a gantry crane it is probable that the time during which heavy current is

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applied in relation to the time during which the motor is idle might be fairly considerable, and hence, although a quarter-hour rating is usually applicable to crane motors, it must be borne in mind that with increased relation of copper to iron there is less total mass of iron to be heated by the C^2R losses, and, therefore, there is more danger of a continuous load warming up the motor excessively than in the ordinarily designed motor. Hence a variation on the above test which might fittingly be applied would be after a steady running to give, say, double the load for 25 minutes while the machine is still hot, the temperature tests being taken between these two running tests.

Messrs. Laurence, Scott, Ltd., have developed a special type of winding for crane motors which requires a slight modification in the design of the controller, but which is very useful for easy acceleration when this is desired. In this case the field magnets are wound with something in the nature of double the number of turns that are usually put upon them, and arrangements are made so that when the motor reaches top speed half the windings are shunted, thus cutting out half the field currrent. It will be seen that on the lighter loads the surplus excitation increases the torque very considerably and decreases the speed, so that at half current from 30 to 60 per cent. extra torque is obtained at each step but the last, on which the series is shunted. Therefore, considerably better control is obtained with the use of the same amount of main resistance as in the ordinary motor, or alternatively, for the same degree of control a smaller resistance can be used. There are also other advantages in connection with this arrangement which may be summarised. Where the lowering speed of the crane is checked by making the motor generate on to a resistance, it is evident that with the shunted type of field the control can be obtained with a smaller generating current, and, therefore, there is considerably less danger of momentary sparking at the commutator when the controller handle is brought over to the braking position, due to the heavy rush of current which would otherwise ensue. Moreover, with this type of winding about half the full-load current is required for a dead slow lifting and lowering motion, as compared with ordinary windings, where something like full-load current is necessary. The advantage of the arrangement is that with this disposition of the windings no extra connections are required between motor and controller, as is the case when separate starting coils are used on the first step and cut-out for full speed. This greatly facilitates working operations. It may be argued that the shunting of part of the field winding in this way involves waste of current at full load, and that, therefore, the efficiency of the motor would be brought down in this way. As, however, the crane motor operates for considerable periods at half or three-quarters load or less, it is evident that the saving of current on these low loads due to the stiffening of the field more than compensates for the slight loss which would not exceed 5 per cent. due to the shunt operation on the top speed. This is, therefore, a most important advance in the design of crane motors.

Another point with regard to Messrs. Laurence, Scott's crane motor, which is illustrated in fig. 3, is that it is fitted with ball-bearings, and has also a solenoid and centrifugal brake gear, to which reference will be made in a further paragraph. Its great feature, however, is that it has a self-contained outer bearing. For pinion drives of any size it is most desirable to have such an outer bearing. This is becoming more and more recognised, and, of course, a single ball-bearing with an overhung pinion is not entirely good practice. When it becomes necessary to provide an outer bearing, ball bearings have great advantages, and the strains are so much reduced on them that they become thoroughly good practice. Endeavours have been made to provide motors with self-contained ordinary plain bearings and the usual ring lubrication, but the difficulty is to get out a practical scheme that allows the spur-wheel to come into the required position without interfering with the oil-box and fixings for the third bearing. The length also with an outer bearing is excessive. Ball bearings, of course, are very much shorter, and as there is no trouble with an oil-box, the bracket fixing for the outer bearing can be swung round to any position, so that a standard construction can be adopted which enables the spur-wheel to be fixed in any position, either at the side, at the top, or at the from the view.

As far as alternating current with regard to crane service is out of the question from the stopping, while the induction m the point of view of control, d any very great flexibility of spe the running speed of the moto quency of supply, with a sl on the load due to slip. Whe too intermittent, that is to sa maintained at some consider example, on long lifts, there application of alternating some of the newer forms interesting example of this motor, made by the Sandyc means of which, in one fo running speeds can be obtaine cated control arrangements. cascade motor is very similar type with the slip-rings left rotor conductors omitted. Th in parallel, and, in addition t are connected to it. The r that it can simultaneously p different numbers of poles. example, the stator is wound duces in it an eight-pole field to induce in it current produc of poles, together with a sup This four-pole field produces the rotor winding, limiting and it, at the same time, ge stator winding. The points induced currents in the stat position of the tapping conn starting resistance of these ing torque can be cont lated in exactly the sam motor. The difference be ordinary slip-ring type may the ordinary type the stator inductive action stops, start only being obtained by con windings. In the cascade supplementary magnetic fie stator, reflecting back to therefrom and the starting connected to the stator, n speed type, slip rings are ne carry only primary currents the higher speed, but when carry in addition secondary of the second rotor field. barrel type, similar to th machines, but as regards windings form a closed ci coils are tapped into this cl their free ends with slip windings is such that when the current induced in the poles, the machine behav exactly like an ordinary sli the slip rings are open-circ conductors become inopera then produce two numbers upon the stator and causes speed. For example, a ma and twelve-pole speeds c order to start it, the switc the ordinary way is gra machine then behaves as the speed is to be reduced, and the short-circuiting s motor and connected to th rotor then reacts upon th twelve-pole speed, the op required to raise the spee

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one. While the machine is slowing down, this acts as a generator and returns energy to the line.

A great advantage of this system is that it is never necessary to break the main circuit except when the motor has to be totally stopped, and hence the whole of the operations can be achieved without sparking. Where two definite speeds are practically necessary for crane work, and especially where the running can take place at relatively long periods, it is a most suitable method of control, and where used on long lifts the losses during acceleration are reduced to nearly half that which would be obtained when using an ordinarily wound induction motor. In such cases, instead of mounting the short-circuiting switch on the side of the machine, the controller is connected with the tappings. When starting, the stator controller is first brought into operation, and the machine speeds up to its lower speed. Under these conditions the slip-ring controller is then brought into operation, and the motor then runs up to the higher speed. This method of operation is exceedingly simple, and there is a further advantage in that when starting, the cascade motor is capable of exerting a larger starting torque than when operating on the slip-rings. For a given input the motor at a lower speed develops 40 to 50 per cent. more torque than when running on the slip-rings, and the most economical method of operation is therefore to start with the maximum amount of energy required during the hoist, and to run up the speed with high acceleration up to the two-thirds speed. Above this speed the slip-ring controller comes into operation, and for the same energy input acceleration is reduced. The efficiency with this system of control is therefore large, and important advantages are obtained without the complications involved in some of the ordinary systems. Moreover, the cost of the arrangement is only small compared with that of the more complicated systems. The cost of a two-speed-wound motor is only a little over that of an ordinary slip-ring motor with one speed, and the further additional cost is only that of the stator controlling gear. As the amount of energy to be dissipated in resistances is only about half the loss with single-speed machines the sizes of the controlling resistances are much reduced. By changing over two of the leads of the stator circuit reversal of the direction of the motor is effected. The motors can be fitted with a

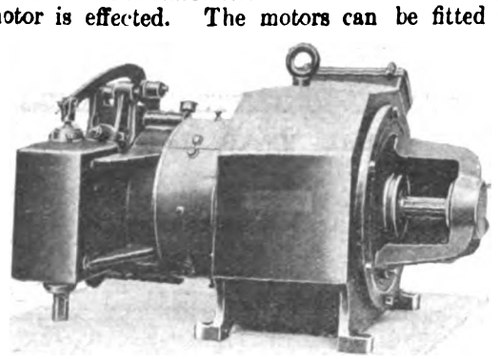

Fig. 3.

vertical shaft arrangement if necessary, and they can be built either ventilated or totally enclosed. For intermittent service, such as for cranes, lifts, and similar purposes, motors can be rated for an hour at 50 per cent. above their normal outputs, it being understood that by intermittent service is meant that the intervals of work and rest are of equal duration, the former not extending beyond a few minutes at a time. Either liquid or metallic switches can be utilised for starting the motor against half or full torque without undue heating, and are designed to start motors against full load torque when taking only full-load current.

While dealing with the motor equipments, the question of adequate braking comes prominently into consideration, and with electrically-operated cranes, some form of solenoid brake is usually fitted. Fig. 3 shows a special type of solenoid and centrifugal brake for series-wound crane motors which represents the latest practice in this portion of the subject. As will be seen, it is arranged for fixing on to the end bracket of the motor, and it is so proportioned that it will hold considerably over the full load even if the motor is fitted with the very efficient gearing which is now customary in connection with crane and lift work, and will deal with the full horse-power of the motor. The motor shown has also a centrifugal brake attachment which is found to be of considerable advantage in connection with lifting motors, although for traversing and slewing motors for crane service the solenoid brake only is found to be sufficient. In the case of series-wound motors, particularly when lowering heavy loads, but also in lifting light ones, there is some danger of too high speed being attained when the controller is put hard-over, while when lowering on a heavy load in compound-wound machines, even with speed-limiting shunt coils there is also the danger of excessive speed, although this is avoided when running light by the shunt coils. When lowering, however, even with moderately efficient gearing the motor will generate, and this generating current in the series winding will possibly nullify the effect of the shunt winding. Another point against the omission of a purely mechanical brake even on shunt-wound motors is that there is always a liability that the motor may be disconnected from the mains so that it cannot generate back on to the line, and, therefore, it may be said that for lifting motors the centrifugal type of brake is a most desirable adjunct. In the case considered, the brake drums for lifting motors where the heaviest wear occurs are made of steel, although for slewing and traversing motors where only the inertia of the lifting parts has to be absorbed by the brakes, cast-iron drums may be employed. In order to secure a tight fit of the drum on to the shaft equal to a hydraulic press fit, and at the same time to secure ease of removal of the drum at any time when this is desired, the method is adopted of splitting the boss into halves, and tightening these halves on to the shaft by means of a coned collar. The solenoid brake straps are lined with phosphor-bronze and provided with adjustments for taking up wear, although between steel and phosphor-bronze the wear is not very great. The brakes are pulled in chiefly by the pressure of a compression spring, although the weight of the arm and the solenoid also help the action to a certain extent. Adjustment is provided for the centrifugal brake by means of rectangular steel springs, and an adjusting nut by which more or less tension can be put on the springs to keep the brake shoes from flying out and touching the external drums.

(To be continued.)

CALCULATIONS RELATING TO ELECTRICAL CONDUCTORS.

[COMMUNICATED.]

In a general survey of the divers sections of the electrical industry of to-day, it would appear that most people who either manufacture, or make use of, electrical apparatus, at some time or other have to handle calculations relating to the sectional area and weight of conductors. Handicapped as we are by an antiquated outfit of measurement standards, the units of which have little or no cohesion or interrelation, it is not easy to work such calculations without considerable expenditure of time and pains. Frequently, too, the cumbrous British units have to be used in conjunction with the metric system, and the combination for some only serves to make confusion worse confounded. For instance, copper strip may be ordered with the dimensions given in fractions of inches, in mils, or in millimetres. The weight is perhaps stated in pounds, and the size in millimetres. Cables may be ordered in terms of square inches, square millimetres, or even circular mils; and in strands made up of wires drawn to any one of three gauges, the standard (S.W.G.), the Birmingham (B.W.G.), or the American Brown and Sharp (B. & S.). Of these three gauges, only the first shows any sign of being constructed in a well-balanced practical manner, in that the various sizes are to some extent uniformly progressive. Naturally this, the standard gauge, is the one most widely used, yet there are people who, from some weird lack of reason, use even the B. & S. gauge. The whole of the former can be memorised without difficulty, but the B. & S., well, hardly ever. For finer wire than, say, No. 26, it may be necessary to go to four places of decimals;

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the B. & S. gauge, however, runs to four places even in large trolley sizes like No. 3/0 (·4096″), in which case it is scarcely practicable, and certainly unnecessary, to obtain such accuracy in drawing.

All these cases serve to emphasise the chaos of the present state of affairs, and the need for reform. Customs and usage seem to militate successfully against such reform, and the only alternative is to adapt oneself as well as possible to the present conditions pending their amendment. In order to do this, the writer has for some time recorded and accumulated some simple figures relating to conductors, which are useful on occasion in the workshop and office. They are based upon the following :—

	For copper.	For aluminium.
1 sq. in. section weighs	11·5625 lb. per yard	3·48 lb. per yard
,, ,,	12·6447 lb. per m.	3·805 lb. per m.
,, ,,	20,350 lb. per mile	6,125 lb. per mile
1 sq. mm. section weighs	31·54 lb. per mile	9·49 lb. per mile

Then to obtain weight per yard, per metre or per mile, for square, rectangular, or irregular section of strip, the area in square inches or square millimetres is multiplied by one of these constants, *e.g.*—

sq. in. area × 3·48 = weight per yard of aluminium.

These figures not only prove useful in ordering quantities of material, but serve as a check upon it when delivered. A yard of copper strip can be taken from a batch, and weighed. If the result differs from the calculated weight, the section s probably smaller in gauge, or larger, than it should be.

In the case of round wire, having the diameter given in mils (·001 in.), the constants are based upon the formulæ :—

1. Weight per 1,000 yards of copper = $D^2 \times ·7854 \times 11·5625 \div 1{,}000$ (where D = diameter of single wire in mils) = $D^2 \times ·00909$, or $D^2 \div 110$ (in pounds).
2. Weight per mile of copper = $D^2 \times ·7854 \times 20{,}350 \div 1{,}000{,}000 = D^2 \times ·016$, or $D^2 \div 62·5$ (in pounds).

For aluminium the figures obtained should be multiplied by ·301, as expressing the difference in weight. In the strands given in the following table, allowance is made for extra weight due to twist or lay, over and above that of straight wire.

For wire and strands : (D = diameter of wire used, in mils.)

	Copper.	*Aluminium.*	
1 wire	$D^2 \times ·00909$	$D^2 \times ·00274$	lb. per 1,000 yards.
3 strand	$D^2 \times ·0278$	$D^2 \times ·00835$	,, ,,
7 ,,	$D^2 \times ·065$	$D^2 \times ·0195$	,, ,,
19 ,,	$D^2 \times ·176$	$D^2 \times ·053$	,, ,,
37 ,,	$D^2 \times ·343$	$D^2 \times ·103$	,, ,,
61 ,,	$D^2 \times ·565$	$D^2 \times ·170$	,, ,,
91 ,,	$D^2 \times ·844$	$D^2 \times ·254$	,, ,,
127 ,,	$D^2 \times 1·177$	$D^2 \times ·354$	,, ,,
169 ,,	$D^2 \times 1·567$	$D^2 \times ·4717$	,, ,,
1 wire	$D^2 \times ·016$	$D^2 \times ·0048$	lb. per mile.
3 strand	$D^2 \times ·049$	$D^2 \times ·0148$	,, ,,
7 ,,	$D^2 \times ·114$	$D^2 \times ·034$	,, ,,
19 ,,	$D^2 \times ·310$	$D^2 \times ·093$	,, ,,
37 ,,	$D^2 \times ·604$	$D^2 \times ·182$	,, ,,
61 ,,	$D^2 \times ·995$	$D^2 \times ·308$	,, ,,
91 ,,	$D^2 \times 1·485$	$D^2 \times ·447$	,, ,,
127 ,,	$D^2 \times 2·07$	$D^2 \times ·623$	,, ,,
169 ,,	$D^2 \times 2·76$	$D^2 \times ·831$	,, ,,

With the aid of a slide rule, and using the above constants, any desired weight of copper, or aluminium, may be quickly, and, for all practical purposes, accurately found. As those familiar with a slide rule know, D^2 is found by inspection, and a simple multiplication completes the operation, provided only that due regard is paid to the position of the decimal point, when recording the result.

Again, one has occasion to find the required size of strand in cases where the area in square millimetres is given. This can be expressed as—

$$\text{Size of wires in strand} = \frac{\sqrt{\text{area in sq. mm.} \times 31·54}}{\text{a constant depending upon number of wires.}}$$

The division of 31·54 by the constant comes out as follows :—

For	
Single wire	1,971
Three-strand	665
7 ,,	285
19 ,,	103
37 ,,	54
61 ,,	32·6
91 ,,	21·8
127 ,,	15·7
169 ,,	11·75

Then, given the square millimetre area, and suppose it is proposed to use a 37 strand, the size of each wire (in mils) would be :—

$$\sqrt{\text{Area sq. mm.} \times 54}$$

e.g., 150 sq. mm. in 37 strand = $\sqrt{150 \times 54} = \sqrt{8{,}100} = 90$ mils, *i.e.*, 371·090 in., or, say, 37/13 s.w.g.

If the result gives a larger wire, or a smaller one, than is suitable for the purpose, the number of wires must be increased (say 61), or decreased (say 19), and the new size calculated according to the above. These figures are near enough, for all pratcical purposes, to mathematical exactness, if the result is taken to the nearest mil, or, where possible, to the nearest standard gauge size. It is preferable, for several reasons, to adhere as far as possible to gauge sizes, and it will often be found that when one strand produces an odd size of wire by the above method, if another strand is tried the wire comes out quite near to a standard gauge number. It is scarcely necessary to add that this formula applies both to copper and aluminium, since no question of weight or conductivity enters into the case. As already indicated, a slide rule is extremely useful, and, accompanied by formulæ similar to those shown, will afford a quite appreciable saving of time and trouble to anyone engaged on electrical or other engineering calculations. When more exactness is requisite one can always work right through step by step, and obtain the result to any number of decimals, but for all ordinary practice a ready reckoner constructed on the lines indicated is a great help. One can adapt other work in a similar way to the same end, and it is a good rule when making calculations to tabulate results for future use, because so often, sooner or later, the same conditions recur and call for the same set of calculations, or at the least another set on identical lines.

Finally, if desirable such tables can be embodied in the form of curves, and in this shape are easily accessible for reference, provided that the curve is plainly marked. Many people publish curves showing this or that, especially in technical papers, which hide more information than they disseminate. In fact, some writers seem to adopt the rule : "If one wishes to give nothing away, show it in graph form, and give no information in plain facts or figures."

ELECTRICAL ACCIDENTS IN MINES FOR THE YEAR 1913.

According to the reports of H.M. Inspector of Mines, during the year 1913 there occurred in the coal mines of Great Britain 15 electrical accidents resulting in 16 deaths, while 50 non-fatal accidents resulted in injuries to 51 persons, but of these only 42 of the accidents caused injuries to 43 workmen, which disabled them for more than seven days. Altogether there were 1,220 fatal accidents which caused 1,753 deaths, so that the percentage of deaths due to electrical accidents is a little over 0·9 per cent. There were, however, no fewer than 177,189 persons injured, so that the proportion of non-fatal electrical accidents is still less, being only about 0·024 per cent., and considering the great development of electricity in mines it certainly cannot be said that it has increased the danger to workmen employed. Still, one could wish there were no accidents due to electricity ; as a rule, with proper care and attention these are preventable, and while electricity is looked upon as "dangerous," it is worth noticing that 45 fatal accidents were caused *by machinery*, and 1,322 considered as specially dangerous.

As regards the accidents, they were in nearly all cases due to electric shock caused by the person coming in contact with a defective cable or other "live" part not efficiently protected or "earthed."

Four fatal and ten non-fatal accidents occurred in Scotland. Of the fatal accidents, one caused the death of a "drawer" at Kenmairhill Colliery, where three-phase alternating current at 400 volts, 25 cycles, is supplied by the Clyde Valley Power Co., and is used for pumping, hauling and coal cutting. In the No. 2 Rise section of the Virtuewell seam, where the accident happened, it was used

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for coal cutting only. Until the present regulations came into force the cables were single core and bitumen insulated, but unarmoured, and these at the time of the accident were being replaced by a three-core armoured cable. In that part of the pit in which the accident occurred the new cable was in place, and was almost ready for connecting up.

There were some drawers and miners on the back shift clearing the faces for the coal-cutters, and it was one of the drawers who was killed. This drawer was working for a brusher, and, as it was food time, he told his employer he was going to have some food. It was customary to go to the haulage lye for it, and in the present case he was going there with a tub. No one saw what occurred, but a lad on his way from the shaft saw the body lying, and he returned to the shaft bottom, where the electrician and fireman cut off the current and hastened in-bye. Deceased was found lying on his back grasping one of the cables in his right hand, and the front of two of his fingers was burned away. Artificial respiration was tried, but the body was nearly cold, and, after about 10 minutes' trial, it was seen to be of no use. It is thought that he had drawn the cable aside to get the flask, and that in so doing had grasped a part which was without effective insulation and was killed.

Each of the three cables was 7/14 S.W.G. bitumen-covered and protected with jute braiding. Just at the part the man had grasped the braiding had become frayed, and at some time in the past it had evidently been taped over to prevent further fraying. The drawer, who was killed, may have cracked or broken the bitumen inside the taping when pulling the cable, or more probably, it was broken there before, and had been merely taped over instead of having been properly insulated before being taped. Mr. Masterton, who investigated this accident, had another joint similar to this opened and found waterproof taping only on top of badly-cracked and hardened bitumen. Other two parts opened had been properly repaired. The cables had been in this colliery for at least three years, and probably for five; no history of them had been kept, and they had been shifted many times. The tapings were old, and neither the person who did them nor the time they were done could be traced.

The electrician said he had examined the cables minutely eight or 10 days before the accident, and, as he and his assistant were in the section daily, they were seen daily, though not in detail. The place where the accident occurred probably looked all right, but the cables generally were as Mr. McIlhenny found them a few days before the accident, viz., exceedingly bad, and they should have been condemned by the electrician.

An accident occurred at Auchengeich Colliery, by which a motorman lost his life.

A turbine pump driven by three-phase alternating current at 440 volts, is placed near the shaft. In order to prevent the pump from going on "air" there is a contrivance contained in a cast-iron box for opening a switch which controls the running of the pump motor. The switch-box cover is secured by two screws. The contrivance was seldom in use, and at the time of the accident, *the switch was out of order*, as one of the contacts was burned out. Deceased was employed at a motor haulage situated about 25 yards away from the pump. He left his place and went to the pump room, and in examining the switch-box referred to, the cover of which was off, he received a fatal shock. As the switch was not in use the connection should have been cut, rendering the whole contrivance dead. The electrician in charge was held, in some measure, to blame for this neglect.

A fireman employed at the Broomrigg Colliery, received a fatal electric shock when working in the neighbourhood of a coal-cutter. The trailing cable was coupled up to the coal-cutter and the gate-end box, and the deceased was engaged in paying out the haulage rope. The machineman closed the switch in the gate-end box, but, as in doing so he received a shock, he at once opened it again. Going down the face he found the deceased apparently dead. Two other men near the machine had also received shocks. The motor was supplied with three-phase current at 440 volts. To account for the accident the management put forward the theory that the deceased had received a shock by making contact with a faulty part of the trailing cable, but the trailing cable had been examined by the electrician on the surface on the morning of the accident, and had just been brought down the pit. For these reasons the theory of the management seems doubtful.

When the machine was examined on the surface, a spot was found in the plug-box where undoubtedly arcing had taken place between the conductors and the frame, and it was considered most probable that this defect caused the accident. The earthing system was defective, as proved by the shock obtained from the gate-end box. The machine was not earthed direct to the surface, but to the delivery pipes of a pump in the seam. The machine man stated that he had received slight shocks on previous occasions.

An earthing system must be completely effective, otherwise it is worse than useless, as it engenders a feeling of security where there is none. In this instance there was little doubt the accident was due to a defective earthing system. Since the accident the apparatus has been brought into conformity with the electricity regulations in all respects.

An accident occurred at Lochore Colliery, by which a roadman lost his life.

The accident occurred on a fairly dry level haulage road opposite a switch-house. There were two girders across the entrance to this switch-house, acting as bearing girders for three of the roadway girders. The place was lighted by electric glow lamps, supplied with current at 500 volts through 3/20 rubber-insulated unarmoured cable, the current being tapped off two phases of the alternating-current power supply. The lighting cables passed under the bearing girders mentioned, which had sagged owing to a severe crush on the road, until they were bearing hard on the cables, one of which had become thereby abraded. This caused the two bearing girders and the three girders resting on them to become "live," a circumstance which became known to several men, including deceased, and in consequence an electrician was sent for to cut off the current. There was a switch in the house just mentioned, but none of the men on the spot, although one of them was an oversman, knew exactly how it worked. As the electrician was a long time in coming, the oversman decided to go to assist in the search for him, and left deceased to guard the place and prevent any person touching the girders. Almost immediately deceased was seen to fall backwards, when apparently searching for something between the girders with his lamp. Artificial respiration was tried at once, and kept up until the arrival of a doctor on the spot an hour later, but life was pronounced to be extinct. Although deceased was apparently guilty of great carelessness, it is to be regretted that the oversman was not able to switch off the current.

At the inquiry the jury returned a formal verdict, and added three riders to the following effect, viz.:—

1. That the present high voltage for lighting the pit should at once be reduced.
2. That in exposed and dangerous places cable stronger mechanically than the cable in use should be adopted.
3. That officials of the mine should receive such instructions as would enable them to switch off current in cases of emergency.

Of the 10 non-fatal accidents underground, these are briefly referred to by the Inspector as follows:—

1. A machineman had his finger burnt owing to the failure of the insulation of a trailing cable.
2. A machineman at the same colliery had his right arm burnt owing to the failure of the insulation of a cable.
3. A machineman was examining a trailing cable when the insulation failed. He received slight burns about the eyes.
4. A coal-cutting machine was at work, but the commutator-cover had not been securely fixed, and, in consequence, it became displaced, when it came into contact with a bar set to the roof. The cover touched the brushes, and a machineman received slight burns from the resulting arcs. This accident seems to have been due to pure carelessness.
5. Another accident which must be placed in the same category resulted in unconsciousness for a time. A fall of roof occurred which severed the tubes carrying medium pressure lighting cables. Instead of cutting off current at once, as required by Regulation 131 (*e*) the electrician attempted a repair with the current on. He asked the man who was subsequently injured to hold the tube, and whilst they were twisting it to get it straight the cable drew out of a lampholder and touched the inside of the tube, which was not earthed for the moment, in consequence of the break. Fortunately, the man holding the tube was standing on dry ground, and escaped with no further injury than that stated. I cannot understand a skilled man allowing men working for him

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to take risks of this kind, and it is very fortunate indeed that the consequences were not more serious.

6. A motor attendant was replacing a fuse controlling five motors, aggregating 125 H.P. on a 500-volt D.C. circuit. By some means the controller of a 40-H.P. motor had been left in the running position, so that as soon as he attempted to put the fuse home, it blew, and he received injuries to the eyes. It would have been better had a switch been in position on the out-bye side of the fuse box, so that the current could have been cut off when fuses were being replaced. This would have complied with Regulation 128 (*b*), and I am glad to say the change was made.

7. Two men were drawing a concentric trailing cable forward when the insulation failed, and one man received burns on the hand from the resulting arc.

8. A machineman was drawing forward a concentric trailing cable when the insulation failed, and there was an arc which severely burned his left arm and forearm. Some days previously a stone had fallen on the cable and sparks had been seen, but a subsequent test with lamps failed to reveal any defect. It seems a great pity that a more thorough test was not made in this case with higher pressure.

9. A motorman was replacing a fuse, when it blew and burnt his right arm. A switch was provided against the fuse-box for cutting off current from the fuse-box when fuses were being replaced, and the injured man alleges that this switch was open. I think, however, he must have been mistaken.

10. A man was crawling over a concentric cable supplying current to a coal-cutting machine, when the insulation failed and he received burns on the abdomen.

The fact that six of these accidents were due to failure of insulation of cables shows how important it is that this matter should have careful and skilful attention. We have often referred to the difficulty of maintaining good insulation in mines, and the necessity of employing competent electricians who understand "insulation" and "earthing," and we regret to read the Inspector's remarks referring to the careful examination of cables: "This is sadly neglected at some mines."

There were no fatal accidents on the surface, but an apprentice electrician was burned on his hands while measuring the distance between terminals through failing to remember that they were "live," and another young apprentice touched a live wire carrying current at 500 volts with another piece of wire in order to ascertain whether it were really "live." Fortunately he escaped with a slight burn on the left hand. As the Inspector says, comment is needless.

(*To be concluded.*)

Electric Lighting of Trains in U.S.A.—At the annual convention of the Association of Railway Electrical Engineers at Chicago, in October, it was stated that more than one-half of the cars in use by the principal American railroads were electrically lighted. The number of electrically lighted railroad cars had increased from 11,017 in 1911 to nearly 19,000 in 1914, an increase of about 72 per cent. Greatest growth had been shown by the straight-storage-battery and axle-generator system, while the number of head-end installations had increased by about one-third the percentage of axle-lighting installations. Nearly 260,000 cells of lead storage battery were in use in the car-lighting field, compared with 32,000 cells of nickel-iron battery, although the number of cells of the latter had increased nearly six times in the last two years.

The report of a Committee on axle-lighting equipment showed that, taking into account certain railroads operating in the north-west section of the United States which favoured the head-end system of lighting, 23,477 cars, or 84 per cent. of the electrically-lighted cars in the United States, Canada and England, were lighted by the axle-generator system. Of the remaining 16 per cent. about nine-tenths could be converted to axle-lighting without loss. Data were given in the report concerning operating costs in the United States and England, and particular attention was called to the high cost of maintaining the dynamos as compared with all other parts of the equipment. Battery maintenance, for example, was found to amount to only about one-half that for generators.

Mr. K. R. Hare, chief electrician of the Northern Pacific Railroad, described the system of head-end lighting from an axle-driven generator mounted in the baggage car, which had been developed by that railroad. Experiments in this direction began in 1909, and the latest type of unit, installed this year, comprised a 20-KW., six-pole, commutating-pole, compound-wound, 80-volt Gould generator, which ran at speeds of from 300 R.P.M. to 2,100 R.P.M. A Morse silent chain drove the generator from a countershaft. This outfit had already run 40,000 miles without a failure. The maximum lamp load was 100 amperes, and the generator was in operation about 80 per cent. of the time. Cells of battery were placed beneath the postal car, the dynamo car, the sleepers and the observation car. The head-end axle-lighting system presented a number of advantages, including the absence of excessive heat in the baggage or express car, and the avoidance of terminal charging. —*Electrical World.*

TRADE STATI

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	1912. Francs.	1913. Francs.	Inc. or Dec. Francs.
Steam engines, locomobiles, steam turbines, etc.—			
From Germany	437,000	791,000	+ 354,000
,, France	41,000	28,000	— 13,000
,, Great Britain ...	71,000	23,000	— 48,000
,, Other countries ...	6,000	9,000	+ 3,000
Total	555,000	851,000	+ 296,000
Gas, petrol, benzine, etc., motors.—			
From Germany	306,000	286,000	— 20,000
,, France	123,000	148,000	+ 25,000
,, Italy	36,000	15,000	— 21,000
,, Great Britain ...	11,000	15,000	+ 4,000
,, United States ...	35,000	35,000	—
,, Other countries ...	20,000	11,000	— 9,000
Total	531,000	510,000	— 21,000
Accumulators, batteries, electrodes.—			
From Germany	244,000	342,000	+ 98,000
,, Austria	77,000	45,000	— 32,000
,, France	31,000	33,000	+ 2,000
,, Other countries ...	8,000	9,000	+ 1,000
Total	360,000	429,000	+ 69,000
Insulators mounted.—			
From Germany	93,000	149,000	+ 56,000
,, France	2,000	2,000	—
,, Other countries ...	3,000	1,000	— 2,000
Total	98,000	152,000	+ 54,000
Electric meters.—			
From Germany	970,000	963,000	— 7,000
,, France	104,000	78,000	— 26,000
,, Italy	10,000	12,000	+ 2,000
,, Great Britain ...	3,000	7,000	+ 4,000
,, United States ...	5,000	6,000	+ 1,000
,, Other countries	17,000	5,000	— 12,000
Total	1,109,000	1,071,000	— 38,000
Telegraph and telephone apparatus.—			
From Germany	348,000	515,000	+ 167,000
,, Belgium	297,000	224,000	— 73,000
,, Great Britain ...	19,000	24,000	+ 5,000
,, Sweden	44,000	55,000	+ 11,000
,, Other countries ...	16,000	54,000	+ 38,000
	724,000	872,000	+ 148,000

Note.—25 francs = £1..

EXPORTS.

The following figures show he exports of electrical and similar machinery from Switzerland in 1912 compared with 1913. The diversity of Switzerland's growing export trade is noteworthy :—

	1912. Francs.	1913. Francs.	Inc. or Dec. Francs.
Dynamo-electric machines and electric transformers of all kinds.—			
To Germany	2,837,000	3,471,000	+ 634,000
,, Austria	1,093,000	1,125,000	+ 32,000
,, France	3,756,000	4,174,000	+ 418,000
,, Italy	901,000	934,000	+ 33,000
,, Belgium	914,000	882,000	— 32,000
,, Great Britain	822,000	1,234,000	+ 412,000
,, Russia	1,805,000	3,278,000	+ 1,473,000
,, Spain	1,410,000	2,080,000	+ 670,000
,, British India	280,000	182,000	— 98,000
,, Mexico	24,000	79,000	+ 55,000
,, Brazil	757,000	1,255,000	+ 498,000
,, Argentina	968,000	231,000	— 737,000
,, Other countries ...	1,459,000	1,428,000	— 31,000
Total	17,026,000	20,353,000	+ 3,327,000
Hydraulic and wind motors and pumps.—			
To Germany	1,223,000	1,149,000	— 74,000
,, France	848,000	1,028,000	+ 180,000
,, Italy	500,000	645,000	+ 145,000
,, Great Britain	480,000	554,000	+ 74,000
,, Russia	279,000	492,000	+ 213,000
,, Spain	468,000	1,151,000	+ 683,000
,, Japan	1,413,000	520,000	— 893,000
,, Canada	81,000	410,000	+ 329,000
,, Mexico	435,000	326,000	— 109,000
,, Brazil	558,000	120,000	— 438,000
,, Argentina	269,000	590,000	+ 321,000
,, Other countries ...	1,566,000	2,107,000*	+ 541,000
Total	7,999,000	8,520,000	+ 521,000

* Includes South Africa 359,000 fcs., and India 536,000 fcs.

	1912. Francs.	1913. Francs.	Inc. or Dec. Francs.
Steam engines, cranes, pumps, turbines, &c.—			
To Germany	1,743,000	2,206,000	+ 463,000
,, France	638,000	888,000	+ 250,000
,, Belgium	1,249,000	1,152,000	— 97,000
,, Russia	1,549,000	3,244,000	+ 1,695,000
,, British India	203,000	84,000	— 119,000
,, Japan	269,000	590,000	+ 321,000
,, Other countries ...	2,589,000	2,330,000*	— 259,000
Total	8,240,000	10,494,000	+ 2,254,000

* Includes Great Britain 651,000 fcs.

Gas, petrol, benzine, hot air, &c., motors.—			
To France	2,406,000	2,599,000	+ 193,000
,, Italy	1,979,000	1,181,000	— 798,000
,, Great Britain	770,000	569,000	— 201,000
,, Russia	862,000	1,337,000	+ 475,000
,, Roumania	315,000	716,000	+ 401,000
,, Egypt	1,039,000	599,000	— 440,000
,, Algeria and Tunis ...	458,000	346,000	— 112,000
,, Argentina	374,000	794,000	+ 420,000
,, Australia	301,000	155,000	— 146,000
,, Other countries ...	3,918,000	3,610,000*	— 308,000
Total	12,422,000	11,906,000	— 516,000

* Includes Brazil 448,000 fcs., Germany 717,000 fcs.

Electric meters.—			
To Germany	291,000	629,000	+ 338,000
,, Austria-Hungary ...	150,000	184,000	+ 34,000
,, France	465,000	635,000	+ 170,000
,, Italy	198,000	355,000	+ 157,000
,, Other countries ...	249,000	504,000*	+ 255,000
Total	1,353,000	2,307,000	+ 954,000

* Includes Great Britain, 181,000 fcs.

Steam, benzine and electric locomotives.†—			
To France	797,000	405,000	— 392,000
,, Algeria and Tunis ...	68,000	350,000	+ 282,000
,, Dutch E. Indies ...	157,000	41,000	— 116,000
,, Italy	130,000	—	— 130,000
,, Other countries ...	306,000	537,000*	+ 231,000
Total	1,458,000	1,463,000	+ 5,000

* Includes Turkey in Asia 158,000 fcs.
† Electric locos in 1912, £257,000; in 1913, none specified.

Electric cable not insulated.—			
To Germany	1,000	3,000	+ 2,000
,, France	24,000	5,000	— 19,000
,, Other countries ...	2,000	1,000	— 1,000
Total	27,000	9,000	— 18,000
Electric cable insulated with rubber or paper.—			
To Germany	9,000	25,000	+ 16,000
,, France	28,000	80,000	+ 52,000
,, Italy	58,000	38,000	— 20,000
,, Other countries ...	282,000	47,000	— 235,000
Total	377,000	190,000	— 187,000
Cable ditto covered with lead.—			
To Germany	42,000	8,000	— 34,000
,, Great Britain	34,000	43,000	+ 9,000
,, Spain	—	7,000	+ 7,000
,, Other countries ...	9,000	4,000	— 5,000
Total	85,000	62,000	— 23,000
Cable ditto, covered with lead and iron armoured.—			
To Germany	213,000	303,000	+ 90,000
,, Great Britain	432,000	393,000	— 39,000
,, France	6,000	14,000	+ 8,000
,, Egypt	1,000	12,000	+ 11,000
,, Other countries ...	13,000	11,000	— 2,000
Total	665,000	733,000	+ 68,000
Cable insulated with rubber or paper and covered with textiles.—			
To France	14,000	24,000	+ 10,000
,, Italy	65,000	123,000	+ 58,000
,, Great Britain	28,000	224,000	+ 196,000
,, Other countries ...	33,000	14,000	— 19,000
Total	140,000	385,000	+ 245,000
Cable ditto covered with lead.—			
To Germany	12,000	9,000	— 3,000
,, Great Britain	3,000	8,000	+ 5,000
,, Other countries ...	8,000	6,000	— 2,000
Total	23,000	23,000	—

Note.—25 francs = £1.

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NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

23,269. "Process for the manufacture of metallic tungsten and its alloys." J. C. BUTTERFIELD. November 30th.

23,272. "Electric switches." J. H. TUCKER & J. A. CRABTREE. November 30th. (Complete.)

23,274. "Device for coupling together two or more servo-motors with any desired phase relationship." W. H. RIDDLESWORTH. November 30th.

23,282. "Telephone instruments." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. November 30th. (Automatic Electric Co., United States.)

23,283. "Telephone receivers." L. BROWN & C. MACINTOSH & Co., LTD. November 30th.

23,292. "Electrical process for producing cyanides." J. E. BUCHER. November 30th. (Convention date, June 25th, 1914, United States.) (Complete.)

23,293. "Electrical water-heater." S. LE F. VARVEL. November 30th. (Complete.)

23,314. "Electric heat-radiators." A. B. NEIMAN. November 30th. (Complete.)

23,321. "Control of switches for electric lighting or heating systems." ELECTRIC & ORDNANCE ACCESSORIES CO., LTD., & J. ETCHELLS. November 30th. (Complete.)

23,332. "Electrical (pen or pencil) lamp attachment." D. F. LINTINE. December 1st.

23,339. "Contact-fingers for electric drum-type controllers and the like apparatus." O. B. JACOBSEN. December 1st.

23,357. "Electric starters for use on motor-cars and the like." A. H. MIDGLEY & C. A. VANDERVELL. December 1st.

23,359. "Limiting reactance coils." J. F. PETERS. December 1st. (Convention date, February 5th, 1914, United States.) (Complete.)

23,366. "Controllers for electric motors." IGRANIC ELECTRIC CO., LTD. December 1st. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

23,368. "Automatic regulating apparatus for dynamo-electric machines." V. A. TRIER. December 1st.

23,379. "Controlling movement at a distance." HARLE ET CIE. December 1st. (Convention date, December 1st, 1913, France.) (Complete.)

23,380. "Telegraph and like signalling systems." T. B. DIXON. December 1st. (Convention date, December 5th, 1913, United States.) (Complete.)

23,392. "Insulated wire and electric-cable coupler." J. M. DUNKLEY. December 2nd.

23,420. "Incandescent electric lamp-holders." W. S. JOHNSTON. December 2nd

23,443. "Production of incandescent light from rare earths." G. F. JAUBERT. December 2nd. (Complete.)

23,444. "Electric starting and illumination of motor-cars." L. RENAULT. December 2nd. (Convention date, December 2nd, 1913, France.) (Complete.)

23,445. "Heating elements." N. C. F. CRONHOLM, A. J. HOOG, & F. O. NILSON. December 2nd. (Convention date, December 3rd, 1913, Sweden.) (Complete.)

23,452. "Electro-deposition of iron." S. O. COWPER-COLES. December 3rd.

23,453. "Process for coating metallic or other surfaces with metals." S. O. COWPER-COLES. December 3rd.

23,454. "Coating metallic or other surfaces with metals." S. O. COWPER-COLES. December 3rd.

23,455. "Production of tinplates and tinplate substitutes by electrolysis." S. O. COWPER-COLES. December 3rd.

23,456. "Electro-plating metallic sheets." S. O. COWPER-COLES. December 3rd.

23,457. "Construction of electrolytic anodes." S. O. COWPER-COLES. December 3rd.

23,458. "Apparatus for coating sheets and plates in continuous lengths." S. O. COWPER-COLES. December 3rd.

23,459. "Apparatus for electro-plating sheets and other objects." S. O. COWPER-COLES. December 3rd.

23,481. "Electric lamps." P. RAMY. December 3rd. (Convention date, December 30th, 1913, Belgium.) (Complete.)

23,485. "Secondary batteries or accumulators." J. C. A. WARD & R. PAPE, LTD. December 3rd.

23,486. "Electric insulators." C. B. BURDON. December 3rd. (Siemens-Schuckertwerke G.m.b.H., Germany.) (Complete.)

23,495. "Electric resistance furnaces." G. GMUR-ZEHNDER. December 3rd. (Complete.)

23,496. "Manufacture of ductile tungsten." GLUHFADENFABRIK AARAU AKT. GES. VORM. GMDR ET CIE. December 3rd. (Convention date, January 15th, 1914, Germany.) (Complete.)

23,505. "Transformer connection for three-phase metal-vapour rectifiers." ALLGEMEINE ELEKTRICITATS-GES. December 3rd. (Convention date, December 3rd, 1913, Germany.) (Complete.)

23,513. "Automatic and semi-automatic telephone systems." BETULANDER AUTOMATIC TELEPHONE CO., LTD., & F. M. WARD. December 4th.

23,524. "Electric lamp fittings and the like." A. A. SCHASCHKE. December 4th

23,544. "Electro-magnetic switches." BRITISH THOMSON-HOUSTON CO., LTD. December 4th. (General Electric Co., United States.)

23,555. "Combined incandescent electric lamp and reflector." C. P. LAWSON. December 4th. (Complete.)

23,563. "Electric ringing-apparatus or other mechanism having polarised electro-magnets." V. CLEUET & G. BONNEUIL. December 4th. (Convention date, December 17th, 1913, Belgium.) (Complete.)

23,566. "Electrically-operated tabulating and like machines." C. A. E. A. GREENE & BRITISH TABULATING MACHINE CO., LTD. December 4th.

23,571. "Electric junction boxes." APPAREILLAGE GARDY SOC. ANON. December 4th. (Convention date, December 5th, 1913, Switzerland.) (Complete.)

23,572. "Frequency-changing transformers." T. KUJIRAI. December 4th. (Complete.)

23,577. "Method and means of fixing insulating-material on the surfaces of metallic walls of ships' cabins, refrigerating plant, and other structures." G. LIZIERI. December 4th.

23,605. "Supports for electric lamps." G. S. HERNE. December 5th.

23,628. "Magnetos and other electric generators." A. KELLER-DORIAN. December 5th. (Addition to 8,391/14. Convention date, December 6th, 1913, France.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

18,869. ELECTROLYTIC DEVICES SUITABLE FOR USE AS OR IN THE CONSTRUCTION OF METERS, SWITCHES, AND OTHER APPARATUS. W. B. Thorpe & Thorpe Meter Syndicate, Ltd. August 19th.

23,444. ELECTRIC SWITCHES. J. H. Tucker & J. A. Crabtree. October 16th.

23,454. APPARATUS FOR ELECTROLYTICALLY CLEANING ARTICLES. E. le R. Couch. October 16th. (January 31st, 1913.)

25,915. ELECTRIC SWITCHES. D. Adamson. November 12th.

25,991. ELECTRIC LINE SELECTOR SWITCHES. I. H. Parsons. November 12th.

26,077. MUSIC TRANSMITTING APPARATUS. J. J. Comer. November 13th (November 13th, 1912.)

26,139. AUTOMATIC EQUIPOISE OR STABILITY CONTROL APPARATUS. F. C. R. Marks. November 14th. (H. Chapman.)

26,497. ELECTRICALLY AND GAS HEATED COOKING OVENS. A. F. Berry. November 18th.

26,831. MEANS FOR USE IN CONTROLLING THE TEMPERATURE OF ELECTRICALLY-HEATED COOKING AND STERILIZING APPARATUS AND THE LIKE. C. E. Hearson. November 21st.

27,360. TIME-ACTUATED MECHANISMS. R. C. Griesbach & Venner Time Switches, Ltd. November 27th.

28,826. ALTERNATING-CURRENT ELECTRIC METERS OF THE INDUCTION TYPE. British Thomson-Houston Co., Ltd., & A. P. Young. December 13th.

1914.

133. ELECTRIC LAMPS FED BY DYNAMO-ELECTRIC GENERATORS DRIVEN BY IRREGULAR ACTUATING MEANS. F. Esteve. January 2nd. (January 4th, 1913.)

925. ELECTRIC CURRENT CONTROLLERS AND LIKE APPARATUS. G. Ellison. January 13th.

5,243. SHIPS' BINNACLES OR THE LIKE. J. W. Mackenzie (B. A. Hand). February 28th.

8,138. COMPOSITION PARTICULARLY SUITABLE FOR INSULATING ELECTRIC CONDUCTORS. T. J. Hadley. March 31st.

9,840. AUTOMATIC OR SEMI-AUTOMATIC TELEPHONE EXCHANGE SYSTEMS. G. A. Betulander. April 21st. (April 23rd, 1913.)

10,707. TIME ALTERNATE-CURRENT METERS. Compagnie pour la Fabrication des Compteurs et Materiel d'Usines a Gaz. April 30th. (July 8th, 1913.)

12,659. CONTROLLING APPARATUS FOR ELECTRICAL LIFTS AND THE LIKE. A. W Penrose & Co. & M. Owen. May 22nd.

13,291. DIAPHRAGMS FOR SOUND RECORDING AND REPRODUCING DEVICES SUCH AS TALKING MACHINES. L. N. Reddie (Owen & Hewitt). May 30th.

14,342. COMBINED INSULATING AND FASTENING MEANS FOR RAILWAY AND LIKE RAILS. W. R. Gorrell. June 13th. (April 20th, 1914.)

15,549. PRINTING TELEGRAPH APPARATUS. A. E. Alexander (Union Switch & Signal Co.) June 29th.

15,550. PRINTING TELEGRAPH APPARATUS. A. E. Alexander (Union Switch & Signal Co.). June 29th.

17,487. RECEIVING SYSTEMS FOR RADIO TELEGRAPHY OR TELEPHONY. G. O. Squier. July 23rd.

Gyrostatic Control.—In a paper read before the Institution of Engineers and Shipbuilders in Scotland on November 17th, Dr. J. G. Gray described a number of new gyrostatic devices for controlling moving bodies, such as torpedoes, and showed that they possessed marked advantages over those at present in use. The latter were effective only for short distances, but the new devices could ensure the maintenance of motion in a straight line for very long distances. Torpedoes thus controlled could also be steered by wires, but the author considered that the direction of torpedoes by wireless transmission was not practical at present, as the sending apparatus would have to be tuned to the receiving apparatus on the torpedo beyond the possibility of interference from without. Aeroplanes and airships capable of being steered and elevated or depressed, under the control of electrical action, could be devised, and would be useful for fighting Zeppelins.

Dr. Gray held that motor gyrostats would in the future play a great part in warfare, and urged that this country should take the lead in the scientific advancement of the subject.

Proposed New Cyanamide Works.—It is stated that the Prussian Minister for Agriculture is in negotiation with various circles for the purpose of providing a substitute in the form of calcium cyanamide and sulphate of ammonia for the present lack of supplies of Chilean nitrate. The imports of Chilean nitrate into Germany amount to about 900,000 tons per annum, of which 200,000 tons are required by the chemical industry and the balance of 700,000 tons by the agricultural industry. It is now sought to take action so as to provide for a large portion of this tonnage being ready for next autumn. The existing works—Knapsack, Baden Aniline and the Bavarian Nitrogen Works of Troptberg—are said either to be competing or co-operating in connection with certain schemes which are based upon the use of existing or prospective electrical powers for the purpose, and leading electrical groups seem to be participating in the preparation of the projects. The Siemens & Halske Co. is already interested in the Bavarian Nitrogen Works Co., which has just declared a dividend of 8 per cent. for 1913-14, as compared with 9 per cent. in 1912-13.

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THE

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ELECTRICAL REVIEW.

Vol. LXXV.] CONTENTS: December 25, 1914. [No. 1,935.

	Page
The L.C.C. Tramways Breakdown	837
The I.E.E. Theatre	838
Professional Etiquette	838
Copper	838
Swiss or German?	839
"We Can't take the Risk" by R. S. T. V.	839
The Effect of Vacuum in Steam Turbines, by G. G. Stoney	840
Power Plant Testing, by W. Selvey	842
The Promotion of the Electrical Trade	843
War Items	844
Correspondence—	
Expenses of Applicants for Appointments	845
Why Britain Loses Trade	845
A New Use for Black Tape	845
Appointments in Hong-Kong	846
Re Rear Lights on Vehicles	846
Electrical Trades and Motor-Ambulances: A Proposal	846
Contradiction	846
German or British?	846
New Electrical Devices, Fittings and Plant (*illus.*)	846
Legal	847
Business Notes	847
New Turbine Plant at Liverpool (*illus.*)	851
Notes	856
City Notes	858
Stocks and Shares	861
Market Quotations	862
Exports and Imports of Electrical Goods during Nov., 1914	863
Electrical Accidents in Mines for the Year 1913 (*continued*)	864
Recent Advances in Electrical Crane and Lift Design (*illus.*) (*continued*)	866
New Patents Applied For, 1914	868
Abstracts of Published Specifications	868
Contractors' Column	Advertisement page xx

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1915 EDITION

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H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C

THE L.C.C. TRAMWAYS BREAKDOWN.

THE recent breakdown of the London County Council's tramway service over practically the whole of the metropolis was the most serious of the various interruptions which have occurred in connection with this system.

While the supplementary statement of the Highways Committee removes any doubt which may have existed as to the cause of the trouble, we feel that no explanation for such an occurrence short of a general disaster or—what is much the same thing—a general strike, can be regarded as satisfactory in the case of a public transportation service such as the London tramways are supposed to give.

Indeed, one may go further and say that a stoppage of this magnitude casts a serious reflection on our present-day engineering ability, for there is no doubt that the London tramways, as a whole, represent a high standard of engineering construction, even though they fall considerably short of that state of perfection which municipal councillors frequently describe as "the last word."

According to the statements made before the Council and by the Highways Committee, the origin of the trouble was the bursting of a ten-year-old instrument transformer box at the Greenwich tramway generating station, which apparently spattered burning oil on, and set fire to, a temporary wooden staging close by, the staging being in use in connection with the alterations which are being carried out in the building.

This, in itself, would have mattered little had not the fire been able to reach and destroy all the generator leads connecting the machines to the switchgear, with the disastrous result that the generating plant was completely isolated and shut down. As the station was originally designed, each generator was coupled directly to a section of four feeders, and the Council's official description of the plant, which was issued on the occasion of the opening ceremony, expressly stated in reference to the switchgear, which is of the usual cubicle construction, that "the whole arrangement is entirely fireproof." Unfortunately we know now that this very necessary feature did not extend to the exposed cable connections for coupling up the generators and the switchgear installed on the lower and upper galleries, the arrangement of which was illustrated in our issue of May 7th, 1909, and was described in detail in the paper by Mr. F. Walker before the I.E.E. in February, 1907. Apparently the main three-core lead-covered cables pass up open brickwork chases to the level of the lower gallery, above which, mounted on the wall, come trifurcating boxes, isolating plugs in enclosed chambers, instrument transformer tanks mounted on open shelves, and the trifurcating boxes from which the main three-core cables run up to and along the underside of the upper gallery which carries the main oil switches.

We have outlined the arrangement because it will probably bear favourable comparison with the majority of H.T. lay-outs installed in our generating stations, on which reliance is being placed at the present time for that continuity of supply which is an essential condition of electrical distribution work; also, because the inference may be reasonably drawn that any H.T. system which does not provide complete fireproof cubicle enclosure of every vital

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link in the chain connecting the generator and outgoing feeder is more or less open to the same risk of total shut-down.

We hesitate to ask how many engineers are satisfied that their installations will comply with such a requirement, despite the attention drawn to the matter by the various switchgear fires which have occurred in recent years.

We, as electrical engineers, have accepted the responsibility of running public services, such as the lighting of streets and operation of tramways, not to mention the ever-growing supply for industrial purposes on which the livelihood of thousands of our operatives depends, and it is up to us to justify the confidence which has been reposed in our engineering ability.

So far the record, despite some blemishes, is no unworthy one for the central station engineer, who has in the last two decades been confronted with problems far more complex than those which have arisen in other spheres of engineering work.

It is the rapid development of electrical supply work, and the immensely larger issues which will be involved in the course of a few years, which render it so necessary for us to reconsider our methods to-day. The subdivision of switchgear by cubicle constructional methods, the isolation of the switch-house from the engine room, and the separation of engine and boiler houses by means of a "buffer" bay containing auxiliary plant, may, in view of the generating plant of the future containing comparatively few but very large sets, require extension in the direction of independent switch-houses for each large generating set and its own feeders, the extra cost of which would be quite justified if the satisfactory isolation of the generating units was obtained.

Low capital cost and high efficiency will prove but a fetish unless the security of the supply is assured, and the engineer must be prepared to sacrifice even more in the future than he has in the past in order to achieve absolute reliability.

The I.E.E. Theatre.

Members of the Institution who have recently attended meetings cannot have failed to notice the improvement which has been effected in the lighting of the theatre. It will be remembered that in March last we drew attention to the very marked deterioration which had taken place in the quality of the illumination, particularly with regard to the power of distinguishing details at a distance; one seemed to be bathed in light and yet unable to see clearly. We suggested that the installation of a few flame arcs or high-candle-power incandescent lamps above the ceiling would probably effect a marked improvement in the lighting, and this course has been followed, no fewer than 16 lamps of 2,000 c.p. each having been installed, with the result that the theatre has lost its depressing influence and is now bright and cheerful.

This end has been attained, however, at the cost of efficiency, in that, in order to secure an adequate degree of general illumination, it has been necessary to provide an excessive illumination on the horizontal plane. As we pointed out in our leaderette, there was even then an abundance of light on the horizontal plane, but too little at an angle with that plane; and we are inclined to agree with Mr. A. P. Trotter, who, commenting on our criticism, suggested that "a few lamps judiciously placed, and contributing but little to the illumination," would have the effect of dispelling the monotony of the wholly indirect system of lighting. These lamps, of course, enclosed in suitable anti-glare fittings, would be exposed to view within the theatre, and would supply the "metaphysical" effects demanded by Mr. T. Birkett in the course of the correspondence which we published, whilst probably enabling a proportion of the external lighting to be dispensed with. It is evident that there is room for further investigation, and we trust that the Council will continue experimenting until it has made the finest lecture theatre in London also the best lighted theatre, which the hall of the Institution of Electrical Engineers ought to be.

Professional Etiquette.

In February last we drew attention to a circular issued by the Council to the members of the Institution of Civil Engineers, in which the practice followed by some local authorities of advertising for consulting engineers was severely reprobated; the Council expressed its repugnance to the practice in question, and its confident expectation that the members would support it by declining to respond to such advertisements.

While we cordially approved of the action of the Council, we suggested that its code of professional etiquette was notoriously disregarded by some members, and by the Association of Consulting Engineers, which, we believed, was in the habit of hurling its whole list of members (numbering some 70) at the head of the advertiser. Apparently the Council has been obliged to take cognisance of the fact that its rather naive trust has been abused, for another circular has recently been issued, in which a particular advertisement is cited as having led to a lamentable backsliding on the part of "a number of corporate members of The Institution."

The Council is long-suffering in the extreme and slow to wrath; but for some reason not apparent on the surface, this particular fall, or rather these several falls, from grace have proved too much for its endurance. Response to such an advertisement is roundly declared to be opposed to the best interests of the Institution and the Engineering profession, and to constitute an action of professional misconduct which renders the offender liable to expulsion.

The matter is left at that, the awesome threat being evidently deemed sufficient to terrify the most recalcitrant into abject submission. We cannot help feeling some misgivings, however, as to the probable effectiveness of the Council's warning. The practice thus condemned has been so long condoned that it is difficult to believe that the sentence will prove to consist of more than sentences usually do consist of—namely, words.

Copper.

Since last writing, copper has had a capital market on the whole, and although the highest prices touched have not been supported, and there has been a reaction from the extreme buoyancy, this in no way betokens any change for the worse in the actual position of the metal. The impelling cause of the first upward movement in prices was the freeing of the position from the incubus of speculative wreckage—the aftermath of the outbreak of war. During the period of the greatest trade despondency, and when brokers and dealers had their books full of German and Austrian accounts which they did not know what to do with, the price of copper dipped below £50 a ton for standard, while within the last few days it has been up to near £59 a ton. This is a very considerable appreciation, and marks the extent of the growth of confidence in the position.

There has been a very large amount of buying done, the great bulk of which seems to have been in connection with the filling of orders in relation to ammunition supplies. The total consumption of copper for this purpose must have been something enormous during the last four months, and, so far from diminishing, it is increasing week by week, as more machines are got to work turning out shells for small-arm and big guns. The other branches of the trade are not so actively employed as they might be, but this is not to be wondered at, for the labour forces available have been enormously reduced, and the cry amongst manufacturers all over the country and in all branches of trade is that they cannot secure the men to turn out work as rapidly as it is wanted. The general industrial position indeed is quite satisfactory, and things are moving forward well.

The producers of copper in the United States are taking a very cheerful attitude towards the future. Within the last few days they have put their price for electro up to £63 a ton. This is above the figure at which dealers would sell, which is only natural, but even the latter have sold copper at up to £62 10s. a ton for January shipment from

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New York, which is a very good price indeed. It is evident that there has been some indication of a forward industrial movement in the United States, and something of the kind is now well overdue, for trade in the whole of North America has for some months past been languishing, and it is high time that there was an alteration for the better. When once consumption in the United States does assume something of its old character, which will be as soon as things financial take a better move, there will be all the elements present for an enormous trade revival.

The mere wastage committed by the Huns will ensure a degree of industrial activity in repairing it that has never before been known, and the progress of replacements will commence to be undertaken very shortly now. Already in the steel trade French orders for repairing the wanton destruction have been given to America, and this is only a ripple upon the surface compared with what is to come when the trade winds get into blowing steadily again.

Swiss or German?

At the recent annual meeting of the Bank for Electrical Undertakings (Bank für Elektrische Unternehmungen), of Zurich, the question was raised for the first time in the comparatively long existence of this investment company, and apparently on account of the possible effects which the war may have in regard to the receipt or non-receipt of dividends or interest in holdings in supply and other undertakings in belligerent countries, as to whether the bank is a Swiss or a German institution. As is probably well known, the bank was formed originally with Teutonic assistance for underwriting capital, investing in undertakings, and in making advances to them, and certain German manufacturers, if not banks, have retained an interest in the bank down to the present moment. But with the lapse of time a remarkable change has taken place, and the preponderating portion of the very considerable share and loan capital, which was formerly held in Germany, is now in Swiss ownership. The board of directors has hitherto numbered 26, of whom 19 were Germans and seven were Swiss. Is it, therefore, surprising under the circumstances and under the pressure of the prospective failure of receipts from Russian investments, that the nationality of the bank should now form the subject of discussion? Dr. Julius Frey, the Swiss chairman of the company, explained to the meeting that the reason why the German directors had a majority was to be found in the historical development of the institution, and it would not be appropriate to remove deserving directors because of the displacement of shareholdings. He added that it was incorrect to assert that the bank was a German undertaking, as the decisive factor was the possession by Swiss of the majority of the shares. As two new Swiss directors were elected to the board, this circumstance appeared to satisfy the meeting, although the German element still stands at 17, as compared with nine Swiss. Apart from the Zurich bank, the same question may occur in the case of the Aluminium Industry Co., of Neuhausen, which has a branch works in Austria, and is also interested in a French undertaking which, we believe, furnishes a supply of bauxite. A large amount of the Neuhausen company's capital is likewise held in Germany, and, if we are not mistaken, Teutons also control the undertaking. However that may be, the company has not yet issued its annual report, and it is impossible to say what attitude, if any, the Swiss shareholders may assume in regard to the German element in the near future. At any rate, the French Government has prohibited payments to persons or companies in belligerent countries, and if the Government holds that the Neuhausen company is a German undertaking, it would seem that the company will be provisionally debarred from receiving any money, if any should be due and available, from any investments in France.

"WE CAN'T TAKE THE RISK."

By R. S. T. V.

Recently I asked a member of one of the few large electrical manufacturing firms which are really English whether his firm was busy. He replied, as most manufacturers could just now, that they were flooded with work, had never been busier, and could do with a works three times the size. He went into further details—if you wanted a certain essential of modern warfare you would have to wait seven months; the Government had ordered 200, and the shops were of limited capacity. Further, "We want 12 weeks' delivery for a 10-horse motor, we simply can't touch the work there is to be done. We are turning down inquiries every day from firms we don't know very well; and it's hopeless to think of trying anything off standard." I inquired whether any extensions of works or plant capacity were being made—"Oh, no, *we can't take the risk* of capital expenditure just now."

To most people these statements will come as no surprise, they will be regarded as an expression of the normal point of view, and probably the sole comment will be a murmured thanksgiving that works are busy and prices consequently high. Really, however, when considered seriously there can be no worse indictment of the commercial methods of the electrical industry, no more convincing proof of the futility of talk of "trade-wars."

Take the remarks as they were made—the Government want a prime necessity of warfare—they must wait anything up to seven months. If they wanted a hundred more it would probably be a year—no matter what the urgency, what hung upon their immediate installation, they could not be supplied. Is the electrical industry doing all it can to further the success of our arms?

Then again, 12 weeks for a small motor, perfectly standard, and "we can't touch the work there is to be done." At the present moment, when new markets are thrown open to us, when we alone of all European nations are in a position to supply all and sundry in every part of the world, all the God-given advantages of living on an island, all the work of the Navy, all the goodwill of all the civilised peoples of the World, are thrown away by a breakdown at the very source—we cannot manufacture! Why can't we? Not because every available man has gone to the Front, not because every machine is being utilised for Government service, but simply because "we can't take the risk."

Again—"we are turning down inquiries every day from firms we don't know very well." As we proceed we get worse and worse. Not only is it that we cannot supply, we will not even quote, we will not even try to secure business, to increase our market. Now, when a large number of customers are cut off from their usual market, when they are anxiously seeking for new sources of supply, when assistance and attention to requirements would secure their gratitude (which would at least be an asset, even if it were not decisive in our favour when competition is reopened), we bang, bolt, and bar the door in their faces. "No, we don't know you, and we cannot speak until we have been introduced." When the war is over, when labour is cheap because of all the discharged soldiers, when competition is fierce, we shall go to these same customers, and make half-hearted efforts to secure their business—and we shall get the answer we deserve. Then shall we raise our hands to the gods and ask why they favour other men, while their hand is heavy upon us. We shall ask for Protection and State-aid, forgetful of how little our present policy is aiding the State in its utmost need, and never thinking that we must work for our bread—"for in sorrow shalt thou eat of it all the days of thy life . . . and in the sweat of thy face shalt thou eat bread."

Lastly, "it is hopeless to think of trying anything off standard." Here we run up against a dead wall that has been blocking progress from time immemorial, and what makes it more irritating is that this most hopeless, most impassable, most criminal of obstacles, is regarded as a virtue. "Standardisation spells efficiency" has been the song of the

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American and the real progressive Englishman for years—the only break was when Mr. Willcox, with delightful *naïveté*, asked our central stations not to standardise on one voltage, but to use some of the unusual ones—120, 245, &c.—in order to facilitate lamp manufacture, and reduce the number of throw-outs. Let it not be thought that I am decrying standardisation, or ignoring its necessity and the fact that by standardising alone can we hope to compete. Standardisation is a prime necessity to secure repetition work, on which the efficiency of a machine shop depends. By all means standardise, standardise, standardise—but do not stop until the range is complete; until, like the modern mechanical toys, you can make a thousand combinations from a hundred standard parts; until, in fact, the selection is so comprehensive that the widest divergences still come within standards.

This, however, opens too wide a question of workshop economics to be entered into lightly in this article, especially by one whose works experience is some years old. The point it is necessary to emphasise is that our standards are not suited to the whole world, and the widest possible latitude should be allowed just now. It is certainly not a time to confine ourselves to one hard and fast line and decline to move. If we are to take the great chances which are undoubtedly offered at this moment, it is not sufficient merely to seek out new customers, to send out catalogues broadcast, and to get in touch with the C.I.B. of the Board of Trade or various other sources of information. All these are valuable, and even indispensable, but beyond all it is essential that we should provide what is wanted, at as near as possible to the price that can be paid for it, whether that be high or low.

I do not think that anyone acquainted with the industry reading this will say: "Oh, yes, but this is only one firm, others are doing better." I do not think that even those most closely acquainted with electrical manufacturers could point out a single firm which has boldly taken up a progressive attitude and endeavoured to supply all the wants allied to its own manufactures with which it has come in contact. All are tarred with the same brush, all are seeking to excuse themselves under cover of the example of others, no one of them will take a single risk to reap the richest harvest that it has ever been the fortune of man to view. Why is it? Because they one and all say: "We can't take the risk."

At about the same time I was discussing with the manager of my bank why I could only get 2 per cent. on money on deposit account, and he told me that it was because money was cheap. There is at present, I am told, no chance of laying money out, and hence much is left in the bank. The bank, also having no use for it, can only pay a low interest—also, there being no other chance of getting any interest at all, there is no reason to pay dearly for money. This is the reason that the recent War Loan was over-subscribed. Now, there is no manufacturer, no adventurous spirit (to pass from one extreme to the other) among us who does not know that, given the money, he could vastly increase his scope and his profits. And so—although there is plenty of money, and plenty of use for it, nothing is done, because the public and the banks, like the manufacturers, say: "We can't take the risk."

Is this the best spirit we can expect? At this moment, when we, as a nation, are risking all for the sake of honour and liberty, can we get nothing better from a majority of those at home than an awed fearfulness which declines to adventure even part of its money? In "Irishmen All," George A. Birmingham, referring to the spirit of adventure, says:—"We are losing it, just, I suppose, as the Portuguese lost it when too many of them went after Vasco da Gama. All the adventurers went, and the new generation was born of those who loved security better than adventuring. . . . It was always those who hoped most and feared least who went away." Are we who are staying at home, for one reason or another, to let posterity's decision on us be couched in such terms? I do not suggest that there are not good and sufficient reasons why men who would be useful on the battlefield may not be even more useful here at the present moment; but because we are at home we are not the less called on to venture our all and to strive our utmost for the good of our country. The men who are at home are not necessarily cowards—but [illegible] spirit is voiced in "we ca[n] spirit which, through the [illegible] of Britain shall be hon[oured] Drake, Frobisher, Raleigh [illegible] to seek new lands that th[ey] be greater? Is it the [illegible] tinental and Colonial wars [of] centuries, enabled us ti[me] successfully the enmity [illegible] of the world? Is [it] the present moment [for] countrymen to give t[hem] happiness of their nearest [and] and again no! But it *is* [the] heartedness which has e[n]d with some show of truth—[in] great electrical professio[n] again "There can be n[o] English manufacturers) [or] Continental and America[n]

At present one lives in [a] her greatest days are y[et] despair at the woodenhea[d] which refuses to see whe[re] queries—is there not o[ne] the spirit of his employés *thing*?

THE EFFECT O[F] T[HE]

By G. GER[RARD]

(*Abstract of paper read b[efore]* ENGINEE[RS]

In considering the effect [of] turbine, and also the m[ost] as a whole must be revi[ewed] the boilers and condensi[ng] case must be considered

The degree of vacuum [at] at the exhaust end as t[he] vacuum under which th[e] quently, a turbine desig[ned] 30 inches, requires more [or] designed for 27 inches, [the] given diameter in each ca[se] available in the range be[tween] and temperatures throug[hout] lb. absolute initial pressu[re] per inch of vacuum in t[he] expansion are as shown [in] 175 lb. absolute, the figu[res]

Between 27 and 28 inches	.			
,, 28 ,, 28½	,,	.		
,, 28½ ,, 28¾	,,	.		
,, 28¾ ,, 29	,,	.		
,, 29 ,, 29½	,,	.		

In the case of an exha[ust] absolute or atmospheric [line] are shown in Table 2.

It is thus seen that [the] depends on the steam co[n]sumption pressure than with high[er] B.Th.U. available is al[so] tions.

Another way to look a[t] that the temperature dr[op] approximately 1.5 more [for] range considered in Tab[le] the question is useful in [the] the case of high-speed [tur]must be made for increa[se] a 3,000 KW. land turbin[e] sure of 175 lb., 150° F. [and] the consumption will b[e] steam per hour will be [the] volume at exhaust, allo[w] 6,000 cubic feet per secon[d] is not in general custom [to] for the mean velocity [to] a mean diameter of 42 [in] tice cannot be more th[an]

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area of the annulus is 7.7 square feet. The velocity of the steam leaving the blades through the restricted area will then be 780 feet per second and involve a loss of 12 B.Th.U., assuming that the velocity ratio and angle of the blades is such that the steam leaves them axially, as it should, to give the minimum loss. Even under these conditions, however, there is still a gain of 6¼ per cent. between 28 and 29 inches vacuum. For still larger powers, however, these effects become more pronounced. It is the constant aim of designers to increase the limiting vacuum by using higher blade speeds and enabling an exhaust end of larger dimensions to be employed. This is undoubtedly a direction in which increased efficiency in large power high-speed turbines is to be found. The effect of increased blade speed is very marked, as for a given vacuum the reduction in available gain varies inversely as the fourth power of the blade speed. Something can also be done by shaping the exhaust suitably, so as gradually to reduce the velocity of the steam on leaving the blades.

The case of reduced loads will now be considered. With throttle governing, the initial steam-pressure is reduced in accordance with a right-line law similar to the Willans law for the steam consumption, and it may be taken that in this case the initial pressure at no load is approximately atmospheric. If at full load the initial pressure is 175 lb. abs., at half load it will be about 95 lb., and at quarter load, 63 lb. At half load, with a vacuum of 28 to 28½ inches, the percentage gains in consumption per inch of vacuum would be increased by about 1 per cent., and at quarter load by about 2½ per cent. above those given in Table 1, owing to the reduced B.Th.U. available by reason of the reduced initial steam-pressure.

With nozzle governing, the gains due to increased vacuum at reduced loads are somewhat less than with throttle governing, and the exact amount depends on the type of nozzle governing used, but broadly, at full load and at reduced loads the gains in consumption per inch of vacuum are more nearly equal with this type of governing. Although there is a decrease in efficiency at the exhaust end by having a cramped exhaust and low velocity ratio, there is but little loss when the exhaust end is large and has an unnecessarily high velocity ratio.

Geared turbines can be bladed and should be bladed for high vacuum, and the blading should be for nearly the highest vacuum obtainable, as there is but little loss by running a turbine bladed for high vacuum, at a lower one. Blading a geared turbine for high vacuum as compared with low vacuum adds very little to the weight, and generally only necessitates the exhaust end being made somewhat larger. It is very important that the exhaust between the turbine blades and the condenser should be free, and should be unrestricted, so that the loss of vacuum between the last row of blades and the steam space in the condenser should be a minimum. This applies to all classes of turbines.

It is equally important that the loss of vacuum between the steam space in the condenser and the air-pump suction should also be a minimum. In other words, given a condenser and an air-pump of the highest efficiency, the difference in vacuum between the air-pump suction and exhaust end of the turbine should be reduced to an absolute minimum. If the reduction of velocity of the exhaust steam can be made to take place gradually as in a diverging orifice, most of the terminal loss at the blades will be recovered. Much more careful attention is required in the future, as to the shape of the exhaust, than in the past, for even at present many exhausts are so shaped as to cause considerable and unnecessary loss of vacuum.

Up to the present the turbine alone has been considered, but in a complete installation there are many other factors to be taken account of. As increase in vacuum is associated wth a correspondingly lower temperature of condensate, it follows that if the vacuum is raised and the condensate is delivered to the boiler at the same temperature at which it leaves the condenser, either the quantity of steam generated in the boiler per unit of coal is decreased or the quantity of coal per unit of steam generated is increased. Such a condition, however, never arises in practice, as the condensate is invariably heated either by the waste gases from the boiler or by the exhaust steam from the auxiliary engines, or by both. Land installations usually include an economiser in the boiler uptake, and the practical requirement in such a case is that, in order to prevent sweating on the tubes, the feed-water should be delivered to the economiser at a temperature of about 120° F. But even at the highest vacua there is usually sufficient exhaust steam from the auxiliaries to raise the condensate to this temperature, so that such a system represents the highest economy attainable with any given plant.

In a surface condenser there are three losses to be considered:—

(*a*) The temperature rise in the circulating water.

(*b*) The resistance of the tube to heat transmission from the steam to the water.

(*c*) Air insulation of the condensing tubes.

These may be summed up in the apparent conductivity K of the condenser, that is, the B.Th.U. transmitted per square foot per hour per 1° F. difference of temperature between the steam and the water. With a condenser in average conditions of cleanliness and efficient air withdrawal, the value of the conductivity K is obviously much higher than with inferior air extraction or a dirty condenser. The conductivity is also influenced by the load. For example, in a very heavily loaded condenser, under the best conditions, a value of K of 1,500 or even higher has been reached, whilst in condensers under low load it may be no higher than 300, so that this method of comparison requires to be used with some discretion.

The effect of reduced conductivity, such as is caused by air, is much more at high rates of condensation than at low, showing that the effect of a faulty air-pump or dirty condenser is much more when the rate of condensation is high. Also, *approximately* the loss of vacuum below that theoretically obtainable depends only on the rate of condensation and on the amount of air insulation, and not on the quantity of circulating water, always assuming a condenser free from oil on the outside of the tubes and scale on the inside. There is not much use in having more circulating water than about sixty times the steam condensed at full load.

Money put into a condenser of ample size is money well spent. Ample surface also gives a good margin to allow of the condenser getting dirty or for overloads. With a high rate of condensation, especially if the condenser is dirty, when an overload is required the vacuum will drop so much that not only is there often difficulty in getting the overload out of the turbine, but the boilers are still further overtaxed, due to the increased steam consumption causing the steam pressure to drop just at the time it is most important to have full pressure. It is usual in modern power stations to have a vacuum of about 29.1 inches, barometer 30 inches, with 50° F. cooling water and circulating water sixty-five times the steam condensed, and 28 inches with 80°, seventy times, and it seems as if these conditions cannot be much improved upon, as, if the circulating water were increased in this case from 65 to 100 times the steam, the improvement in vacuum would only be about one-eighth inch, and the pumps and circulating pipes would have to be increased 50 per cent. With sixty-five times also and a moderate rate of condensation, such as 6 to 8 lb. per square foot at normal load, there is an ample margin for overload, an overload of 50 per cent. only reducing the vacuum by about half an inch.

In cases where there is not a supply of natural cooling water or only a restricted supply, or where cooling towers are used, the question of the best vacuum has to be most carefully considered, and so many factors come into the case that each problem must be considered on its merits and alternative schemes worked out to find which is best.

DISCUSSION.

In opening the discussion, the Chairman (Mr. MICHAEL LONGRIDGE, Vice-President) said that the author's curves showing the increase in quantity of heat convertible to work when expanding to various vacua were very useful and, since turbine expansion was sensibly adiabatic, quite reliable. The curves showing vacua with various amounts of cooling water and vacua and temperatures with varying conductivity were not so trustworthy, since they did not and could not allow for the often considerable difference in temperature between the steam at top and bottom of the condenser and between this steam and the condensate.

Mr. D. B. MORISON (Member of Council) said that the turbine, more than any other steam engine, appreciated vacuum, and the commercial turbine of to-day was bladed for the highest vacuum obtainable with the water available. The effect of increased vacuum on a turbine bladed for 26 in. was considerable only if the exhaust chamber were properly designed, the ideal being one in which steam issuing from the last row of blades was conducted to the condenser by a suitable diverging nozzle. On the contour of the exhaust passage depended the degree of vacuum which could be responded to. Geared turbines enabled the highest vacua to give almost full theoretical economy and should be bladed for the highest vacuum attainable with the coldest circulating water. It was easy to determine the highest vacuum responded to in any turbine; higher vacuum sacrificed turbine efficiency and also boiler efficiency, since the condensate was cooled unnecessarily. The controlling vacuum was that in the steam space above the tubes, and this should be made as high as possible by reducing resistance to steam flow through the condenser and using the most efficient air pump available. A steam jet gave maximum commercial surface condenser vacuum, higher than attainable by any other air pump. High air-pump efficiency was particularly necessary during light load working, condensation then being chiefly on the top tubes, below which was a large volume of aerated vapour very difficult to condense. A steam jet maintained higher temperature lower down in the condenser; using the steam jet to discharge a large volume of vapour to a jet condenser at an absolute pressure little higher than that in the surface condenser, the turbine vacuum and condensate temperature were raised and overall efficiency improved.

Mr. H. FOTHERGILL said that if the exhaust passages were properly designed advantage was taken of the kinetic energy of the steam to carry it through the condenser; otherwise only the potential energy due to pressure difference was available (the kinetic energy being wasted in shock), and to secure adequate flow involved high difference in pressure across the condenser and therefore inefficiency.

Prof. H. HUBERT (Liége) emphasised the special importance of high vacuum in exhaust-turbine installations and of keeping short the connection between turbine and condenser in such cases.

Mr. C. WINGFIELD pointed out that the pressure in the exhaust chamber was due to air and steam, whereas the tem-

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perature was that of the steam, hence the apparent lack of concordance between pressure and temperature measurements.

Mr. W. H. Patchell said that central stations had reached the "condenser age." The best vacuum attainable with the cooling water available was decided, the turbines were bladed for this vacuum and as much and as good condenser as possible was installed.

Capt. H. Riall-Sankey illustrated a simple means of predicting steam consumption under other conditions, once it was known for one set of conditions. The author's figures showed an efficiency ratio of 80 per cent. for the vacuum range 26 in. to 27 in., and 70 per cent. for the range 28.5 in. to 29 in.; for a reciprocating engine, the corresponding efficiencies would probably be 20 per cent. and negative respectively.

In reply, the Author again emphasised the importance of considering the effect of changes in condenser conditions on the power installation as a whole; if that were done his statement of general desiderata would be found correct, each individual case demanding, however, consideration on its merits. The gain due to the vacuum was very great at low loads. In exhaust-steam turbines the highest vacuum was nearly always best, the gain due to vacuum being about twice as great as in high-pressure turbines. No one had yet succeeded in making really satisfactory pressure and temperature measurements on moving gases. The precise effect of vacuum changes on a given turbine was difficult and costly to determine; probably no one knew it within 1 per cent. The conductivity K might reach 1,500 B.Th.U. per sq. ft. per hour per 1° F. temperature difference, but 600-800 was a better average for full load and 400-500 for reduced load working. The reduction at low loads was due to the increased effect of residual air.

POWER PLANT TESTING.

(*For abstract of paper read by* Mr. W. M. Selvey *before the* Institution of Electrical Engineers, *see* Electrical Review, *pp.* 803 *and* 809.)

Discussion at Manchester.

Mr. S. L. Pearce said that in a paper by Messrs. Merz and McClellan some years ago the importance of keeping down the capital expenditure was emphasised. The present paper emphasised the importance of getting the most economical plant possible with a view of reducing the running costs. The majority of undertakings to-day recognised the importance of doing something more than providing the statutory sinking fund and wrote down the plant within a term of years considerably less than that given by the L.G.B. Most stations to-day had sets of about 500 kw. capacity only; it was therefore undesirable to set forth that eight to ten years was long enough life for plant and that it should be written down within that period. The eight or ten years' basis would make it impossible to carry on undertakings, and it would be making the present generation bear a double burden. The reduction of the running costs varied with the load factor on the station, and if the significance of the load factor was to disappear it seemed that the author was arguing against his own case, which was in favour of emphasising the importance of obtaining economical plant and so reducing running costs. He agreed with the figures given for back of boiler and economiser temperatures. Using a dry slack of about 12,000 B.Th.U. the temperature at the back of the economiser would be about 350 degrees, and at the back of the boiler about 550 degrees; this meant a drop of 200 degrees through the economiser. The figures for a coal of higher calorific value, say 13,500 B.Th.U., might be 400 and 600 degrees respectively. Regarding turbines and generators, the loss of vacuum between the last row of blades and the steam space of the condenser should be reduced to an absolute minimum; so far as the turbine and condenser were concerned, the controlling vacuum was in the steam space immediately above the tubes, and to record any other vacuum in the condenser was practically futile. Another important point was to test the loss of vacuum between the steam space of the condenser and the air-pump suction. This should be reduced to a minimum. If the air pump was not doing its work, the excess air in the condenser would mean lower temperature of the condenser, and insufficient cooling owing to the air insulation round the tubes. Another test not referred to in the paper was the measurement of the difference between the exhaust steam temperature and the temperature of the condensate. A slight difference would be a good indication of a certain furring action or deposit action in the tube, whereas a big difference would indicate a serious air leakage. The author was right in emphasising the value of ample cooling surface. No reference was made in the paper to the advantage of having recording instruments centralised. The author had stated that measurement should be purely a measurement of matter against energy, but he immediately departed from this ideal by condemning the use of watt-hour meters. Continuous-current watt-hour meters were admittedly somewhat unsatisfactory, but unless dealing with an absolutely steady load there appeared little to gain in accuracy of the energy measurement if this was computed from observations of the three factors—current, voltage, time. In Manchester both methods were employed simultaneously and the observations checked. Regarding high-tension three-phase current, it was always advisable to use special instruments with independent current and potential transformers. He advocated the use of two single-phase watt-hour meters instead of a polyphase meter, with a view to greater accuracy. It was not at all obvious why tests should be made at unity power factor, as tests under actual running conditions in practice were always below unity. Regarding cooling towers, the speaker had prepared a set of figures which could be summarised as follows:—With natural-draught towers the number of gallons cooled per square foot of surface = 100, forced draught 200, and with air-cooled type 70. Cooling towers were excellent things to be without. Six months' run before testing was too long; two months was quite reasonable.

Mr. David Wilson said that contractors' guaranteed efficiencies were creeping up to high figures, due, he was afraid, to competitive pressure rather than scientific development, and it was probable that a contractor quoting an abnormally high efficiency would trust to the variables to carry him through. The Institution of Civil Engineers was about to issue a report embodying instructions for carrying out and standardising boiler tests, in which it was specified that the higher or lower calorific value of the coal should be taken into consideration. The calorific value of coal was its value as fuel after deducting the moisture formed by the oxygen and hydrogen which had to be evaporated with superheat, and if this correction was made upon the calorific value, all agreed efficiencies automatically went up 3 per cent. There was no actual saving in the coal bill following upon this, but it represented more correctly the true efficiency of the boiler. Very little was known regarding the physical properties of coal, as two coals of the same approximate analysis might behave totally differently in the furnace. These variables necessitated a design of furnace or a stoker suitable for all conditions. He cited the case of two large power stations, amongst the most efficient in the world, one of which used a coal of calorific value 14,000 B.Th.U. and obtained 20 to 25 B.Th.U. per watt-hour, whilst the other obtained 26 B.Th.U. per watt-hour using a coal with 60 per cent. small and a calorific value never exceeding 10,500 B.Th.U. Under circumstances practically identical as regards design of plant both were doing equally well with two different classes of stokers in the reverse order to that suggested by the author. The calorific value of coal was no guide to the destructive effect on furnace structure or grates; it was the composition of the ash in the coal that decided these effects.

Mr. J. Firth said that water could be superheated to 300° F. and still remain water, and it was difficult to dry coal without heating it sufficiently to drive off volatiles. In view of the author's plea for accuracy, it was significant that the analysis of coal in one case was 14.2 per cent. and in another case 10 per cent. short of 100 per cent.; perhaps the volatiles had been left out. He suggested that a vertical perforated pipe would be better for taking samples of flue gases, owing to the stratification which occurred. Boiler makers guaranteed 10 lb. of steam, yet it was a good station that could raise one kw.-hr. on 3 lb. of coal. A good deal of the difference was due to auxiliaries such as boiler fans, motor pumps, coal and ash handling plant.

Mr. Seaton strongly advocated an engineer to stand between contractor and customer, and considered an independent test a very good investment. He strongly deprecated the suggested combination of air pump and steam jet.

Mr. J. S. Peck said that every honest manufacturer tried to give the best apparatus he had, and when it was known that competitors were giving guarantees that he could not tolerate, it appeared that such competitors were either taking an abnormal chance or depending upon skilful testing. He thought manufacturers generally who were doing their best would welcome independent tests on a basis which could not be questioned.

Mr. S. J. Watson said there were few areas where the questions of low steam consumption and general efficiency of large plants were of greater importance than the Lancashire district, where the power portion of loads was becoming so large. Regarding obsolescence, the small plant of ten or fifteen years ago was quite out of date to-day, and if the financial side had been properly handled such plant would have been entirely eliminated from the capital account and more modern plant substituted. Fifteen years ago the cost of a generating set was £10 to £15 per kw., and the steam consumption anything from 30 to 40 lb. per kw.-hr. To-day a large modern turbine set could be had for about £3 5s. per kw., with steam consumption from 11.5 to 13 lb. per kw.-hr. What sum of money should be paid for a given percentage saving in steam consumption was a difficult point. The guarantees of steam consumption only extended for one year, and reduced steam consumption often meant increased liability to breakdown. Further, it frequently happened that the large plant which was installed took care of about 80 per cent. of the total output for a year or two, and then became one of the smaller sizes, so that the saving which extended over a period of eight or ten years, as suggested by the author, could not be considered in calculating what could be afforded as the purchase price. The author was surely wrong in taking effi-

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ciency tests at unity power factor irrespective of the conditions under which the plant was to be used. He preferred reciprocating to rotary pumps on the score of increased efficiency and the possibility of reducing the amount of circulating water at low loads.

Mr. W. Cramp said that during the past decade a change had taken place in power plant which was not likely to occur again over a similar period, namely, the change from the reciprocating engine to the steam turbine. The change from steam to gas plant might also be added. Although the obsolescence allowed in past years might have been inadequate because of changes in size of plant, it was also due to some extent to change in type of plant, and it was necessary to separate these two items. Accuracy in testing depended upon the fire being uniform throughout the test, but no hint was given as to how this was to be carried out. Ordinary methods of regulating a fire did not permit of the accuracy suggested by the author. A machine would easily give good results on unity power factor, but disappointing results on, say, 80 per cent. He considered air tests with calibrated nozzles extremely inaccurate.

Mr. Scanes agreed with Mr. Seaton in condemning the combination of steam jet and Leblanc pump. Since about 10° temperature represented one per cent. consumption when water was used for boiler feed, the advantage of the Leblanc pump, which could deliver water nearly 10° hotter than the reciprocating pump, would be appreciated.

The Author, in reply, said that in the early days people worked on 10 per cent. load factor; nowadays there were load factors of 30 and 50, and his point was that by the time 50 was arrived at, any increase, as regards a power station generating electricity, would make practically no difference to the total cost because the improvement between, say, 50 and 70 was small compared with all other things. He considered that the standard for coal should represent physical facts and have no relation to the apparatus. It was not his intention to suggest that there should be accuracy to the limit of one per cent. It was an ideal to be aimed at if not obtained, and it was only in connection with turbine testing that one per cent. was mentioned. Regarding cooling towers, the steel towers would give the best results, but the upkeep was heavier and it became a commercial question, and not merely one of efficiency. The question of obsolescence was extremely interesting, and with his faith in the future, the author expected to see the 5,000 kw. set a toy. Whilst the author did not advocate high draught he was of the opinion that it would come into use for emergencies; the tendency was all towards being able to rush a boiler up quickly.

Discussion at Leeds.

A meeting of the Yorkshire Local Section of the Institution of Electrical Engineers was held on Wednesday, December 3rd, at Leeds, when Mr. W. M. Selvey spoke upon the subject of his paper, as read to various sections previously, on "Power Plant Testing."

Mr. Selvey devoted himself entirely to answers to some criticisms in the previous discussions. He said that his paper had not been intended to be a technical paper in the ordinary sense; nor to discuss little details, but to try to deal with big principles which were being discussed in private and were moulding the future history of those large corporations who were going in for the very large power stations. In many places where his paper had been dealt with, people had discussed the details and missed the principles.

The Chairman, Mr. T. Roles, in opening the discussion, said he felt that the ordinary central station engineer did not usually test plant to the extent that he ought to. The question of testing was often overlooked, and when it was kept in mind it was often done in a somewhat perfunctory manner. In cases when he had been struck by the remarkable differences in the steam consumptions quoted by people who offered him turbine plant, and had asked contractors why he should not accept certain low offers, seeing that if the plant did not satisfy guarantees his contract enabled him to reject it, the answer given to him was that such makers took the chance that if the acceptance test was made, the engineer would come to some terms with them by which they could escape with some slight reduction of price. He thought they would agree with him that if the engineer did not make the full test of acceptance of the plant, he was doing an injustice both to his employer and to the honest persons who put forward absolutely reliable figures, and if it were to be understood that it was safe to give unreliable figures that would be greatly to the disadvantage of the industry. The testing should be extremely accurate, and no doubt a difficulty in the case of the smaller central stations was to get thoroughly reliable and independent and unbiassed men for the purpose. He urged the necessity of rest periods for the men who were engaged on such tests.

Mr. Christiansen said the testing of plant should be on three sequential lines, first the acceptance test, then the ordinary routine test, and, thirdly, a series of observation readings. He thought that boilers could be tested fairly well by the indirect method of recording the flue gases and the temperatures, particularly the exit temperature. With regard to staff, he thought it was a difficult matter to get the suitable men unless they had been specially trained for the purpose.

Mr. Morley said he had been interested in all kinds of steam testing for over thirty years, and he felt that the remarks which had been made by Mr. Selvey in a great measure confirmed the results of his own observation. Certainly the personal element in testing was exceedingly important. In a hundred observers he did not find more than ten who could be relied upon for continuously careful testing—taking accurate readings so as not to favour either the up or the down scale. He emphasised the importance of a close regard to proportions in ordering the various parts of central station plant. It was easy to spoil the success of good and efficient turbines and generators by the bad proportions of the boilers in relation to the plant. As to acceptance test only, those who knew how to convey instruments successfully from one place to another could make these tests. The only way to test coal satisfactorily was to buy not less than ten tons and test it in the boiler itself.

Mr. Yerbury said he agreed that the arrangement of compromise in cases of failure to come up to a reasonable specification was a most unfortunate and disagreeable job. It was somewhat farcical to have specifications stating what efficiencies were guaranteed, but with the statement added that these were subject to the usual margin of perhaps 2 or 3 per cent., which margin was found in practice to cover a lot of irregular readings.

Mr. Shaw said that perhaps central station engineers had not always been successful in their testing because they had so many other things to think about, and had such limitations to take into account in regard to staff. For the taking-over test there was certainly room for the specialist.

Mr. Whitehouse said he was more particularly concerned at the moment with questions in regard to the cooling tower, a difficulty in connection with which was that there was no standard specification. It was highly necessary that better attention should be given to the standardising of specifications so that the different parts of an installation were more in line with each other. In regard to the cooling tower, the conditions as to quantity of gallons to cool were not in any proportion to the load that could be put on to the cooler. It ought to be possible to gain from the records of the cooler some idea how the plant in general was running.

Mr. Campion mentioned a case in which rotary converters were being tested and the commercial instruments supplied with the switchboard differed as much as 4 to 5 per cent. from the test instruments, but upon both sets of instruments being sent to the N.P.L. they were both declared to be correct. What, he asked, was the engineer to make of that?

Mr. Selvey said that as Sir John Snell was to address a special meeting of the members on the 17th, he proposed to reply then to the various points raised, and would confine himself for the present to stating that he had been particularly pleased with the way in which the discussion had gone that night in having kept to main issues. The whole attitude of the testing had been put by Mr. Christiansen in a particularly clear way—acceptance test, routine test, and the use of recording instruments. He himself had confined his observations mainly to the conditions of the acceptance test, but that did not mean that he failed in any degree to recognise that the more recording instruments they could get that they could rely upon, the better it would be, but they wanted to be certain about the constancy of the inspection, and that the instruments should be so arranged that they would be in a position to cross-check them if necessary in the way of using them.

THE PROMOTION OF THE ELECTRICAL TRADE.

Discussion before the Sales Managers' Association.

The discussion which took place at the meeting of the Sales Managers' Association on Thursday of last week resulted in the presentation of many matters, both of past and present interest to the electrical industry. As the subject for consideration there had been selected—"The Position of the British electrical industry and the methods of extension in the markets of the world"—a subject which was worthy of a larger attendance than that represented by those who were present, although it has to be remembered that December is usually an unfortunate month for a gathering of this character. Nevertheless, and apart from the comparatively few criticisms which were made on the opening speech, the discussion had the effect of bringing to light valuable information concerning business both at home and abroad.

The debate was opened by Mr. H. Scholey, who first referred to the legislative restrictions imposed and the financial speculation which took place in the eighties of the past century, and stated that the industry to-day is weak in a financial sense, largely owing to the early mistakes which were made. Dividing the industry into three sections—large machinery, cables, and special work such as small switchgear, lamps, lamp-holders, etc.—the speaker submitted that the specialists have been, generally speaking, remarkably successful, as they have been able to develop their apparatus so that it can be said to compete with any material in any part of

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the world. But the vision of the specialists is restricted through manufacturing on a small scale, and they are therefore unable to take foreign markets into consideration. The same observation applies to arc lamp carbons, as we have no special makers on a sufficiently large scale to meet the enormous demands of our own country, and there will continue to be a scarcity until some of the neutral countries render us assistance. Dealing next with the construction of large machinery, of which various British makers are turning out types which are second to none, the speaker pointed out that from their balance sheets it was found that the makers of large machines had not paid any dividends for years past. Broadly speaking the reason lies in the circumstance that competition from which the industry has suffered has prevented the firms from earning profits. The output approximates to £17,000,000, of which we send quantities varying up to £8,500,000 abroad, but as we import electrical goods to the value of £3,500,000 per annum, we already purchase more than one-third of the value of our exports. Competition has taken various forms. It has primarily taken the shape of cutting prices, but the pace has been set by competition from abroad, and at prices which would not have represented any profits to British manufacturers. It has also assumed the insidious form of offering plant on easy terms or in exchange for shares, but no British firms are financially strong enough to compete on these lines. Concerning the conditions imposed by large customers, such as municipalities and large corporations, including railways, the meeting was reminded that these purchasers had made conditions in their tenders which they were not able to impose on foreign manufacturers, whilst the municipal councils, stipulating for the payment of local rates of wages at home, allowed the condition to go by the board when ordering abroad. There are other conditions in regard to the performance of the machinery. British makers have standards on certain lines, whereas foreign makers have adopted standards which are entirely different and give a smaller margin; they are therefore able to produce a cheaper machine, and they succeed with their tenders because the municipal councils waive this particular clause in so far as these manufacturers are concerned. In addition foreign firms have come and started works in this country to compete with us, but they have made "a worse mess" in respect of profits and dividends.

The question of neutral markets was next raised by Mr. Scholey, who reminded his audience that our greatest competitor has been Germany. That country has made electrical machinery of the value of £60,000,000 per annum, and has sent abroad electrical goods amounting to £14,000,000. One of the largest purchasing countries has been Russia, which has imported Teutonic products for from £5,000,000 to £5,500,000 yearly. In one section alone Germany has exported £960,000 to Russia, whereas the British have only sent the value of £66,000 in the same group. If this should be thought to be another instance of the lack of British enterprise the speaker tried to dispel this view by narrating the experience of a British company with a certain large municipality in Russia which required tramway plant. The company had the necessary experience of similar work, submitted the lowest tender and possessed the necessary financial support, but it was eventually discovered that the bank of the Russian agents who were employed was almost entirely in the hands of the Deutsche Bank of Berlin and would not put in a British tender. Still the matter was not finally settled. A committee of the municipality reported that the tender could not be refused on technical grounds nor by reason of the prices, but the trade counsels in the municipal council set to work and brought such pressure to bear that the British tender was rejected. A case of this kind, however, may be expected never to be repeated in the future. Passing on from France to South America the speaker remarked that British firms have been gradually losing ground in the latter market owing largely to the great financial interests developed by German firms. On the other hand we have progressed in Australia, where we have supplied electrical machinery of the annual value of £1,000,000, as compared with considerably less in the case of Germany, and £146,000 in that of the United States. In New Zealand the British share has been ten times greater than the machinery furnished by other countries. The next reference made was to the well-known case of the Victoria Falls and Transvaal Power Co. As will be remembered, the company was able to go to a large German works which supplied the whole of the plant for its generating stations, accepting payment in debentures. This was not sufficient to keep the company going, and it was then able to dispose of all its preference stock, as previously it had disposed of its ordinary shares, on the English market—without spending a penny on electrical manufactures in this country. Obviously the company, in the opinion of the speaker, made a good contract for the machines, but other things were necessary. The Rand mines had to buy motors, and they invited tenders from both British and Continental firms. With one or two exceptions all the orders went to German capital on prices. The prices were such that the British firms would have lost heavily if they had attempted to undertake the work. That, however, did not mean that the German manufacturer was going to sell machinery in South Africa with no profits for himself. Where the Germans have scored is that makers there who construct large machines also produce smaller types, and they are able to sell everything that is called for in one schedule. Therefore they can afford to sell the large machines at no profit in order to obtain eventually give them o manufacturers have reali lies in the advertisemen machinery and accessorie was appreciated by the

The circumstances set mark, indicate that, in the situation we must ordination whereby we pete on a better basis, will be necessary. Tak they stand, we observe of losing an export tra can be secured? If we 25 per cent. we should o of our own country. I shines we shall have to ably. That calls for gre arrangement on the pa possible we may obtain assumed that we can work as other countries possibly be found by co- of the industry, but it to set forth a definite s sought in the City the financiers concern electrical machinery is taking, there is at ho porting. Another point ordination concerns t are always said to be it is felt that custome tion for our standards, requirements dictated not give customers wh that attempts to modif sum of money, and in to carry out the modi again emphasised the n tion in order to show he thought that we sho on a stronger and mor and said that the indu we could get the neces co-operation among ou

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exercised an extraordi non-ferrous metals i bronze, aluminium, t trical manufacturing ing the comparative charged for different cessation or practical from other countries. chants, who are decl advance in prices, ot speculative upward whilst firms who we have embarked in it amount of money prices as soon as po porarily from the ma higher prices in the plicated by the fact of copper and one or articles of peace has Government order to the output of electric purposes, it has not holders of these me of war material. be entirely changed b by the Federal Coun various States in G of metals, and whic 14th. Leaving bras noteworthy that the maximum price of 99.7 per cent. of co not exceed £100 pe a minimum content old copper is not to not to be higher tha for new aluminium prices for old metal antimony at £75, a compared with Eng German maximum crease. The prices

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forwarding charges, and if credit is required the purchaser will have to pay 2 per cent. per annum in excess of the discount rate of the Imperial Bank prevailing at the time. If required by the government authorities the holders of any stocks are placed under the obligation to deliver them to the former, who will fix the prices to be paid after hearing expert opinion. Any contravention of the order involves a penalty either of one year's imprisonment and a fine of up to £500, or a penalty of one of these two punishments.

A Premature Proposal.—The German Count Mirbach-Sorquitten, apparently under the impression that the war on the Eastern frontier has now been brought to a conclusion successful to Germany, has just submitted a comprehensive proposal to the Prussian Ministry and the chief of the Province of East Prussia, suggesting the allocation out of State funds of a considerable endowment for the electrification of that province which is said to have been severely damaged. As the basis for the proposal the Count points out the dearth of labour and the scarcity of horses, which offer insurmountable difficulties in the way of the revival of economic activity. It is held that the only remedy is to proceed with the establishment of great supply works for the delivery of energy for lighting and power purposes.

Manchester Men with the Forces.—Messrs. Chas. Macintosh & Co., Ltd., of Manchester, have 294 of their 2,500 workpeople serving with the colours, the proportion being 14 per cent. One has been killed in action.—Messrs. Ferranti, of Hollinwood, have 134 employés, or 10 per cent. of their total workers, in the forces, and one has been wounded.—Messrs. Mather & Platt, Ltd., Manchester, have contributed 481 men, including 18 officers, to the army and navy, which is equal to 20 per cent. of the 2,400 workpeople employed. One has been killed in action, another has died from wounds, and three have returned wounded.

Tram Cars and Recruiting.—At Wakefield the local recruiting authorities have adopted the idea of using an electric recruiting car for the purpose of delivering speeches in various parts of the city. Bugle calls are given from the car, and the Wakefield City Band plays patriotic airs. The car has been lent through the kindness of Mr. England, the manager of the local tramways company.

Electrical Supplies Scarce at Buenos Aires.—A recent call for tenders for electrical material for the Provincial Telegraph Department of Buenos Aires produced no offers. Enquiries made by the Department reveal the fact that this abstinence on the part of the firms usually tendering was due to their not having the goods in stock, with no immediate probability of receiving further supplies owing to the war in Europe. It has been decided to purchase some of the articles more urgently required at retail establishments.—"Review of River Plate."

Names Wanted.—In regard to the lengthy lists of Distinguished Conduct Medals awarded for bravery in the ranks, we shall be glad if readers who know of electrical employés whose names have appeared, or in future may appear, in any such lists, will send us particulars, so that they may be duly recorded in this column.

Appeal.—An urgent appeal is made on behalf of the British and Foreign Sailors' Society, which is doing so much for both soldiers and sailors just now, and is in need of £10,000 to repay bankers' overdrafts. Address: 2, 4 and 6, Beccles Street, London, E.

Quite the Right Thing.—The Blackburn tramway employés on Thursday last week entertained the wives, children and mothers of the men in the department who are now serving the colours. Tea was served, and the children were presented with purses containing money and with toys for a Christmas tree. A social and dance afterwards took place.

Personal.—We are pleased to learn that Captain Bullock, manager in Johannesburg for Messrs. Stewarts & Lloyds, played an important part in effecting the capture of De Wet. According to the "Times," the following telegram was sent by General Smuts, Minister of Defence, to the District Staff Officer at Kimberley:—

"December 5th.—Please convey to Captain Bullock my congratulations on the splendid work which he and the motor squadron have performed in connection with the capture of General De Wet. Colonel Brits has assured me that, without their efficient assistance, the capture might not have been possible."

Mr. L. B. Hogarth, borough electrical engineer at Whitehaven, has been gazetted temporary lieutenant in the 11th Border (The Lonsdale) Regiment.

Roll of Honour.—We greatly regret to read in our contemporary, the American "Electrical Review and Western Electrician, that Mr. Douglas Sutherland Martin, whose contributions to our own pages will be remembered by our readers, died at the end of November at the Boulogne Hospital, France, from shrapnel wounds received at the battle of Messines on the Belgian border. Our contemporary says:—"Soon after his graduation as an electrical engineer from the Central Technical College, London, Mr. Martin came to this country and became editor of the "General Electric Review." He later made an extended trip to the Pacific coast and upon returning east joined the editorial staff of the "Electrical World" at New York. Mr. Martin left New York early in August to enrol in the mounted forces of Great Britain. He was 27 years of age. He had made a great many firm friends in this country who will greatly deplore his untimely passing away." Mr. Martin was a young man of great spirit and ability, and gave promise of making considerable progress in his profession. We are personally very sorry to record his loss, but knowing from a lengthy correspondence from him something of his energy, spirit and thorough-going loyalty to the land of his birth, we are not in the least surprised that when the war broke out he answered the call so quickly and eagerly. The "Electrical World" says that Mr. Martin left the B.T.H. Works at Rugby and went to the States in 1911. In regard to his departure for the front our contemporary says:—"Having already served in the Yeomanry, and being a dashing horseman as well as a crack shot, he sought an opportunity to get to the fighting line and, to use his own phrase, 'by the greatest of good luck' was drafted into the Sixteenth Lancers, which went to the war immediately. He was a brother of Mr. T. C. Martin, secretary of the National Electric Light Association." Mr. T. Commerford Martin is an old friend of the "Electrical Review," and we offer him our sincere sympathy in the loss that he has sustained.

Private James Foster, of Preston, who had been employed at the works of Messrs. Dick, Kerr & Co., has been killed at the front. He was 27 years old, and was married only four months ago.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Expenses of Applicants for Appointments.

I would like to draw the attention of your readers who may be looking for a post to what, in my opinion, is a very shady method of dealing with applicants selected for interview.

In your issue of November 13th appeared an advertisement for an electrical engineer for West Africa, to which I replied. I was eventually requested to call at the London office of an exceptionally wealthy mining syndicate, which I did at a great deal of inconvenience to myself and my employers, at a cost of £3 8s. 6d.

At this interview, which took place on November 25th, I was informed that I was very likely to receive the offer of the position and should know definitely not later than December 2nd. On November 26th I wrote the company enclosing account for my expenses, to which I received a reply on the note heading of the gentleman I interviewed to the effect that he was not under any obligation to pay my expenses.

I wrote on December 4th and 8th pointing out that in the past I had always received my expenses for every interview I had been requested to arrange, and that I should be glad to know if they had decided to offer me the post. To these letters I received a reply on December 13th offering me the position and enclosing a draft agreement totally different to the conditions which had been mentioned at the interview, and promising to recommend the company to make some allowance towards the above expenses if I accepted the post. In the meantime, I had accepted another position, and had, of course, to decline the offer on this account, and also because I could not accept the agreement of which they had enclosed a specimen.

I am now informed that none of my expenses will be refunded.

The object of this letter is to warn applicants to make definite arrangements as to expenses before arranging an interview, which I am pleased to say has not been necessary in the whole of my previous experience.

Disillusioned.

Why Britain Loses Trade.

I should like to reply to your two correspondents.

I note they both blame the "firms." This, to my mind, is too sweeping.

The real reason "Why Britain Loses Trade" can be stated in a sentence; it is this:—

The technical side of many manufacturing businesses in Britain is under the bad management of an "office."

Hence all the trouble, and until all "offices" are relegated to their proper places as adjuncts, and are not allowed to consider themselves as the "Centre around which all other things revolve," we shall continue to have complaints similar to those of your correspondents.

It is a remarkable fact that all successful manufacturing concerns have technical and not so-called "business" men at their head, and the materials of these firms are always welcomed everywhere, and are always properly packed and described, and sufficiently concise directions are given, when necessary, for their successful operation.

Observer.

A New Use for Black Tape.

A fortnight ago a lady asked for a pennyworth of "Electric tape," *i.e.*, black tape, and a week later came for another. While being served she remarked: "It's a good thing for spots and sores." I told her it was inadvisable to use it for that purpose, as it was liable to contain impurities. "Why," she exclaimed, "a woman told me it was made specially for that purpose, and that she had eczema all over her arms and it had cured her." So if trade gets very bad there is still one new source of revenue.

Black Tape.

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Appointments in Hong-Kong.

I should like to give a word of warning to engineers thinking of signing contracts for positions in Hong-Kong.

Doubtless, they will be informed that living is wonderfully cheap, and that the value of the dollar is 2s. I have been out here about 12 months. The dollar has never been worth more than 1s. 10d., and for the past two months it has only been 1s. 8½d. To those engineers who, for various reasons, have to send money home, the fact that they lose about 2s. 6d. in the £ is a serious item in their financial arrangements.

House rents are notoriously high; a four-roomed house, similar to what one would pay £80 for at home, is between £6 and £8 per month out here. Flats (three rooms) cost from £5 to £11 per month. Coal is 30s. per ton; electric light, 8d. per unit; hair-cut, 1s. 6d.; shave, 1s.; drinks, 6d. (minimum); doctor, £1 per visit; medicines, twice home prices; suit of tweeds, £6 to £9; cinema, 2s.; theatre, from 6s.; books, twice home prices; boots, 25s.

To these worries add the risk of plague, enteric, small-pox and malaria, and the thousand and one discomforts of tropical life, as Hong-Kong during the hot season (June to end of September) is very unhealthy.

For a junior position, a man of good experience should insist on $350 per month without quarters, or $300 per month with quarters and medical attendance.

Taken all round, however, life out here may be made fairly comfortable, provided one can obtain an *entrée* into the social world. This, however, owing to rigid class distinctions, presents grave difficulties and considerable expense.

No. 2.

Hong-Kong, *November 12th*, 1914.

Rear Lights on Vehicles.

You will undoubtedly be aware of the fact that an order has been made making it compulsory for all vehicles in London to carry a red tail light during the period of subdued lighting in London. There was a short leaderette in the *Daily Mail* yesterday, the 16th inst., on this question, and I quite agree with the writer when he expresses the hope that this innovation is for all time and will not be annulled when the war is over.

You will perhaps remember that in 1904 I issued a circular letter to all the tramways and light railways in Great Britain, and I also had some correspondence with the Secretaries of the Royal Automobile Club and Motor Union, asking them to take action with the Tramways Associations to get a Bill passed making it compulsory for all vehicles to carry rear lights.

The ordinary lighting of provincial main roads is no better, and often very much worse, than the present subdued lighting in London, and every day we have driven home to us the necessity for red tail lights on vehicles.

The present regulation is insufficient and inadequate because the lamps carried on the fronts of vehicles, which are supposed to show a red light to the rear, are often hidden by merchandise or placed in such a position that the light can only be seen when the vehicles are at a certain angle.

This is a particularly important thing to those of us who are operating inter-urban tramways on roads often not lighted at all, and, in other cases, badly lit. It is also important to all owners of speedy vehicles, and I think the time is opportune, with the example of London before us, for doing something.

Can I beg of you to draw attention to this question in your valuable paper?

H. England, *General Manager,*
Yorkshire (W.R.) Electric Tramways Co., Ltd.

Wakefield, *December 17th*, 1914.

[We cordially sympathise with Mr. England's views. Some would go further, and say that pedestrians who are addicted to walking along the roads in preference to the sidewalks, in the dark, ought to carry lights.—EDS. ELEC. REV.]

Electrical Trades and Motor-Ambulances: A Proposal.

I notice that the London Musical Trades have presented a motor-ambulance to the Red Cross Society, and it has occurred to me that it would be an excellent idea if the electrical world were to follow this example.

Our industry is such an extensive one that each branch might, perhaps, raise sufficient money for its own van, so that we could present, say, an "Electrical Manufacturers' Ambulance" and an "Electrical Contractors' Ambulance."

If you would open a subscription list in your columns, no doubt the necessary funds would be forthcoming without difficulty.

I hope you will see your way to fall in with the suggestion.

Alpha.

A Contradiction.

I notice in your issue of December 18th in the report of the meeting of the Metalite Co., that reference is made to the new manager, Mr. J. L. Green, "that he had come from the Osram Works at Hammersmith." I have to inform you that Mr. J. L. Green has *never* been in the employ of the Osram Lamp Works, Ltd., Hammersmith, and to the best of my knowledge has never even been inside the Osram factory.

C. Wilson, *General Manager.*

Hammersmith, W., *December 19th*, 1914.

The letter appearing
signature E. Jacob, Ma
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Melbourne, *Novembe*

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NEW ELECT

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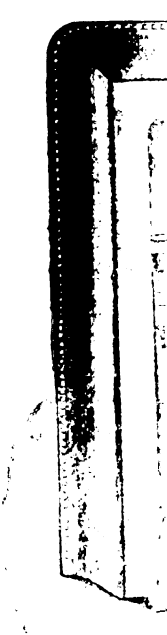

FIG. 1.—

Dowsing-Huntley
illustrated in fig. 2,
3,000 to 4,000 hours

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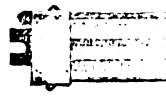

FIG. 2.—D

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Mining Switchgear.

The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., recently issued Part II. of their *Bulletin* on Colliery and Mining Machinery, a bulky and comprehensive catalogue of apparatus covering a wide range of motor starters and controllers, ironclad switchgear for both high and low pressures, circuit-breakers, accessories for mining installations, instruments, lighting apparatus and fittings, transformers, lamps, cables, and signalling apparatus. Amongst all these there are many new items, some of which we illustrate herewith.

Fig. 3 shows a 15-ampere D.P. switch with "bobbin" fuses, for circuits up to 500 volts; this is designed for the control of small motors and for heavy lighting circuits. The switch and fuses are enclosed in an explosion-proof and flame-proof case, and the fuses are contained in separate chambers.

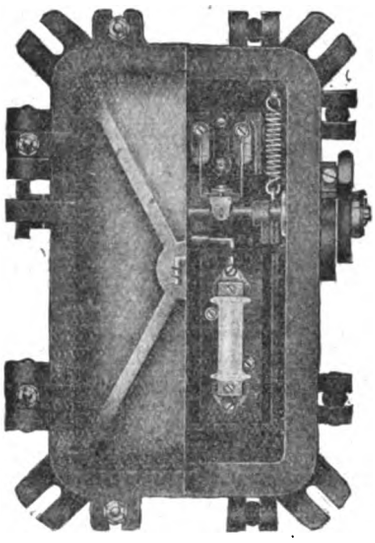
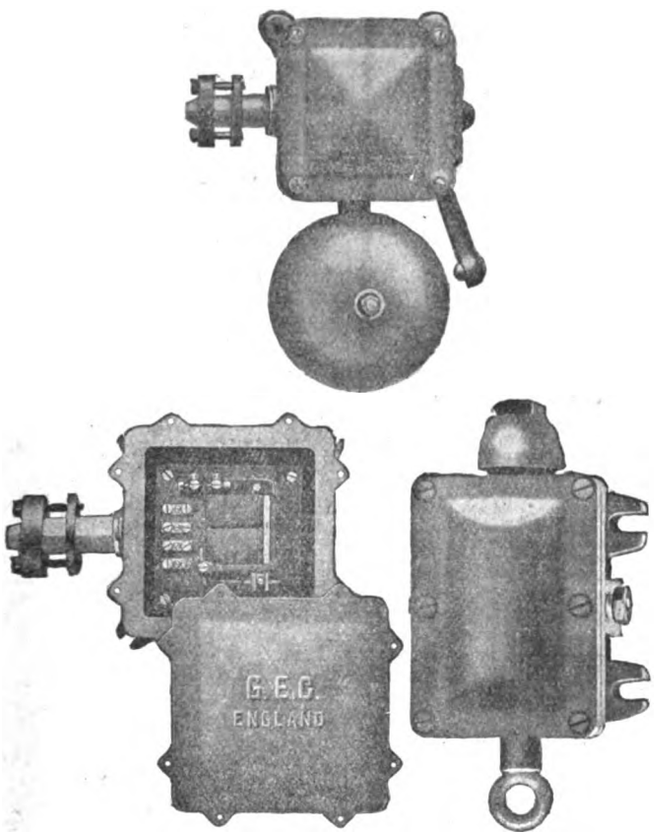


Fig. 3.—G.E.C. Ironclad Switch and Fuses.

Figs. 4, 5 and 6 illustrate the "Kingsway" signalling system, which consists of fool-proof bells (fig. 4), contained in cast-iron cases with broad machined flanges, relays in similar cases (fig. 5), and pushes, keys, or pulls (fig. 6). Audible and visible indicators are also provided, in gas and watertight cases, as well as luminous level indicators, &c., the whole forming a complete system in full compliance with the Home Office regulations. The use of relays



Figs. 4, 5 and 6.—"Kingsway" F.P. Bell, Relay and Mine Pull.

will be discussed elsewhere in this issue in a paper on bell-signalling in mines. Judging by the contents of this exhaustive list, the company are in a position to satisfy all the requirements of up-to-date installations of electric power in mines.

LEGAL.

Baillie *v.* Oriental Telephone and Electric Co., Ltd., and Others.

This case came before the Court of Appeal, composed of the Master of the Rolls and Lords Justices Kennedy and Swinfen Eady upon the appeal of the plaintiff from an interlocutory order of Mr. Justice Astbury, on Friday last.

In the result their Lordships allowed the appeal and granted an injunction until the trial of the action, with further order restraining the defendants from acting on certain resolutions.

Electricity in Mines.—An Appeal.

The Justiciary Appeal Court on December 18th, in Edinburgh, gave the decision in an important appeal from Hamilton Sheriff Court, where a test case was raised to determine the true construction of the Coal Mines Act, 1911. The Sholts Iron Co., Ltd., 1, Castle Street, Edinburgh, were convicted by Sheriff-Substitute Shennan on a complaint at the instance of the Procurator Fiscal of Lanarkshire of having, between March 1st and April 24th, 1914, in Rimmon Pitt, Sholts, with respect to two single-core electric cables, not being either flexible cables for portable apparatus or signalling wires, used during said period in the stone mine haulage road, which stone mine haulage road was then being used for mechanical haulage, failed to have each of the cables protected by a metallic covering, contrary to the Coal Mines Act, 1911, Sections 60 (4), 86, 90 and 101, and to General Regulation 129 (*c*).

The appellants contended that they were released from compliance with the existing regulations because the two cables were in use in the mine prior to June 1st, 1911, and were so adapted as to comply with the regulations then in force. The Sheriff-Substitute fined the appellants the nominal penalty of £1, holding that the Regulation 137 (*b*) merely authorised the continued use of an existing installation, and that when the appellants proceeded in January last to lay a cable on a mechanical-haulage road they were not entitled to use for this purpose any existing cable which had complied with the regulations before June 1st, 1911, but were bound to provide a cable with a metallic covering, which covering would comply with the new regulations.

The Justiciary Appeal Court dismissed the appeal, and found the respondent entitled to expenses modified to seven guineas.

North British Wireless Schools, Ltd., *v.* Mayne.

At Aberdeen, Sheriff-Principal Campbell Lorimer has dismissed an appeal against the Sheriff-Substitute's judgment in a case in which plaintiffs asked the Court to interdict Edward Alfred Mayne from conducting wireless telegraphic schools in Aberdeen City and county, and asking for £1,000 damages for breach of agreement. The Sheriff-Substitute had given judgment for pursuers on a point of jurisdiction, and defender appealed. As defender had failed to comply with the Court's order regarding the payment of certain expenses, the Sheriff-Principal dismissed the appeal, and granted the interdict and decree.

BUSINESS NOTES.

Water Softening Plant.—Since the outbreak of war, Messrs. United Water Softeners, Ltd., makers of "Lassen-Hjort" and "Permutit" water softening and purifying plants, have entered into contracts to erect over 100 installations, totalling several millions of gallons daily, for firms in the United Kingdom. Prominent among those who have placed orders for softening plants are the Admiralty (30,000 gallons per day), Vickers, Ltd. (14,000), Armstrong, Whitworth & Co., Brunner, Mond & Co. (500,000), Bickershaw Collieries, the North-Eastern Railway Co. (96,000), &c.

Australia.—The principal of a technical institute in Sydney is desirous of acting as an agent for United Kingdom manufacturers of mathematical instruments. An old-established firm is desirous of obtaining agencies for United Kingdom manufacturers of the following:—Telphers, gasworks installations, electric cranes, wheels and axles, and locomotives. Communications regarding these inquiries should be addressed to the Official Secretary, Office of the High Commissioner for Australia, 72, Victoria Street, London, S.W.

Trade with the Argentine.—We have received from Messrs. C. S. Lawson, of Avenida de Mayo 963, Buenos Ayres, a circular-letter relating to La Bolsa Mercantil (The Mercantile Exchange), which, it is stated, has been formed with a view to providing a means for merchants in this great market to be brought into contact with manufacturers' representatives and commercial travellers visiting the country from Europe and North America. They state that they are in constant touch with the principal firms dealing in many specified lines, including electrical materials and appliances.

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Private Arrangements.—APPARATUS AND ACCESSORIES, LTD., Mansion House Chambers, Queen Victoria Street, E.C.—The creditors interested herein were called together on December 16th, at the offices of Messrs. Corfield & Cripwell, Finsbury Pavement, E.C. Mr. C. Corfield had been appointed to act as Receiver for the debenture-holders, and also as the liquidator in the voluntary winding up. The statement of affairs presented showed liabilities of £731. The assets were estimated to realise £770, from which had to be deducted £765 for preferential claims and debentures, leaving net assets of £4 8s. 7d., or a deficiency as regarded the creditors of £727. The paid-up capital of the company was £150, and as regarded the contributories, there was a deficiency of £877. Mr. P. Houstoun said that the company was formed on April 24th, 1914, to take over the factory portion of the business of the Eastern Electric Co., Ltd. The two companies were practically run by the same people. Apparatus and Accessories, Ltd., had a nominal capital of £3,000, and the principal shareholder was a Mr. Walters. The only other shareholder was a Mr. Midworth. The company took over assets valued at £1,114 from the Eastern Electric Co., and also agreed to discharge liabilities of £114. In payment of the balance of £1,000, debentures for that amount were given to the Eastern Electric Co. Those debentures were now held by the Eastern Electric Co., but it had been decided that they would not prove for the full amount, but would forego £295, which had been drawn by the directors as salaries. Mr. Walters was the managing director of Apparatus and Accessories, Ltd., at a salary of £500 per annum, and he and Mr. Midworth had drawn £295. Mr. Houstoun added that he had gone into the trading of the company, and a rather curious position had been disclosed. It appeared that there had been a gross loss on the trading of over £400. That meant that either the company did not receive the £760 worth of stock which it was supposed to have obtained from the Eastern Electric Co., or that £400 worth of stock had disappeared. The only other alternative was that goods had been sold at less than cost prices. The books of the company were well kept and there was no evidence that goods had been sold at under cost. Mr. Walters had been asked for an explanation, and he stated that the value of the stock actually taken over by the company was only £289, and the balance of the £760 represented goodwill. The expenses of carrying on the business of the company had been £528, and the total loss on the trading was rather more than £1,000. Mr. Walters had suggested that he should waive the debentures until the unsecured creditors had received 5s. in the £. Mr. Corfield had been carrying on the business, and there was nearly sufficient in hand to pay that amount.

The representative of Messrs. Ward & Goldstone expressed the opinion that at least 10s. in the £ should be paid to the creditors. Another creditor gave it as his opinion that the debentures might be contested, and after some discussion it was unanimously decided to accept 10s. in the £ in settlement of the debts. The following are creditors :—

Braulik, George	£12	Jaeger Bros.	£25
Brotherton Tube and Conduit Co.	21	Midland Elec. Mfg. Co.	11
Barton & Sons	15	Plutte, Scheele Co., Ltd.	11
Blackwell & Co.	14	Reliance Electric Wire Co.	15
Carr Bros., Ltd.	15	Stella Conduits, Ltd.	14
Clifford, Chas., & Son	16	Siemens Bros. Dynamo Works	26
District Iron and Steel Co.	41	Turner & Burger	41
Ebonestos Manufacturing Co.	16	Ward & Goldstone	58
Elec. Ordnance and Acces. Co.	15	Yorks. Copper Co.	23
Falk, Stadelmann & Co.	20	Mehne, J. G. (Germany)	11
Fisher Ludlow, Ltd.	16	Maltzahn & Springer (Germany)	21
General Accessories Co.	55	Armon Eichel (Germany)	12
General Cable Mfg. Co.	21		

Bankruptcy Proceedings.—WILLIAM HENRY WOOD, electrical engineer, Lorna Doone, School Lane, Hall Green, Birmingham, Warwick.—The public examination of this debtor was recently held at the Court House, Corporation Street, Birmingham. It was stated that the cash account which debtor had been ordered to furnish was incomplete, while the trustee had met the committee of inspection, but had not received definite instructions. The Official Receiver therefore asked for an adjournment, which was granted.

ALFRED JOSEPH LOADER, medical electrician, lately carrying on business at 3, Forest Street, Nelson.—At Burnley, on December 18th, the first public examination was held. Debtor alleged as the cause of failure "liability of £209 to a creditor under a guarantee he signed for his brother Fred., and the present condition of things owing to the war." The gross liabilities amount to £332, of which £308 was expected to rank for dividend, the assets being estimated at £3 8s. 6d.

H. PEASE, electrical engineer, Scarborough and Doncaster.—Last day for proofs for dividend January 4th, 1915. Trustee, Mr. J. C. Clegg, Official Receiver, 14, Figtree Lane, Sheffield.

GEORGE EDWARD HIPKINS, 48, Wolverhampton Street, Dudley, Worcester, electrical engineer. The following are creditors :—

Armorduct Manfg. Co.	£36	Collings, George A.	£22
Adnil Electric Co.	15	Dudley Garage Co.	14
Bill & Berry	45	Fisher, F.	47
Donovan & Co.	18	Edison & Swan U.E.L. Co.	23
Metallic Seamless Tube Co.	22		

Canada.—A firm at Montreal wishes to get into touch with United Kingdom manufacturers of electric pocket-lamps, batteries, small electric bulbs, and all kinds of advertising goods, including electrical novelties, celluloid articles, &c. The name and address can be obtained at the Board of Trade Commercial Intelligence Department in London, but communications should be sent to H.M. Trade Commissioner for Canada, Mr. C. Hamilton Wickes, in Montreal.

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Calendar.—From MESSRS. PIRELLI & Co., of 144, Queen Victoria Street, London, E.C., we have received a wall calendar for 1915, consisting of a block of daily slips with bold red figuring, fixed on a large metal base, bearing an appropriate coloured view in which one of the firm's tires form a feature.

Spain.—An English engineer desires to get into touch with United Kingdom manufacturers of machinery, rails, steel cables, pipes, and electrical material and fittings. Apply, for the name, to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London E.C.; then communicate direct with the British Consulate, Seville.

Electrical Imports of China.—H.M. Commercial Attaché in Peking reports that, owing to the growing use of electric lighting, the imports of electrical material and fittings into China during 1913 rose from £256,419 to £850,770.

LIGHTING and POWER NOTES.

Arbroath.—RESTRICTED LIGHTING.—The Corporation Lighting Committee has had under consideration a letter from the Arbroath Electric Light and Power Co., stating that it could not reduce the annual charge for electric lighting under the contract from £282 to £58 15s., as proposed by the T.C. The company considered a loss occasioned by the war should be fairly shared by all parties concerned, and is willing to accept £100 per annum so long as the lighting is abnormal, provided that the period of the contract is run out under normal conditions. If the Council cannot accept this proposal, the company is willing that the question should be remitted to an independent electrical engineer. The Committee is to interview the company on the matter.

Argentina.—A large meeting of merchants and others has been held in Tucumán, to give practical form to the general protest against the tariffs charged by the amalgamated electric light companies in Tucumán. After much discussion, the following points were approved:—To boycott the electric tramways until the present question has been settled; to boycott the Central Cordoba Railway Co., as it is the principal author of the fusion of the three companies, as the Argentine Railway Co. holds a controlling interest in the Hydro-Electric Co.; to boycott a certain daily paper which, during the present campaign, has openly showed itself to be partial to the companies; to name a secret vigilance committee to ascertain what wholesale houses receive their goods by the said railway, and to take such reprisals as may be deemed necessary; to close all establishments at sundown until the Legislature sanctions laws to safeguard public interests.

The electric light company working at Rafaela, Santa Fe, has informed the municipal authorities that it will discontinue the public lighting if it is not paid regularly every month. The public pays the municipality the lighting tax, but the company never receives a cent.—*Review of the River Plate.*

Australia.—The Toowong T.C. (Queensland) is considering as to the advisability of establishing within its own area an electric lighting plant.

Baildon.—The Buildings and Highways Committee of the U.D.C. has considered a communication from the West Riding District Councils' Association asking for its observations on the proposal of the Yorks. Electric Power Co. to apply for power to supply electricity for lighting in those districts in which it is already authorised to supply current for other purposes, and has decided to request the Association to use its best endeavours to prevent the granting of the powers asked for to any company in any district, except with the full consent of the local authority.

Banchory.—E.L. SCHEME.—The Streets and Lighting Committee of Banchory T.C. is to make a personal canvass in favour of the electric scheme early in the new year.

Belfast.—EXTENSION SCHEME.—The Tramways and Electricity Committee has received a report from the city electrical engineer on the additional plant required for the purpose of meeting the requirements for the next three years. The total estimated cost amounts to £28,000, and it has been decided to refer the matter to the City Council for consideration.

Crayford.—STREET LIGHTING.—The P.C. has decided to utilise gas for lighting Barnes Cray, where dwellings built and to be erected will be supplied with electricity by the West Kent Electric Co., provided that the South Suburban Gas Co. lays a main in every road where houses are erected, free of cost. The charges quoted by the Electric Co. were £3 12s. 6d., £3 2s., and £2 10s. per lamp per annum, according to candle-power, and for gas £3 15s., the lamps, &c., to become the Council's property at the end of five years.

Crompton.—DESTRUCTOR LOAN.—The U.D.C. has decided to take up a loan for the immediate construction of a refuse destructor.

Doncaster.—The Tradesmen's Associations is considering the advisability of opposing the Bill of the T.C. which seeks powers to purchase, sell, let or hire, &c., meters, and other electrical fittings and apparatus for lighting, motive power, and other purposes, and to establish a showroom in connection with the undertaking. The opposition is on the ground of wide municipal trading.

Failsworth.—PROPOSED DESTRUCTOR.—The U.D.C. has appointed a Committee to visit other towns with regard to ascertaining the cost of working a refuse destructor.

Fleetwood.—The U.D.C. has adopted the following alternative systems to existing charges for electricity for lighting, cooking and heating. Tariff A: A quarterly charge or assessment, payable in advance, based on the total watts of lamps installed, at the rate of £6 per KW. per annum, plus 1d. per unit for all units consumed, the appliances not being assessed in fixing the quarterly charge. Tariff B: A quarterly contract based on the total C.P. and watts of lamps which are made use of at the same time, and not on the total number of lamps installed on the premises.

Harrogate.—PROV. ORDER.—The T.C. decided at a special meeting on the 15th inst. to apply for a prov. order in connection with the proposed electric light extension scheme.

Haslingden.—SCHOOL LIGHTING.—The Education Committee has decided to engage the services of Mr. Thorp to report with respect to the lighting of the new Council school.

Hyde.—STREET LIGHTING.—The T.C. has accepted terms quoted by the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board for lighting the tramway route by electricity.

London.—L.C.C.—The Finance Committee recommends the L.C.C. to sanction the following loans for electricity purposes:—Bethnal Green B.C., £24,470, made up as follows: Sites for sub-stations, £935; sub-station buildings, £1,980; mains, £14,536; sub-station plant (transformers and switchgear), £4,269; house services, £500; meters, £300; contingencies and engineers' charges, £1,950. The loan is in connection with the bulk supply for the Stepney B.C., at a pressure of about 6,000 volts, the high-pressure current being transmitted through duplicate cables to two sub-stations, one in the western and the other in the eastern part of the borough. Hampstead B.C., £17,300 for the purposes of the electricity undertaking, as follows:—Sub-station buildings, £472; mains, £6,317; plant, £8,583; house services, £1,928.

The Highways Committee reports that the B. of T. has inserted in the orders made by the Board in respect of a bulk supply of electricity between the Woolwich B.C., the South Metropolitan E.L. and Power Co., Ltd., and the West Kent Electric Co., Ltd., a proviso that any agreements made thereunder should be subject to the approval of the L.C.C.

Luton.—The Electricity Committee has received various complaints of the emission of smoke and grit from the chimney shaft at the works and has instructed the engineer to reply thereto. The Committee is of opinion that it is not advisable, at the present time, to join in promoting the proposed Bill of the I.M.E.A., and it does not feel able to make any contribution towards the costs to be incurred by two local authorities in appealing against certain legal decisions adverse to electricity supply undertakings. The engineer is negotiating for the purchase of land in the Leagrave Road district as a site for a sub-station.

Neath.—As a result of the recent trouble with the employés of the Corporation gasworks, when the supply of gas was cut off for a week, many large consumers are having an electric supply installed on their premises.

Oldham.—Councillor Hardman informed the Electricity Committee, on December 16th, that the number of units sold during the previous fortnight was 70,000 more than in the corresponding period of 1913, but the station costs was £80 less. Three years ago, the coal used per unit was 7·14 lb., and now it was 4·77 lb.

Queensferry.—E.L. SCHEME.—At a meeting of the West Saltney P.C., on December 15th, it was stated that everything possible was being done to expedite the scheme for providing electric lighting at Queensferry, and it was thought that the charge would be 4d. per unit.

Saddleworth.—At a meeting of the D.C. last week a letter was reported from the Yorkshire E.P. Co. stating that it was intended to include Saddleworth in its Bill for supplying electricity for lighting as well as for power. The clerk was ordered to inform the company that the D.C. was negotiating with the Stalybridge Joint Electricity Board.

Sandown.—STREET LIGHTING.—The U.D.C. has renewed for another quarter the street lighting contract with the Isle of Wight E.L. Co. The contract price is reduced by £25 on account of restricted lighting.

Selby.—E.L. PROPOSALS.—The U.D.C. has decided to oppose the application of the Yorkshire Electrical Distribution Co., Ltd., for a prov. order for the district in the event of satisfactory terms not being obtained. It was stated that the company had offered the right to purchase at the end of 21 years the company's works in the urban district as a going concern, if the Council did not oppose the application.

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Skipton.—Prov. Order; Proposed Loan.—At a special statutory meeting of the Council last week it was decided to make application to the B. of T. for a prov. order for the urban district. An estimate of the cost has been prepared, and the Council has decided to apply for powers to borrow £13,000 in connection with the electric lighting scheme.

Southend-on-Sea.—Street Lighting.—During the execution of the Leigh Broadway improvement, provision is to be made for the erection of arc lamp columns in order that the thoroughfare may be electrically lighted. In this connection the Electric Lighting Committee proposes to erect a sub-station, and has accepted a tender of £4,882, to carry out the work.

Stoke-on-Trent.—Loan Application.—The T.C. has applied to the L.G.B. for a loan of an additional £12,230 for electricity purposes.

Surbiton.—E.L. Transfer.—The Council has had before it draft agreements for the transfer of the E.L. undertaking, and has referred them to a special sub-Committee to consider certain alterations and amendments.

U.S.A.—Canvassing Up-to-Date.—The Consolidated Gas, Electric Light and Power Co., of Baltimore, has hit upon a novel idea of demonstrating the use of electrical appliances. An electric motor-car, with a battery of 60 cells and three 150-ft. cords, is brought up alongside any house; the cords are run into the house and used for demonstrating lighting fixtures, heating fixtures, heating devices, vacuum cleaners or other household appliances. One of the big advantages of this equipment is that it is applicable to the unwired house, and is often a sufficient argument in favour of having the house wired up. By large signs placed on the car, the whole neighbourhood is apprised of the nature of the demonstration. This usually results in a number of demonstrations being given in the same street. It is claimed that this has been a most effective means of assisting the wiring and appliance department of this company. English central stations might with advantage copy this idea.

TRAMWAY and RAILWAY NOTES.

Australia.—The Victorian Government has decided to build an electric street railway from Sandringham to Black Rock, along the coast of Port Phillip. The gauge is to be 4 ft. 8½ in., and the cost is estimated at over £44,000.

Bristol.—The Kingswood U.D.C. has decided not to oppose the application of the Bristol Tramway Co. for an extension of time for extending its lines from the Hanham terminus to Willsbridge, and from the Kingswood terminus to Warmley.

Subject to the tramways company continuing to provide a 'bus service on the proposed new tramway routes, the Warmley U.D.C. has decided not to oppose the company's application for an extension of time for the construction of the tramways in the district.

Barnsley.—Strike.—Considerable inconvenience was caused to the people of Barnsley and district last Friday evening by the decision of the employés of the Barnsley and District Electric Traction Co. to strike. This action resulted in the stoppage of the tramway service, and also the service of motor-'buses which runs between the surrounding districts and the town. The reason for the strike is stated to be a demand by the men for an increase in their pay and the reinstatement of one or more dismissed employés.

Decreased Tram Receipts.—The loss of revenue sustained by the Manchester tramways department since the outbreak of war has been at the rate of £50,000 per annum.—The Salford tramways department is reported to have decreased receipts averaging about £600 per week.—Alderman Schofield mentioned at the Rawtenstall T.C. meeting on December 17th that the tramway department had lost over £400 during the past month, and £500 in the previous month, and Mr. Stewart (the Rawtenstall tramway manager), when asked how other towns were affected, stated that the tramway receipts at Accrington were down by about £150 per week, and the Burnley receipts were down between £300 and £400 per week. Receipts were down in practically every town, added Mr. Stewart, except in those towns where special war work was going on.

Glossop.—The T.C. has appointed a Committee to act with the town clerk in watching the Corporation's interests regarding the application of the Stalybridge, Hyde, Mossley, and Dukinfield Electricity and Tramways Board for powers to construct a tramway at Woolley Bridge, which is in the borough, and to acquire by agreement the undertaking of the Urban Electric Supply Co., Ltd., at Glossop.

Halifax.—Proposed Tramway Extension.—The Tramways Committee has agreed to an application from the Southowram Council for an extension of the tramway system from the present terminus, providing that the Council agrees to pay a subsidy each year for a period of 15 years. This condition has not yet been accepted by the Southowram Council, but the Tramways Sub-Committee is to consider the matter this week.

Provision is being made in the Corporation Tramways Bill for a motor-omnibus service from Mytholmroyd to Cragg Vale.

Hurst.—There was a loss on the tramway working for the past year of £35.

Keighley.—B. of T. Inspection.—On Tuesday, last week, Col. Druitt, of the B. of T., inspected the Utley to Eastburn, and the Keighley to Oakworth railless traction routes of the Corporation, which are now in readiness for passenger traffic.

Manchester.—The Tramways Committee has approved plans for a re-arrangement of the tram lines in Albert Square, so as to provide for the erection of tramway shelters.

South Shields.—At a meeting of the T.C. on the 14th inst., the draft of the Bill for tramway extensions, &c., to be promoted in the next Session of Parliament was approved. The estimates included in the Bill were £15,392 for the construction of tramways, £1,319 for equipment and general tramway purposes, and £3,600 for omnibuses.

TELEGRAPH and TELEPHONE NOTES.

Canada.—The Government wireless station at Cape Race is to be improved, the range being increased from 400 to 800 or 1,000 miles. All the Canadian stations were taken over by the Government on the outbreak of war.

For the year 1912-13 the total number of wireless telegraph messages was 272,087, and the words handled were 4,275 759.

The gross revenue from telephones in 1913 was $14,897,278, and the net revenue $3,721,589. The number of employés was 12,867, compared with 12,783 for 1912, and the salaries amounted to $6,839,309 against $2,659,642. The total wire mileage in 1913 was 1,092,587.

Germany's Isolation.—The following statement with reference to the cable isolation of the German and the Austro-Hungarian Empires has been given out by the German Information Service:—

"Germany has five cables ending at the Island of Borkum, in the North Sea, one going to Brest, in France; one to Vigo, in the north of Spain; one to Teneriffe, on the Canary Islands at the north of Africa, and two by way of the Azores to New York. All five lead through the English Channel, so that it was not difficult for England to cut them. On the other hand, it will be very difficult, even impossible, for Germany to repair them as long as the war lasts.

"Between Germany and England there exist six cable lines, partly German, partly English, which, of course, are not used now. From Germany's west coast, therefore, no communication with the world is possible.

"The telegraphic communication *viâ* Holland, Denmark, Norway and Sweden can only be kept up by cables that end in England and France, where, of course, cablegrams are censored.

"The ways to the south *viâ* Austria or Italy are also blocked, as the cables that run from west to east in the Mediterranean belong to an English company, the Eastern Telegraph Co., and end in English territory. The cables starting from Italy, and also from Turkey, go *viâ* Malta, Gibraltar and Lisbon to the Atlantic Ocean. With Africa no communication is possible without using the cables of the Eastern Telegraph Co., and telegraphic land connections with China pass through Russia or British India. Therefore, with the exception of the wireless service, Germany can telegraph only to Austria-Hungary, Holland, Switzerland, Italy and the Scandinavian countries. Spain and Portugal are cut off, too."—*Telegraph and Telephone Age.*

New Cables.—The Mexican Telegraph Co. and the Central and South American Telegraph Co. in July last contracted with the Telegraph Construction and Maintenence Co. of London for the manufacture and laying of a duplicate cable between New York and Colon, Isthmus of Panama, *via* Guantanamo, Cuba. The length of this cable will be about 2,328 nautical miles, which includes an allowance of 12 per cent. for slack. A considerable portion of the cable will have a core of 550 lb. copper and 310 lb. gutta-percha per mile, which will insure a working speed of over 200 letters per minute. Two thousand nautical miles have already been completed, and it is expected that the remainder will be finished and the cable steamer *Colonia* will sail from London before the end of this year. The cable will be laid from New York southward to Colon, Isthmus of Panama.

The Central and South American Telegraph Co. expects shortly to extend its cable system by laying two cables, one from Buenos Ayres to Santos and one from Rio de Janeiro.—*Telegraph and Telephone Age.*

United States.—On November 13th, Judge Hough, of the United States District Court, New York, granted the temporary injunction sued for by the Marconi Wireless Telegraph Co. against the De Forest Wireless Telegraph and Telephone Co., the Standard Oil Co. and Lee de Forest. The charge was that the defendants had been installing and were continuing to install on the Standard Oil ships a wireless device which is an infringement of the Fessenden patents owned by the plaintiffs.—*Telegraph and Telephone Age.*

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NEW TURBINE PLANT AT LIVERPOOL.

Although it is some years since an opportunity presented itself for visiting the Liverpool Corporation's electrical supply undertaking, the interval has seen great changes in the working of this important department.

The business of electricity supply in Liverpool dates back to 1883, when the local company was formed, and our issue of January 6th, 1893, contains some typical illustrations of the local generating stations in existence at that date, which subsequently gave place to the modern direct-current generating stations at Pumpfields and Lister Drive.

Some years ago the growth of the undertaking rendered it necessary to eliminate direct-current generation, and at the present time the Lister Drive station supplies practically the whole of the needs of the area from turbine-driven three-phase plant installed there, the exceptions being two direct-current turbine sets for local supply and certain small plants, totalling some 2,000 KW., installed at five destructor stations, which supply direct to the tramways system.

Fig. 1.—Interior of Lister Drive No. 2 Station, showing Westinghouse and B.T.H. Vertical Curtis Turbine Plant.

On Friday, the 11th inst., a new 6,000-KW. turbo-alternator set was formally started up at the Lister Drive station by the Chairman of the Tramways and Electric Power and Lighting Committee (Mr. Russell Taylor), the occasion being the annual inspection of the undertakings by the Committee, which was followed in the evening by an informal dinner at the Adelphi Hotel, to which representatives of other Corporation departments and of the daily and technical Press were invited.

The new 6,000-KW. turbine set is, we gather, the forerunner of four similar-sized sets, one of which is in course of erection, and when these extensions are completed, and the necessary boiler plant provided, some 55,000-KW. of plant will be installed at the Lister Drive station.

The new set, which we illustrate in figs. 2 and 7, has been supplied by the British Thomson-Houston Co., Ltd., and runs at 1,500 R.P.M., generating three-phase 50-cycle current at 6,600 volts pressure, on steam at 200 lb. pressure, superheated 200° F., when exhausting into a 28-in. vacuum (bar. 30 in.). The turbine casing is divided in a horizontal plane, allowing the top half to be removed for inspection purposes.

The bearings are lubricated by oil under pressure from the main lubricating system and water cooled; an auxiliary steam oil pump is provided for starting up.

The governor, shown in fig. 7, is of the low-speed centrifugal type and is driven from the same shaft which operates the oil pump. The governor controls a small hydraulic pilot valve, admitting oil at 60 lb. pressure on either side of a rotary piston attached to the shaft which operates the steam controlling valves, and each of the latter admits steam to a group of nozzles, the number in use being proportional to the load.

The governing is within 2½ per cent. variation between no-load and full load, and an additional safety governor is provided which shuts off steam should the speed exceed 12½ per cent. above the normal.

The alternator is designed to give a normal full load output of 7,500 K.V.A. at 80 per cent. power factor; it is of the forced ventilated type, fans on the rotor providing for the circulation of 25,000 cb. ft. of air per min.

A direct-coupled shunt-wound exciter, at the end of the main shaft, supplies excitation current at 125 volts pressure for the main field, the rheostat for the latter being electrically operated.

The condenser, of the Mirrlees wedge-shaped type, will deal with 88,000 lb. of steam per hour, and contains 14,000 sq. ft. of cooling surface.

It is designed on strictly counter-current principles, and the tubes are divided into sections for compartmental drainage.

One steam-turbine-driven condenser auxiliary set is provided, as shown in fig. 3.

This consists of a three-stage 2,000-R.P.M. turbine, exhausting into the main condenser, and driving a centrifugal circulating pump, to deal with 11,000 gallons of water per min., a Mirrlees-Leblanc rotary air pump, and a centrifugal water-extraction pump, all coupled in succession to the turbine shaft.

The main generator has an overload capacity of 25 per cent. at 80 per cent. power-factor, for two hours following a full load run.

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It is coupled to its control panel by three 1-sq. in. H.T. lead-covered cables, each having a central jute core.

Fig. 5, a general view in No. 1 engine room, shows the older plant in the foreground with the new turbine set behind; it will be noted that owing to the space requirements of the condensing plant, the new unit has been installed at a higher floor level than the older plant, which includes two 3,500-KW. B.T.H. 6,600-volt turbo-alternators and two 2,000-KW. Westinghouse turbine sets, each consisting of two 1,000-KW. direct-current machines in tandem, for local lighting and traction supply, these machines being fitted with the Westinghouse radial commutator. This engine room also contains two 500-KW. Westinghouse motor-generators.

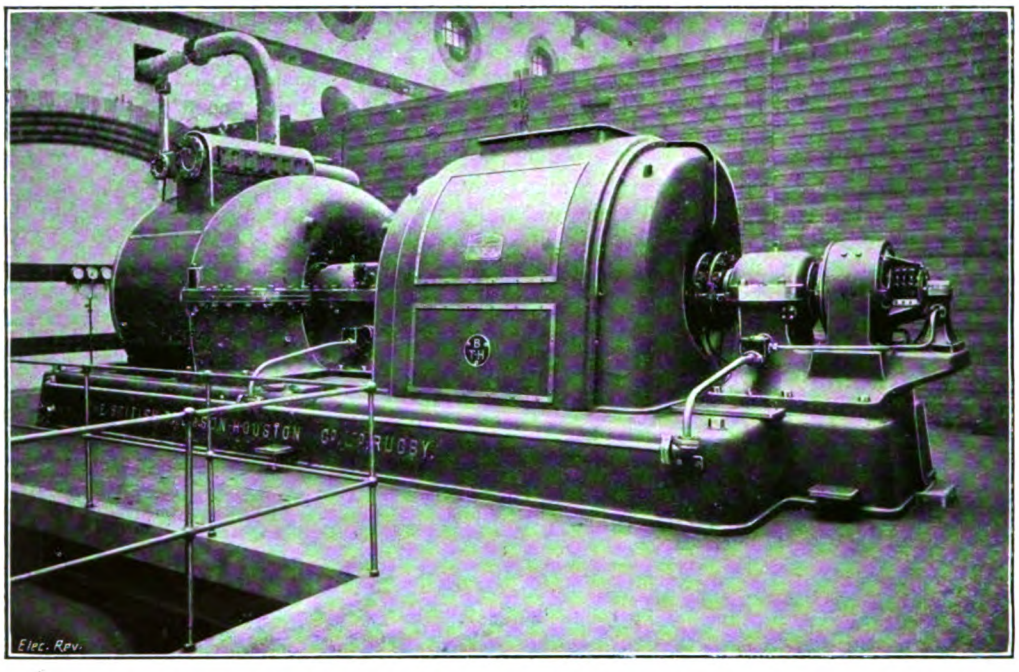

FIG. 2.—NEW 6,000-KW. B.T.H. THREE-PHASE TURBO-ALTERNATOR, SPEED 1,500 R.P.M.

The adjoining No. 2 engine room, which was equipped with turbine plant at an earlier date, is shown in fig. 1; this contains 10 6,600-volt turbo-alternators, four being Westinghouse machines of 2,000 KW. each, and the other six, B.T.H. vertical Curtis turbines, each of similar capacity. These latter machines, which have rendered very satisfactory service, are, we believe, the only vertical turbines in this country which are fitted with oil footstep bearings, instead of the usual hydraulic footstep bearing.

All these turbines are operated in conjunction with surface-condensing plants, the circulating water for which is passed over a large bank of cooling towers, including eight Worthington and four Richardsons, Westgarth natural-draught towers and two Wheeler forced-draught towers.

The make-up water for this installation is obtained from the public supply mains.

In conjunction with the re-equipment of the engine rooms, the boiler house plant has been brought up to date, the Lancashire boilers have been discarded, and at the present time some 22 Babcock & Wilcox water-tube boilers, each of 25,000 to 30,000 lb. per hour steaming capacity, are in use, supplying steam at 200-lb. pressure, superheated 200°.

Each of the four chimneys has also been equipped with two induced-draught fans to assist in meeting the peak loads. We illustrate in fig. 6 the most recently re-equipped boiler house at this station.

The Lister Drive plant supplies H.T. energy to 14 transforming sub-stations in various parts of the city, also to six static sub-stations as shown in fig. 4.

The older Pumpfields generating station is now supplied through three 1,500-KW. rotary converters installed there; the Highfield Street and Paradise Street stations are each equipped with eight 500-KW. motor-generators; Oldham Place with five 500-KW. motor-generators; Fairclough Lane with four 500-KW. and four 200-KW. motor-generators; Beaumaris Street with three 500-KW. and two 200-KW. motor-generators; and Rice Lane sub-station with one 500-KW. and four 200-KW. machines, while in the remaining sub-stations there are 23 200-KW. and six 100-KW. motor-generators installed.

All the sub-station machinery is suitable for either lighting or tramway purposes, and in connection with the latter it may be worth recalling the fact that—in common with the L.C.C. tramway system—shunt-wound machines have been adopted throughout for traction supply.

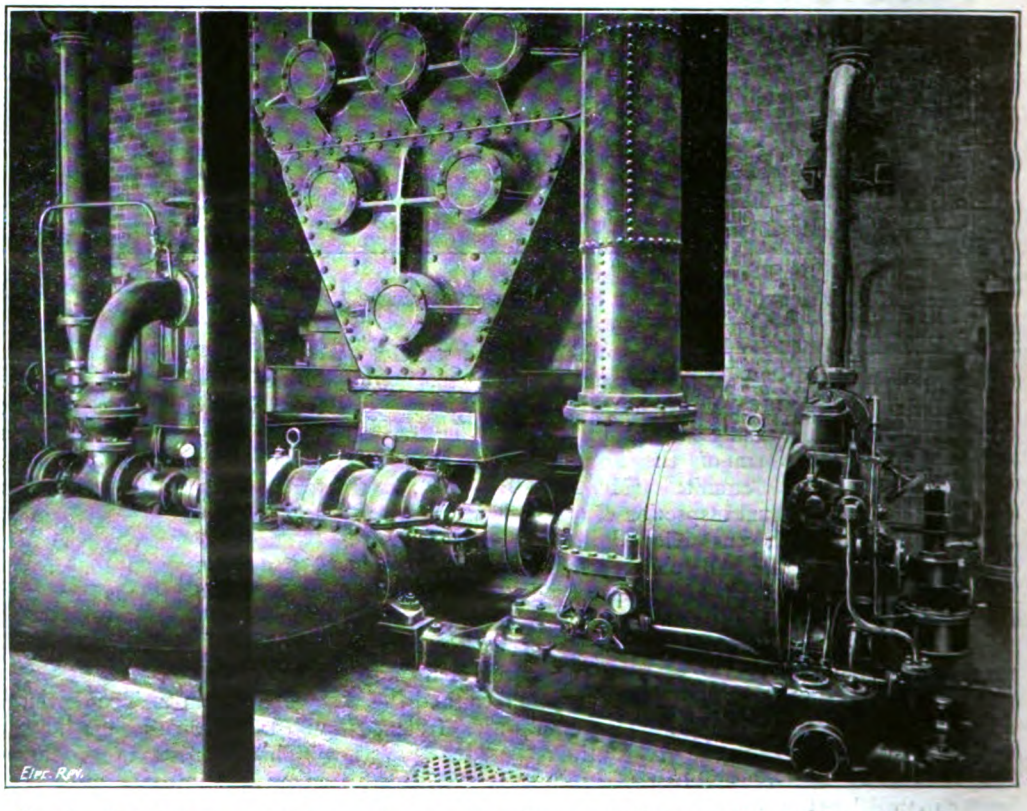

FIG. 3.—TURBINE-DRIVEN AIR AND CIRCULATING PUMPS, 6,000-KW. B.T.H. TURBINE SET.

The greater part of the switchgear installed at the Lister Drive station has been built by the Electric Supply

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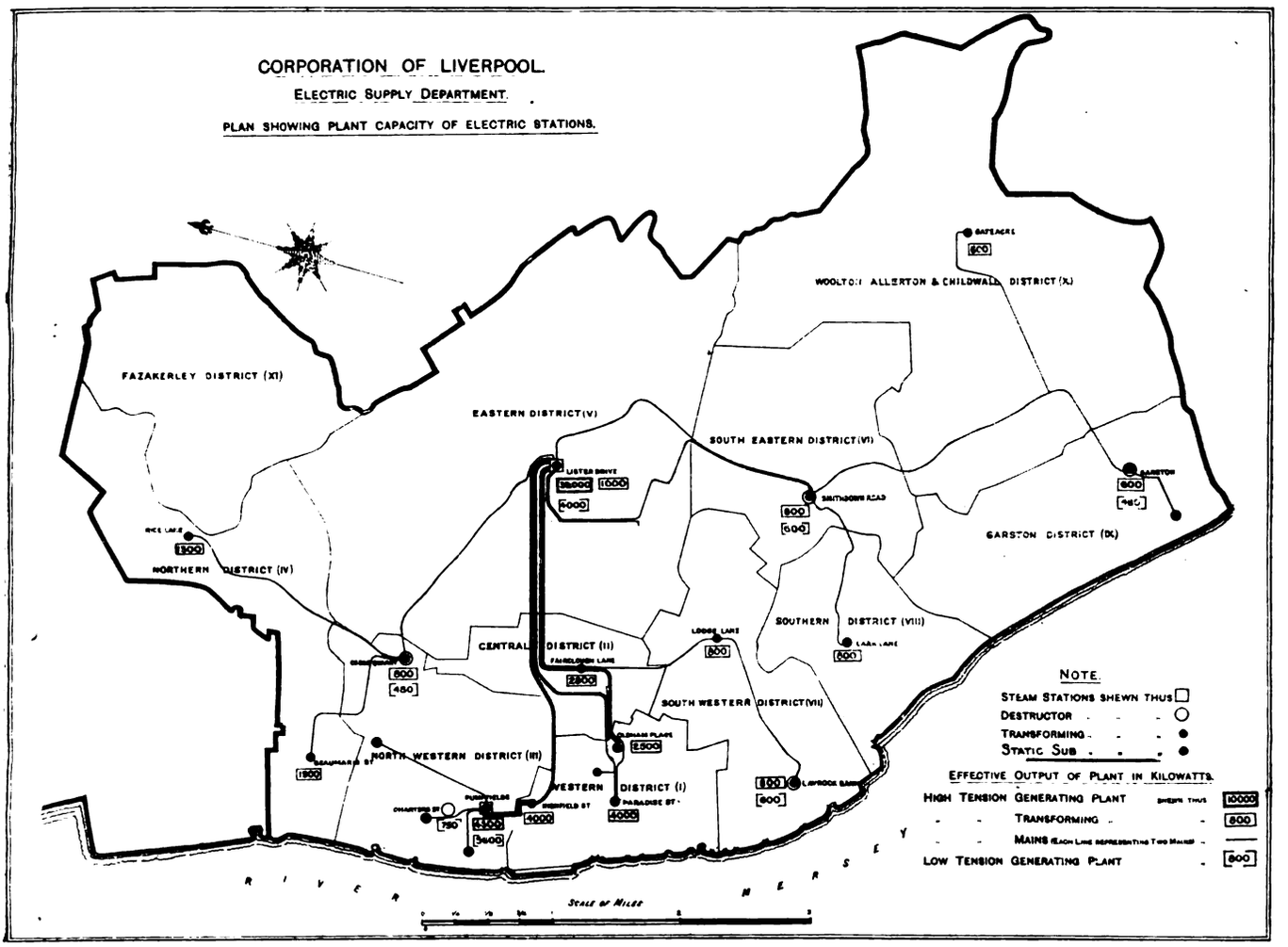

FIG. 4.—GENERAL PLAN OF THE 6,600-VOLT SUB-STATION LAY-OUT, LIVERPOOL ELECTRICITY DEPARTMENT.

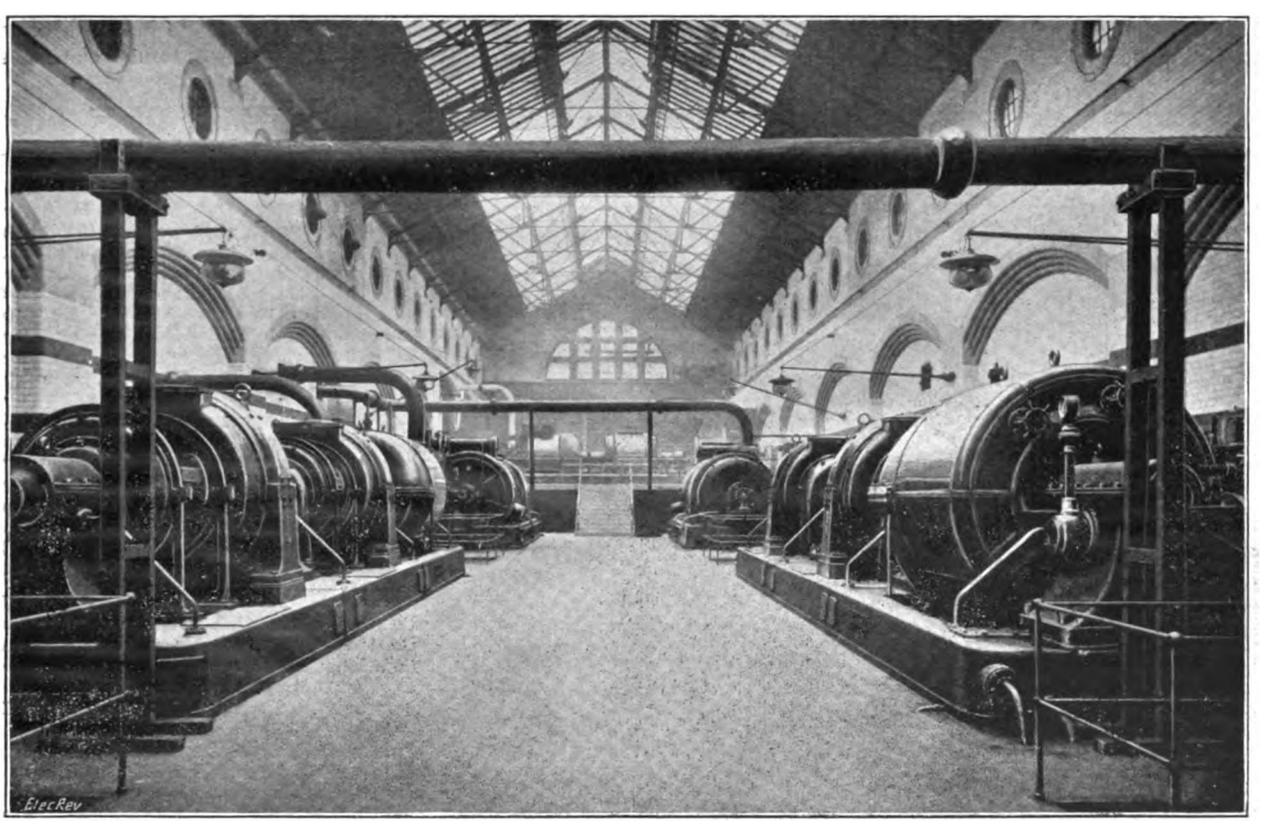

FIG. 5.—THE ENGINE ROOM, LISTER DRIVE NO. 1 STATION, LIVERPOOL, SHOWING NEW 6,000-KW. SET IN BACKGROUND.

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Constructional Department, which also carries out cable fittings work, motor installations for large consumers, and is available for general repair work when required.

The 6,600-volt switchgear includes control boards on the ground floor, with oil switches and bus-bars in concrete and brick chambers above.

The oil switchgear is divided into four sections coupled by means of 10,000-KW. section switches, while 6,000-KW. oil switches—with a breaking capacity of 25,000 KW.—are installed for all feeders and generators; a similar subdivision of feeders, switchgear and machines has also been adopted in the principal sub-stations.

Under the arrangement outlined above, the generators and feeders of each group are normally operated in conjunction with each other, the bus-bar connection between groups being mainly for emergency purposes, while for a similar reason the extreme ends of these bus-bars are coupled by means of cables.

In case of a failure affecting any one section of the switches, that section can be cut out by means of the section switches, and all the latter can be tripped simultaneously by means of a tripping device in the engine room, should occasion arise, thus sub-dividing the whole of the H.T. supply system, both in the generating and sub-stations.

The above gives some indication of the lines of development of the electric supply department in recent years; it is anticipated that the maximum load on the Lister Drive plant will this year reach from 24,000 to 25,000 KW., and that over 50 million units will be generated there. Under the *régime* of Mr. Harold Dickinson, the present city electrical engineer, the Lister Drive plant—which at the time of its construction as a direct-current station, represented the best practice of the day—has been brought up to date, and its generating capacity greatly increased by the introduction of modern turbine and water-tube boiler plant, without addition to the original buildings.

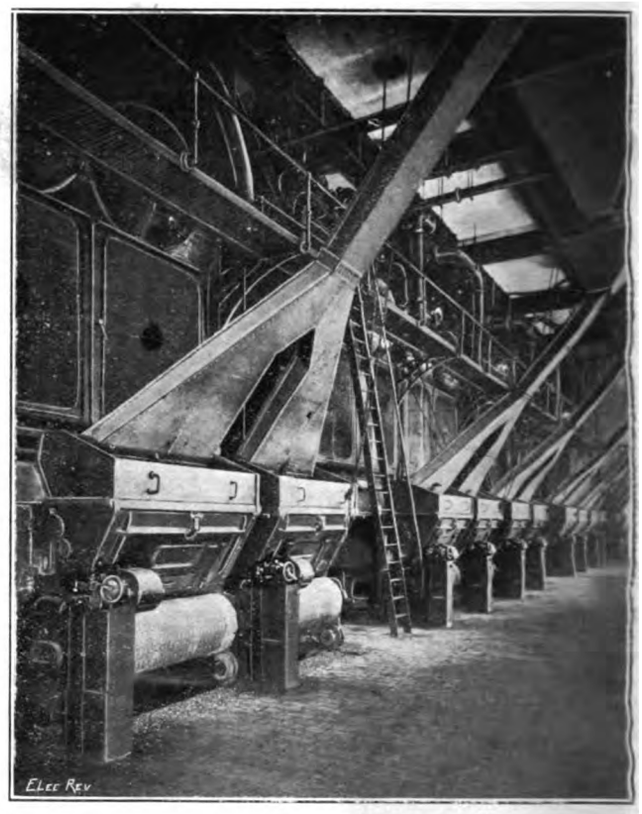

Fig. 6.—Interior of the Latest Water-Tube Boiler House, Lister Drive Station.

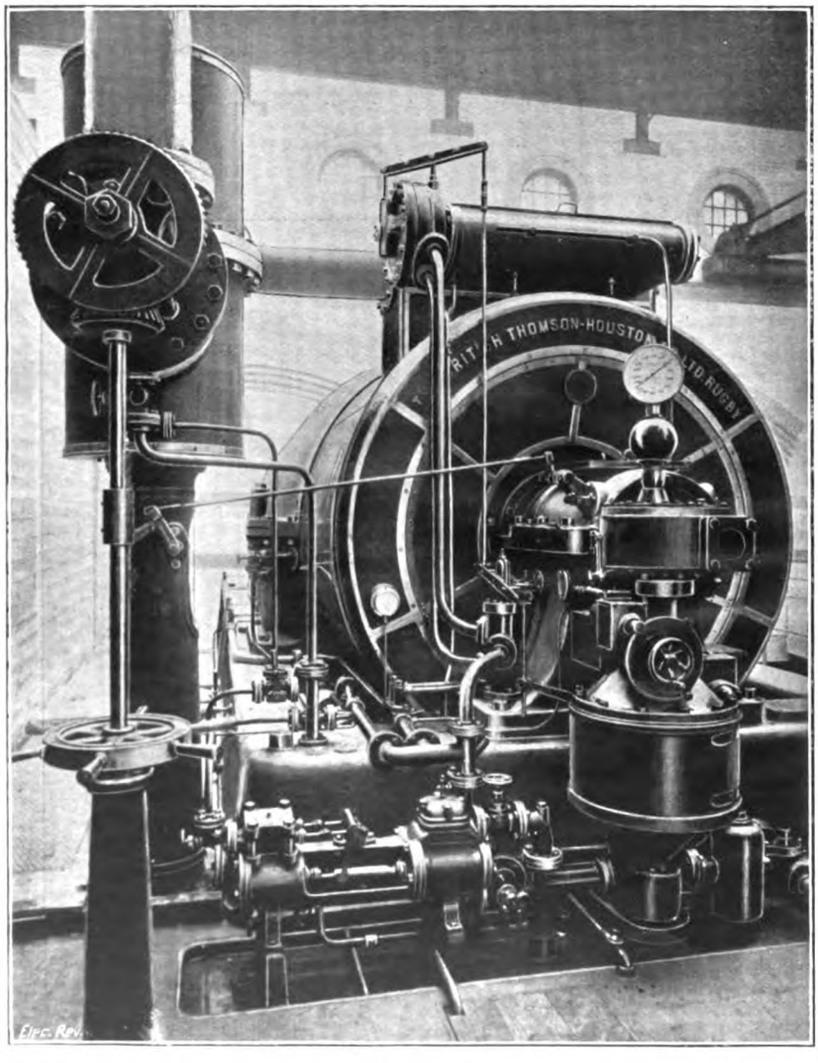

Fig. 7.—Steam End, showing the Governor, Auxiliary Steam Oil Pump, &c., 6,000-KW. B.T.H. Turbine Set.

On the other hand, great efforts are being made to secure the power load in the city, and thus improve the working conditions of the undertaking, which has in the past, no doubt, suffered to some extent from the preponderance of the lighting peak. On all these matters congratulations are due to Mr. Dickinson, to whom, and to his assistants, we are indebted for assistance in the preparation of this short article.

U.S. Electrical Vehicle Standardisation.—The Electrical Vehicle Division of the American Society of Automobile Engineers, which is working in conjunction with the Electric Vehicle Association of America, has just drawn up a proposed standard for two types of motors for electric vehicles, of 60-66 volts and 80-85 volts respectively, which, when completed, will include the standard characteristic curves. The Division has also recommended two much-needed standards in the matter of ratings of electric vehicles, as follows:—"Electric vehicle mileage ratings shall be based on the rated five-hour discharge capacity of the battery and a continuous run with one-half load over hard, smooth and level roads or pavements. Electric vehicle speed ratings shall be based on continuous operation with one-half load, over hard, even and level roads or pavements, at the actual average battery voltage."

High Temperature Arc.—A German Professor, Dr. Otto Lummer, some time ago, at Breslau, gave some information about certain experiments which had been carried out with a view to producing exceedingly high temperatures. His method consisted chiefly in allowing the lamp to burn in an atmosphere under a very high pressure. Many experiments were made before a suitable carbon was discovered which was able to preserve its full lighting power for a long period under pressures up to 22 atmospheres. The temperature in the crater of an ordinary arc burning in free air is 4,200° C.; this temperature has been exceeded by more than 3,000°, while the temperature of the sun is estimated at only about 6,000° C.

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CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—March 15th. Municipal Council. Transformer testing apparatus. Specification from City Electrical Engineer. A copy can be seen at the Board of Trade C.I. Branch in London.

Adelaide.—January 20th. Telephone material, fuses, &c., for Postmaster-General. See "Official Notices" December 11th.

January 27th. Accumulators, and power board, for Postmaster-General. See "Official Notices" December 18th.

February 10th. Testing instruments, for Postmaster-General. See "Official Notices" to-day.

Melbourne.—January 6th. Six 100-K.V.A. single-phase transformers. 7,230 yards of single conductor lead-covered cable, for the City Council. See "Official Notices" December 11th.

Birkenhead.—January 12th. Twelve months' supply of electric motors and motor-starters, from ¼ to 15 H.P., for the Corporation electricity supply. See "Official Notices" Dec. 18th.

Bradwell (Staffs).—December 29th. Electric lighting installation at Hospital, for the Bradwell Joint Isolation Hospital Committee. Messrs. A. R. Wood & Son, architects, Tunstall.

Dover.—January 18th. Uniforms for the Corporation tramways staff. Mr. R. E. Knocker, town clerk, 69, Castle Street.

Hong Kong.—January 15th. Two 1,500-KW. (2,000 K.V.A.), turbo-alternators with condensing plant and switchboards, E.H.T. cable, sub-station switchboards and transformers, for the North Point generating station. See "Official Notices" Dec. 18th.

Hornsey.—December 29th. E.H.T. switchgear and E.H.T. three-core cable, for the Borough electricity works. See "Official Notices" December 4th.

January 2nd. L.T. switchgear, &c., for the T.C. See "Official Notices" December 11th.

Leeds.—January 22nd. Overhead electrically-driven travelling crane, coal and ash-conveying plant, for Electric Lighting Department. See "Official Notices" December 11th.

Leyton.—U.D.C. Repairs, &c., to cooling tower, for Lighting Committee. See "Official Notices" December 18th.

London.—L.C.C. The Highways Committee recommends that tenders be invited for the supply of a new motor required in connection with the testing by the Council of electrical meters.

Manchester.—January 19th. Tramways Committee. (*a*) Permanent way special track work, and (*b*) permanent way points, tongues, and hardened steel centres. Specifications, &c. (£1 1s. returnable), from Mr. J. M. McElroy, general manager.

Shanghai.—January 12th. 68 three-phase induction motors, various sizes between 5 and 60 B.H.P., with slide rails and liquid starters, for Municipal Council. See "Official Notices" to-day.

Shrewsbury.—January 1st. Electric light installation at Belle Vue House, for Atcham Board of Guardians. Mr. F. H. Shayler, architect, 16, Pride Hill, Shrewsbury.

Spain.—The municipal authorities of Candeleda (province of Avila) have just invited tenders for the concession for the electric lighting of the town during a period of 10 years.

Valencia.—Ministerio de Fomento. Four electric cranes for the Port of Valencia (cost about £7,200).

CLOSED.

Brighton.—The T.C. has renewed the contract with the British Westinghouse Electric and Manufacturing Co., Ltd., for the supply of motors for hiring, for a year from April 1st next.

Crewe.—The following tenders have been accepted by the Higher Education Committee:—

Electrically driven high-lift centrifugal pump, £78.—Mather & Platt, Ltd.
100,000-lb. Riehle testing machine with driving motor, £345.—A. Macklow Smith.
8,000 single-lever testing machine, £95.—Denison & Son, Ltd.

Croydon.—The T.C. has accepted the tender of Messrs. S. Wolstenholme & Son, at £385, for two electric motors, pumps and connections, at the S. Norwood sewage farm.

Luton.—The Electricity Committee recommends the acceptance of the tender of Messrs. W. H. Bowater, Ltd., to supply between 5,000 and 6,000 tons of Ibstock coal, at 14s. 2d. per ton and 13s. 2d. per ton, according to the mode of delivery.

London.—Islington.—The B.C. Lighting Committee has had under consideration the desirability, having regard to the special circumstances created by the war, of continuing contracts for the supply of materials for a further period of 12 months from March 31st next. As, in the opinion of the Committee, the adoption of such a course would probably be in the Council's interests, it has given instructions for the views of the contractors to be obtained on the matter.

L.C.C.—The Highways Committee has considered the following tenders for the supply of high and low-tension switchgear for tramways sub-stations:—

Johnson & Phillips, Ltd.	£1,178
Spagnoletti, Ltd.	1,240
Ferguson, Pailin & Co. (recommended)	1,275
Switchgear & Cowans, Ltd.	1,275
British Westinghouse Elec. and Manufg. Co., Ltd.	1,825

Estimate of Chief Officer, £1,100.

The Committee reports it has for some time past been in communication with the B.E.A.M.A. as to certain conditions of contract put forward by the Association, and had been informed that its members had decided to tender to the Council's future requirements, and to enter into contracts for plant only under the conditions issued by the I.E.E. Before such conditions could be accepted several substantial alterations in the Council's Standing Orders would have to be made, and, quite apart from the consideration of the matters of principle involved, the procedure to effect these alterations would occupy considerable time. The question is receiving the consideration of the Committee, but it is necessary that a decision should be come to regarding the acceptance of a tender for the supply of high and low-tension switchgear.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

H.M. Office of Works.

Electric passenger lift, Bankruptcy Buildings, W.C.—The Easton Lift Co.

Post Office.

Annual contracts for laying conduits, supplying drawing-in and jointing cables in the following engineering districts:—Scotland, Northern and North-Eastern, Siemens Bros. & Co., Ltd.; North Western, South Lancs. and Ireland, British Insulated and Helsby Cables, Ltd.
North Wales and North Midland.—Western Electric Co., Ltd.
South Wales, South-Western, South Midland, Eastern and South-Eastern; London (cables and cabling only).—Callender's Cable and Construction Co., Ltd.
Laying lines of pipes.—Portobello: T. Spence; Birkenhead: W. Pollett and Co., Ltd.
Laying lines of pipes, stoneware ducts and "U" troughing.—Erith, J. A. Ewart, Ltd.
Laying lines of pipes along the following routes:—Blackburn-Bolton: Secs. 1 and 11, J. A. Ewart, Ltd.; St. Helens: Sec. 1, J. A. Ewart, Ltd.; Wigan-St. Helens: Sec. 11, J. A. Ewart, Ltd.; Long Lane, Abbey Street, S.E.: J. A. Ewart, Ltd.; Liverpool-Manchester: Sec. 8, W. Pollett & Co., Ltd.; Liverpool-Manchester: Sec. 2, R. C. Brebner & Co.; Sheffield-Doncaster: Sec. 8, J. A. Ewart, Ltd.; Chelmsford-Colchester: Sec. 1, J. Mowlem & Co., Ltd.; Edinburgh-Forth Bridge: Casey & Darragh, Ltd.
Laying lines of stoneware ducts and pipes.—Cardiff-Pontypridd, J. A. Ewart, junr.; Dorking, J. A. Ewart, Ltd.; Belfast, J. A. Ewart, Ltd.; Guildford-Farnham-Aldershot, A. H Ball & Co., Ltd.; Preston-Bolton: Sect. 1, J. A. Ewart, Ltd.; Wavertree (Liverpool), W. Pollett and Co., Ltd.; Liverpool-Manchester: Sec. 4, W. Pollett & Co., Ltd.
Laying lines of stoneware ducts, pipes and steel tubes.—Liverpool-Ormskirk: Robson, Eckford & Co.; Wigan Bolton: J. A. Ewart, Ltd.; Preston-Bolton: Section 11, J. A. Ewart, Ltd.; Liverpool-Manchester: Section I, R. C. Brebner & Co.
Laying lines of stoneware ducts, "U" troughing and cable.—Redhill: J. Mowlem & Co., Ltd.
Manufacturing, drawing-in and jointing lead-covered cable, Cardiff-Pontypridd-Caerphilly: W. T. Henley's Telegraph Works Co., Ltd.; Guildford-Farnham-Aldershot: Callender's Cable and Construction Co., Ltd.; Wigan-St. Helens: British Insulated and Helsby Cables, Ltd.; Wigan-Bolton: British Insulated and Helsby Cables, Ltd.; Manchester-Bury: British Insulated and Helsby Cables, Ltd.; Bolton-Preston: Western Electric Co., Ltd.; Blackburn-Bolton: Western Electric Co., Ltd.
Supplying and erecting electric lifts, Liverpool Head Post Office.—Medway's Safety Lift Co.
Telephone exchange equipment extension, Hampstead.—Western Electric Co., Ltd.
Protective apparatus.—Automatic Telephone Manufacturing Co., Ltd.
Telegraphic apparatus.—General Electric Co., Ltd.
Telephonic apparatus.—Automatic Telephone Manufacturing Co.; Brit. L.M. Ericsson Manufacturing Co.; Peel-Conner Telephone Manufacturing Co., Ltd.; Western Electric Co., Ltd.
Submarine cables.—Telegraph Construction and Maintenance Co., Ltd.
Telephonic cables.—W. T. Henley's Telegraph Works Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.; Western Electric Co., Ltd.
Compound for jointing ducts.—Dussek Bros. & Co., Ltd.
Glow lamps.—Brit. Thomson-Houston Co., Ltd.; Edison & Swan U.E.L. Co., Ltd.; General Electric Co., Ltd.

Crown Agents for the Colonies.

Telephones.—British L. M. Ericsson Manufacturing Co., Ltd.

India Office.—Store Department.

Standards.—Siemens Bros. & Co., Ltd.
Tape.—I.R., Gutta-Percha & Telegraph Works Co., Ltd.
Transforming Station Equipment.—British Electric Transformer Co., Ltd.
Wire.—Dorman, Long & Co.; R. Johnson & Nephew.

Paisley.—The T.C. has placed an order with the Paterson Engineering Co., Ltd., for water filtering plant capable of treating 5,500,000 gallons per 24 hours, at a cost exceeding £16,000.

Salford.—The B. of G. has accepted the tender of Messrs. Willoughby for the renewal of the telephone system (£21 12s.) and for the installation of a 12-line fire-alarm system (£17 15s.), including maintenance for 12 months.

Spain.—The Companhia Hidro-Eléctrica do Varosa has received the contract for the construction and working for a period of 75 years of an electric railway, 12 kilome. (about 7½ miles) long, from Lamego to the left bank of the Douro. Work has to be commenced within 30 days from the date of the contract and completed within two years.—*Board of Trade Journal.*

Winchester.—The tender of Mr. W. N. Walters has been accepted for the electric light installation at Winchester Barracks.

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NOTES.

The Season's Greeting.—The ELECTRICAL REVIEW offers to all of its readers the greetings of Christmastide and hearty good wishes for peace and prosperity in the year 1915, which dawns before the next edition appears in print.

Electric Vehicle Committee.—The Committee has decided to make another effort to bring all electric supply undertakings into line in regard to a flat rate of 1d. per unit for the supply of electric energy for charging vehicle batteries at times other than those during "peak" load; it has also decided to approach those undertakings which had adopted a high minimum charge with a view to their reducing it to a figure nearer to that which the Committee recommended.

The matter of standard rim diameters for vehicle wheels was discussed, and it was decided to support the efforts, which, it is understood, are being made by the Motor Manufacturers and Traders' Association, to get certain diameters standardised for this purpose.

It was decided that the present members of Committee should hold office until March 31st next, when they may be re-elected by the bodies which they represent; also it was agreed to ask the British Electrical Federation, Ltd., to nominate a representative on the Committee.

Battery makers are to be informed that the most convenient method of charging, from the charging station point of view, is that which is carried out at constant potential and automatically tapering current, and the makers are to be asked how far they can supply batteries to comply with this requirement.

It was decided to confer with the Tungsten Lamp Association with a view to getting certain vehicle lamp sizes standardised.

The contributions received or promised to the funds of the Committee up to date amounted to £185 14s.

The Hon. Secretary announced the issue of the first number of *The Electric Vehicle*, to which reference has already been made in our pages.

The final revision of the specification for the charging plug and receptacle has been completed. It was decided to recommend that where the charging current required by a large vehicle exceeds the safe current carrying capacity of the plug and its charging cable, two plugs and connections should be used in parallel.

The secretary was instructed to write to each of the principal electrical journals and to convey to the Editors the thanks of the Committee for the valuable assistance they had, individually and collectively, afforded to the Committee in the latter's work, the feeling being expressed that it was largely owing to the pioneer work of these journals that the electric vehicle movement had taken root in this country.

Copper.—The interesting features of copper statistics at the present time are the supply in hand, *i.e.*, stocks, and the consumption as an indication of trade recovery. Messrs. H. R. Merton's statistical circular for mid-month shows European supplies as 36 474 tons on December 15th, an increase of 725 tons on the quantity for November 30th. English supplies account for 21,040 tons, or 50 tons less than for the end of November. Stocks at Hamburg and Bremen—*in partibus infidelium*—are necessarily estimated only.

Of the detailed supplies the item, "Supplies to England and France from other countries" (*i.e.*, from other sources than the well-known ones America, the Peninsula, Australia and Chile), is most gratifying, the quantity under this head being 3,224 tons for the half-month, whereas the average quantity derived in half a month during the year ending July 31st was only 2,456 tons. Shipments from Chile are also well above the average for the same period. The increase in price may be expected to elicit even larger quantities. The quantity from Australia is a little below the average, but from the quantity afloat it may be expected to considerably exceed it on the month. American supplies appear to be required mainly by home manufacturers, as would be expected.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The Council is desirous of preparing a complete list of the names of all members who are engaged in military service, either in the Regular or the Territorial Army, or in the Navy, and members are desired to forward the requisite information to the secretary.

At a meeting of the YORKSHIRE LOCAL SECTION, on Thursday last week, the discussion was concluded on a paper read by Mr. W. M. Selvey on "Power Plant Testing."

Diesel Engine Users' Association.—At the annual general meeting of this Association, at the Institution of Electrical Engineers, Mr. J. E. Edgcome was re-elected as president for the ensuing year. Messrs. F. H. Francis and Napier Prentice were elected as members of the Committee in place of the two retiring members. Mr. W. E. Brandreth was re-elected as hon. secretary, and, as at the present time he is engaged on military duties, Mr. Percy Still was requested to act as hon. secretary during Mr. Brandreth's absence. Particulars were given in connection with a recent breakdown of a Diesel engine at Oxford, and an interesting discussion ensued. The subject is to be brought up again for the further consideration of the Association. It was announced that the general question of Diesel engine insurance against breakdown would be brought forward for discussion at the next meeting, which is to be held on Friday, January 15th, 1915.

We are asked to state that any request for information concerning the Association, and applications for membership, should be addressed to th
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Inquiries.—Makers of "Tec" flash-lamp batteries and "Simplicitas" heating elements, and makers of machines for making holder parts are asked for.

Appointments Vacant. — Improver, for Sleaford U.D.C. electricity works; shift engineer (32s. 6d.), jointer (35s.), for Gillingham Electricity Department. Particulars are given in our advertisement pages.

Fatality. — Fife. — James Harkes, 32, an electric machineman, of Cardenden, was killed in the West Mine, Dundonald Colliery, belonging to the Lochgelly Iron and Coal Co., Ltd. It is supposed that he had been drawing a switch in connection with the coal-cutting machine, when he was heard to moan, and a fellow-worker found him dead. It was discovered that the lid of the switchbox was resting on his neck, it having, apparently, through some unknown cause, fallen unexpectedly.

Late Legal.—South Metropolitan Gas Co. and the South London Electric Light Corporation, Ltd.—In the Chancery Division, on Monday, Mr. Justice Eve heard a further mention of this litigation, which was recently before the Court. Then his Lordship granted the Gas Co. a declaration to the effect that the Electric Light Co. had illegally allowed certain of their customers a rebate of ¼d. a unit, provided they used only electricity as an illuminant.

Mr. Wheeler, now appearing for the Gas Co., said his Lordship, after making the declaration about a breach by the defendants of the Electric Light Act, gave plaintiffs liberty to apply for an injunction if necessary. The Registrar, however, had declined to put that in the order.

His Lordship said he thought that was a mistake.

Mr. Tyldesley Jones (for the defendants) said he did not object to that being in the order, and his Lordship said the order could contain the reference to the fact that the plaintiffs could apply for an injunction if necessary.

The Trade Situation in Switzerland.—This question was referred to at the recent meeting of the Zurich Bank for Electrical Undertakings. In the first place, it was mentioned that a reduction in the consumption of electrical energy had taken place in Switzerland in consequence of the war; and, secondly, that numerous orders were on hand for the electrical industry, although they had to be carried out under the operation of the existing restrictions in working. It was added that concern was being manifested in regard to procuring adequate supplies of copper.

Strength of Tungsten Lamps.—The splendid progress made in the efficiency of incandescent lamps—from a specific consumption of 5 watts per candle in the early days of the carbon lamp to half a watt, or in the ratio of 10 : 1, in the case of the latest tungsten lamps—is familiar to all, but it is not generally known how great has been the progress in the manufacture of the tungsten lamp itself within the last seven years. The earliest tungsten filaments were extremely fragile, so that their life depended mainly on the care with which they were handled, and the absence of vibration in their neighbourhood. Measuring the strength of the filaments by their ability to withstand bending, and representing the strength of the pressed or squirted filaments on the market in 1907 by the number seven, in 1908 it had been increased to 19, in 1909 to 28, in 1910 to 34, and in 1911 to 38—excellent progress in view of the difficulties of manufacture. In 1911 the Mazda drawn-wire filaments were introduced, and the strength of these on the same basis was represented by the number 56, or eight times that of the first tungsten filaments. Since then steady progress has been made, in 1912 to 64, in 1913 to 73, and in 1914 to 81. It will be noticed that the increase in strength of the wire filaments during the past three years is nearly 50 per cent. greater than the difference in strength between the squirted and the wire filaments in 1911. The improvement in the uniformity and homogeneity of the wire to which the increase in strength is due has naturally been accompanied by an improvement in the life of the lamp and the efficiency at which it can be run. We are indebted for these interesting figures to the British Thomson-Houston Co., Ltd., to whose associates the introduction of the drawn-wire tungsten filament was due.

Fire Precautions in Factories.—The British Fire Prevention Committee has issued a special "Fire Warning" (No. 16) for factories and works engaged on war emergency work, which can be obtained from the Committee, small supplies not exceeding six being provided from the Committee's free issue, or large supplies at a nominal payment. This "Warning" deals with all those points that are of special importance when works are carried on under special pressure and night shifts have to be arranged for. Works managers would be well advised to obtain the complimentary copies of this "Fire Warning" that are available under the free issue to those who send large envelopes, duly stamped, to the Registrar of the British Fire Prevention Committee, 8, Waterloo Place, Pall Mall, London, S.W.

Co-operation in Italy.—A public meeting of consumers of electrical materials was recently held at Milan with a view to forming a co-operative supply association. A Committee was appointed to draw up a programme and establish the basis of the proposed society. It is hoped that besides the usual co-operative advantages, including free technical and legal advice, the scheme will lead to the federation of the electrical contracting industry, and to the solution of many technical difficulties, such as standardisation of materials, plant, &c.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. J. E. R. Baker, for nine years electric works superintendent at Finchley, has been appointed engineer to the Stratford-on-Avon Electric Co., and enters on his duties on January 1st.

In connection with the work done by Mr. Robertson, late Corporation electrical engineer at Greenock, and now of Salford, in recent important extensions of the local electrical undertaking, the Greenock Town Council is to send him a cheque for £200.

Tramway Officials. — Mr. A. Coveney, electrical engineer and tramways manager at Erith, who is leaving, has been presented by the staff with a gold albert.

Obituary.—We regret to record the death, at the age of 61 years, of Mr. Edward Crabb, C.B., late Second Secretary of the Post Office.

NEW COMPANY REGISTERED.

Stentophone Magneto Works, Ltd. (138,625).—This company was registered on December 14th, with a capital of £1,000 in £1 shares, to carry on the business of manufacturers of and dealers in magnetos suitable for use with internal combustion engines, manufacturers of dynamos for lighting and other purposes, motor and motor-cycle accessories, motor-cars and the like, etc. The subscribers are: A. H. Treloggan, 36, South Road, Handsworth, patentee and manufacturer; H. Price, 14, Abbotts Road, Kings Heath, manager. Private company. The number of directors is not to be less than two or more than five; the first are A. H. Treloggan and H. Price. Qualification, 100 fully-paid shares. Remuneration of H. Price not less than £3 per week. Solicitor, W. H. Stubbs, 33, Exchange Buildings, New Street, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Edison and Swan United Electric Light Co., Ltd.—Correction.—By an unfortunate printer's error in our last issue the capital of this company was given as £88,071 instead of £888,071.

Dick, Kerr and Co., Ltd.—Debenture dated 10th Dec., 1914, to secure £150,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: J. Ferguson and D. Smith, 37, Nicholas Lane, E.C.

Reside and Co., Ltd.—Assignment of a book debt dated 23rd November, 1914, to secure £50. Holders: Halifax Commercial Banking Co., Ltd., Silver Street, Halifax.

Sheerness and District Electric Power and Traction Co., Ltd.—Issue on 8th December, 1914, of £500 second debs., part of a series of which particulars have already been filed.

Brilliant Arc Lamp and Engineering Co., Ltd.—Particulars of £100 second debs., created 7th December, 1914, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £30. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

British Columbia Electric Railway Co., Ltd.

The annual meeting was held on Friday last week at the Great Eastern Hotel, E.C., Mr. G. P. Norton presiding in the absence of the Chairman, Mr. R. M. Horne-Payne.

Mr. T. B. Brown, a director, read the speech which the Chairman had prepared. In this he stated that the past year had been a bad one and the immediate prospects were extremely unfavourable, but that was due to causes well known to them all, and no explanations or apologies were needed. Their present disappointments were the direct outcome of the war, and they would all suffer them cheerfully as part of their individual contributions to the national cause, and suffer them cheerfully for however long a period might be necessary to finally achieve the nation's objects. As to the extent of the loss which they might be called upon to bear and how long it might continue he could tell them very little more than they already knew. He could only point to the monthly traffic returns, which showed up to October last, as compared with last year, a falling off in net earnings at the rate of between £90,000 and £100,000 a year. As it required nearly £15,000 to pay 1 per cent. on either the preferred, ordinary or deferred ordinary stock, even if there was no increased falling off in the last eight months of their year, it would require a reduction of 1 per cent. in the dividend on the preferred and 5 per cent. on the deferred stock to balance £90,000 loss in earnings. He did not think they could hope for any marked improvement in conditions during the current financial year, but he did think it was reasonable to hope for an improvement in the latter half of 1915. That improvement might arise from two sources, namely, from the final extermination of the enemy's cruisers in the Pacific and South Atlantic Oceans and from good prices for wheat and a large crop in the prairie provinces of Canada. Either of those

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factors would immediately resuscitate business in British Columbia. Their business was focussed round the three ocean ports of Vancouver, Victoria, and New Westminster, which were the Pacific gateways for the trade of Canada, and the prosperity of these cities and of their business was considerably dependent upon the shipping trade, which had almost ceased to exist since the war commenced. It was expected that this trade would be largely increased by the opening of the Panama Canal, and there could be no doubt that it would have been but for the activities of German cruisers, and that it would be as soon as those cruisers were removed. Again, as soon as the seas were free and ships could be found to carry lumber at reasonable cost, British Columbian lumber exporters would be able to take advantage of the large demand existing for timber. The British Columbian lumber trade would also be beneficially affected by the successful marketing of a good grain crop in the prairie provinces, and as it was certain that the acreage under cultivation would very largely exceed that of any previous year, and fairly certain that high prices would prevail for wheat and oats, there were grounds for hope in this direction. Other industries in British Columbia were also similarly affected by the same or kindred causes. Whenever the revival came it would, he felt sure, be found that this period of depression had been for the permanent good of the province, and that in several important ways new conditions had been established enabling its sounder and more rapid development. He thought it would be found that the cost of living, especially in the matter of rentals, would have considerably decreased, and that with this a lower basis of wages would be in force, which would remove what had hitherto been the greatest obstacle to the prosperous development of the country. The future of the company was so closely bound up with the prosperity of the districts which they served that anything which tended to the development of these districts must be to their advantage, and while the present period of depression was seriosuly affecting them, if the ultimate result was to place their business upon a surer foundation they, along with the districts themselves, would live to look back to the present period as the beginning of much prosperity. Their relations with the Government of British Columbia and with the municipal authorities were most satisfactory, and he was glad to have that opportunity of expressing their appreciation of the reasonable and friendly spirit in which, realising the many difficulties of conducting a business such as theirs under present circumstances, they were meeting them on every occasion. Owing to the particular stage reached in her progress, Canada had, he thought, suffered more acutely than any other part of the Empire from the outbreak of war, but there were unmistakable signs of a return of more normal conditions after the winter was over.

The adoption of the report was seconded by Mr. EVAN-THOMAS.

Replying to a shareholder, the CHAIRMAN said that under the present condition of things it was not the intention of the board to issue any of the additional capital for which they obtained powers at the last meeting.

The report was adopted.

German Electrical Companies and the War.

IT will be seen from the undernoted extracts, which have been made from recent issues of the German newspapers, that the electrical companies have already begun to make provision for the business risks incidental to the war, and that dividends are consequently being reduced for the year 1913-14. It may be expected that further light on the situation will be thrown at the annual meetings of the companies in question. The extracts are as follows:—

The Telephon Fabrik A. G. vorm. J. Berliner of Hanover, after apportioning £10,000 to depreciation in 1913-14, as in the preceding year, reports net profits of £41,000, as against £40,000 in 1912-13. Having regard to existing interests abroad the directors have made provision for exceptional internal reserves before arriving at the net profits, so that the full account has been taken for any possible deficiency. It is proposed to pay 10 per cent. for 1913-14, as contrasted with 12 per cent. in the previous year.

The A. G. fur Elektrizitats Anlagen, of Berlin, which owns various supply works as well as being interested in others, and also in tramways, reports favourable results for the year 1913-14, which permits of the payment of the same rate of dividend after having made internal reserves to provide for the situation created by the war. The accounts show gross profits of £66,000 on a share capital of £500,000, and loans amounting to £300,000, as compared with £64,000 in the previous year. Together with the balance brought forward the net profits total £45,000, as against £44,000, and the dividend is at the rate of 8 per cent., as in each of the three preceding years.

The accounts of the *Siemens & Halske Co.* for the year ended with July 31st, 1914, show, after a specially cautious valuation of the assets rendered necessary by the present situation, net profits amounting to £557,000, as compared with £625,000 in the preceding financial year. The sum of £100,000 has been placed to the special reserve fund and £25,000 to the disposition fund, whilst the bonuses to staff and workmen represent £45,000, being the same in each case as in 1912-13. It is propo
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Cordoba Light, Power and Traction Co., Ltd.

The directors' report to 30th September, 1914, shows that the balance of profit, after meeting all charges, is £20,819, plus £23,502 brought forward, making a total of £44,321. £18,000 has been absorbed by the payment of the dividend on the preference shares for the year to 31st July, 1914, leaving £26,321 which is to be carried forward. The combined gross receipts of the two subsidiary companies (the Light and Power Co., and the Tramways Co.) showed an increase of about 4½ per cent., and the net results of operation an increase of over 8½ per cent. as compared with the previous year. The satisfactory feature of this progress is that it has been made during a year in which the Argentine Republic suffered from great commercial and financial depression, accentuated during the later months by the war. While the results of operation have improved there has not been a corresponding increase in the net profits of the subsidiary companies. The construction period having been substantially completed, no part of the interest payable on loans to the subsidiary companies was chargeable to capital account, and various exceptional expenses, such as the costs imposed by local competition, and loss on exchange, have further affected the revenue account. The Tramways Co. now has approximately 30 miles of track in operation, and another mile constructed.

The annual meeting was held on Dec. 9th at Winchester House, E.C., Mr. G. A. Touche, M.P., presiding.

The Chairman said that the year had been one of acute financial and commercial depression in the Argentine Republic and throughout South America generally. It was thought, early in the year, that the bottom had been reached, but much lower depths of depression were subsequently experienced. The condition was bad enough before the war; its severity had been greatly accentuated by the war. The period covered by the accounts included two months of the war. These were the months of greatest strain, for the uncertainty of the outlook, and the abruptness with which its effects were sprung on a situation already greatly weakened had, temporarily, a paralysing effect. In so dismal a year it would have been idle to look for any very marked improvement in their position. It spoke well for the local administration that they were able not only to hold their own, but to make some progress on balance. This progress was naturally most apparent in the earlier months of the year. The first six months showed a considerable advance on the corresponding figures of the previous year. For the half-year to 31st March, 1914, there was a total increase in gross receipts of upwards of £6,000. Increases on a smaller scale were shown each month until the war broke out. It was not until August and September that they experienced any actual decrease. For the entire year to 30th September, 1914, the gross receipts of the subsidiary companies were £160,430, compared with £154,060 in 1913, and £137,900 in 1912. There was thus an increase over last year of £6,370, or in the last two years £22,470. The expenses were £72,910. These compared with £73,230 in 1913, and £74,100 in 1912. The record was therefore one of increasing receipts and diminishing expenses. The percentage of expense to the gross receipts of the two undertakings was as follows:—1912, 53.8 per cent; 1913, 47.5 per cent.; 1914, 45.8 per cent. Mr. Lewis (the Manager) was to be congratulated on this reduction in the cost of operation, and he was very desirous of making further economies. The net receipts were £87,520, compared with £80,830 last year and with £63,800 in 1912. These figures indicated a steady growth from year to year, in spite of the check caused by temporary reductions. The abnormal conditions could not be permanent. No one could say when the war would finish and its effects would pass. It would take time for the Argentine to recover from the effects of the financial stress through which she had been passing; but in the meantime everyone in the country had made drastic reductions in expenditure to meet the difficulties of the situation and strengthen the financial fabric. There was, therefore, no need to be unduly despondent about the outlook for their business in Cordoba. This current year might be a disappointing one, but it would be futile, at this early stage, to forecast its results. The figures which he had given them were those of the combined businesses. With regard to the Light & Power Co., the gross results in 1914 were £85,540, as compared with £83,130 in 1913, an increase of £2,410. These gross receipts were the largest in the history of the company. The expenses were £28,990 against £30,320, a decrease of £1,330. The net receipts were £56,550 against £52,810, and the percentage of expenses to gross receipts 33.8 against 36.5. The number of customers for light and power had grown each year, and since 1910 the increase had been 53 per cent. In the same period the number of lamps connected had increased by 90 per cent., and the horse-power of motors connected had been increased by 113 per cent. Taking the subsidiary company's financial year to 31st March, the number of units of electrical energy sold were, in 1914, 112 per cent. greater than in 1910, while the cost of production per unit had decreased by 44 per cent. The one item which, at first glance, did not look satisfactory, was the income per unit. In the same five years it had decreased by 30 per cent. There were a variety of reasons for this decrease. The power load, which included energy taken by the tramways, had greatly increased. This, of course, was a comparatively low-priced current. Then the metallic filament lamps had had a considerable effect. Also, as the business extended the number of smaller customers increased, and they were less remunerative than the larger ones. The Light & Power Co. had expended £46,567 during the year on improvements to the property. Of this, £26,928 was on reformation of overhead mains, and was made necessary by a municipal decree, as explained a year ago. The fact that existing lines were being replaced by new ones limited the speed of the work, as the services must not be interrupted. The net receipts of the Light & Power Co. represented only about 4½ per cent. on the amount at which the undertaking stood in the books; a very poor return. Reference was made at the last meeting to the competition in the light and power business, and to the defensive measures which the company had been reluctantly compelled to take to recover trade taken from them by the competing company. He did not propose to go into particulars of the lamps lost and recovered in this commercial struggle, except to say that the casualties of the invaders were greater than theirs. The number of customers who had voluntarily asked for light from this company was increasing. They recognised that they could probably avoid unnecessary waste, and, at the same time, serve the community better, if some unity of interest could be arranged. While confident of the strength of their position they were prepared to entertain an *entente* on an equitable commercial basis. When negotiations in South America had been unsuccessful they met the representative of the competing company, Senor Herlitzka, on his visit to Europe during the summer, and a frank discussion took place. But his friends' views of relative values were apparently not the directors', and no agreement was then arrived at. The negotiation, however, was not wholly broken off. They were to have met again after he had been on the Continent for some time. The date had been arranged when the war broke out and changed the entire situation, and the claims of business necessitated his immediate return to the Argentine. He thought, perhaps, a better understanding had been established, but that was all. When these negotiations were proceeding they had in view certain rearrangements of the capital account (subject to the approval of the proprietors) which, if successfully carried out, would have provided for the inclusion of whatever might have been properly attributable to the other company, and also for the placing of the capital, at present represented by temporary notes, and of further construction capital, on a permanent basis. The war, however, made the time wholly inopportune for any arrangement of the kind. If he was asked what plan of permanent finance was now to take its place, he said frankly that, in these times, they must, like many other concerns, be content to take short views. In the tramway business the improvement had been steady. The passengers carried in the year to 30th September were 8,161,600, compared with 7,755,800 in 1913. A considerable number of the inhabitants made very slight use of the tramways as yet. The length of the line open to traffic was now 30 miles, against 26¾. The gross traffic receipts were £74,880, as against £70,990 in 1913, or an increase of £3,950. The rate of increase in gross receipts showed a heavy falling off. Expenses were £43,920, against £42,910; net traffic receipts £30,960, against £28,020; and the percentage of expenses to gross receipts 58.6, against 60.5. The tramway company had spent £26,493 during the year on extensions of lines, rolling stock and street paving. Both in regard to the Light and Power Co. and the Tramway Co. a strict check had been put on capital expenditure. They would, perhaps, ask him how it was that when the combined profits of the underlying companies were £87,520, the credit to revenue account was only £81,040. The difference was £6,480, and he should explain that the £87,520 represented the profits of the underlying companies given for comparative purposes. The £81,040 represented the profits divided and paid over to them by way of interest and dividends as holders of the capital of these companies. Before arriving at the divisible profits several charges and reserves had been made in the underlying companies. These included certain abnormal expenses in connection with the local competition, loss on exchange, various writings down of materials, preliminary and legal expenses, and an increase in the balance carried forward. A shareholder, who had written a letter conveying some very reasonable observations on the financial position, made the criticism that the profit and loss account contained no provision for depreciation of plant. He would therefore take the opportunity of pointing out that this was a holdings company, on trust, and that the proper place for such provisions was in the accounts of the subsidiary operating companies.

Mr. C. W. Trotter seconded the motion.

In reply to questions, the Chairman said that the total amount of debentures redeemed was £11,000. They had to set aside a certain sum each year for that purpose. The total issue was £500,000, so that the amount outstanding was £489,000, which, with accrued interest, came to a little over £500,000. With regard to the promissory notes, if the board had been able to carry out what they had in view before the war broke out they would have been provided for. The present situation, however, had altered things, and it was not possible to go to the holders with any proposal.

The report was adopted.

Bell Telephone Company of Canada, Ltd.—The directors have declared the usual dividend of 2 per cent. for the quarter ending December 31st.

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Isle of Thanet Electric Tramways and Lighting Co., Ltd.

THE directors' report for the year ending 30th September, 1914, shows a balance, being profit, of £18,063, compared with £21,636 in 1913.

On the 31st July, 1914, the traffic showed an increase from 1st October, 1913, to that date of £1,255, compared with the same ten months in the previous financial year, but upon the declaration of war, on 4th August, an exodus of the visitors immediately commenced, and the traffic receipts fell largely from day to day, the total decrease for August being £3,124, and for September £1,324, so that, after allowing for the increase in the first ten months, the year ended with a decrease of £3,192. The war caused the company for the months of August and September a loss in receipts of £4,447, without making any allowance for increases in those months, which might reasonably be anticipated in normal times. The sale of electricity shows an increase of £1,307, or nearly 13 per cent. over last year, though it was also injuriously affected by the war.

During the year £11,725 was expended on new plant which became necessary to meet the growing demands for lighting and power, and which is effecting a considerable saving in coal consumption. The increased capital expenditure has been met partly out of the accumulated profits, and partly by temporary loans made by the directors and the secretary.

The balance of the revenue account at the disposal of the company, including £3,108 brought forward, is £12,692, and it is proposed to place £1,000 to rolling stock reserve account, to appropriate £3,500 towards future maintenance of permanent way, to add to third party insurance reserve £1,000, leaving £7,192.

Owing to the present financial conditions of the country, the directors do not deem it prudent to pay a dividend on the preference shares at the present time, but they hope to be in a position to pay during the current financial year a dividend of 2½ per cent. on the preference shares (£3,750), leaving £3,442 unappropriated, and to be added to the next account.

Mr. H. R. MONKS, who presided at the annual meeting, held at Winchester House, E.C., on December 17th, said that the debenture loans had increased by £10,000. These loans were mainly to cover the following items:—Electrical installation £2,146, new plant £11,725, motor 'buses £815, and stores £610. They had also used £4,604 from the reserve in respect of permanent way, and £1,076 from rolling-stock reserve in respect of rolling stock. The item of £1,076 for rolling-stock represented the cost of converting old trucks to steel wheels. The expenditure of £2,146 on electrical installation was, of course, necessary, and they obtained 195 extra consumers, although they would not benefit from them in the present year. Regarding the new plant of £11,725, last year he told them they were ordering a turbine of the Curtis type, but he did not explain that the cost would be somewhat increased by the cooling towers they found necessary to put in. The turbine plant had worked admirably and economically, and they expected to make a saving of perhaps £2,000 or £2,500 a year in fuel consumption. It was only running in August and September, so that the benefit was not manifest in the current year. The necessary work of foundations, etc., was carried out by Mr. Ford and his immediate staff and saved a considerable amount of money. With the exception of a few hundreds a year, they were satisfied that this heavy expenditure on new plant would carry them on for many years. As to the revenue account, expenses had increased by £1,800. Wages increased £393, but they ran 45,000 additional car miles. But for the war they believed they would have made that £4,000 and an additional £2,000, and there were other potentialities, such as the motor 'buses and the electric light, which would have been considerably up. Light, both public and private, was reduced to a minimum. But for this his anticipation of last year of being able to maintain the dividend, or even increase it, would have been realised. Still, the company was in a strong position, and he hoped, if the war did not last too long, they might be in as good a position next year as in 1913. Although they had earned the money they did not feel justified in paying the dividend of 2½ per cent. at the present time, and in the report they suggested that if things looked better they might be able to do so.

Mr. H. BROWN seconded the motion.

Mr. C. LOCK asked if the board had deposited the whole of the £150,000 debenture stock as security for the loan of £52,000.

The CHAIRMAN said they had pledged £100,000 with two banks.

Mr. LOCK asked if the turbine referred to was the same kind of plant which the committee of shareholders, of which he was a member, recommended should be adopted in 1909, because at that time great contempt was poured on the proposal.

The CHAIRMAN said in substance it was a similar machine, but things in the turbine world had altered since 1909. They had now got an up-to-date turbine at a cost of £11,000.

Mr. W. M. MURPHY (a director) said the suggestion of the committee as to a turbine was coupled with a scheme for altering the whole system of distributing mains, and that was why they opposed it. The effect of the turbine had been to reduce the cost of coal from .64d. to .32d, which represented a saving of £2,000 a year.

Mr. H. BROWN (a director) remarked that a turbine to be efficient must have a very high vacuum, which meant a good supply of water. In 1909 they only had their own well. Now they were able also to get a supply from the town, so that they could always get the necessary quantity. That was why they had spent a large sum in cooling towers, so as to ensure the high vacuum necessary for the efficient working of the turbine.

The report was adopted.

Blackpool, St. Anne's & Lytham Tramways Co., Ltd.

THE annual meeting was held on Dec. 17th. The Chairman, Mr. GEORGE NICHOLSON, said that up to August 4th, when war was declared, the company's receipts were within £100 of the receipts for the corresponding period of 1913, their record year. Traffic at once fell away, and the receipts for August, September, and October were less by £4,300 than in the corresponding three months of 1913. The receipts of Blackpool Corporation were £14,500 less since the war began, a difference of 35 per cent., and Fleetwood Tramroad Co., returns showed a falling off to the extent of £5,700, or 28 per cent. They had been successful in getting Blackpool Corporation to reduce the minimum quantity of electricity they took from that authority, who also put an automatic point controller by central station, thereby saving the company £60 a year in wages. The experiment of reduced fares suggested last year was tried for 17 days during the Christmas holidays, but their takings were £84 less than in 1913. Excepting 1912, when the total was £24,438, last year's receipts were the lowest recorded for the past five years, and he was afraid they must look for a further contraction in the coming year, as from November 1st there had already been a shrinkage of £150.

Mr. BOYD said they could save £400 a year by having less lights in the winter-time, when they only had two or three passengers.

National Telewriter Co., Ltd.

THE directors' report for the year ending 30th June, 1914, states that the receipts from rentals, etc., increased by about 30 per cent. This additional revenue was, however, largely applied in increasing the efficiency of the public exchange service. Owing to this expenditure the results of the company's operations for the period under review show that the loss, carried to suspense account, is £980, as against £854 for the previous year. An issue of 6 per cent. and profit-sharing debentures amounting to £2,750 was made during the year.

Sir J. G. CRAGGS presided on Dec. 14th at the annual meeting held at the Cannon Street Hotel, E.C. He said that the amount expended during the year upon instruments, plant, etc., was £3,619, as against £4,904 for the previous year. The revenue from rentals and other sources was £6,800, as compared was £5,300, and the amount carried to suspense account was £980, as against £854 last year. The apportionment of rentals carried forward was £2,416 as against £1,974. It would be seen that the revenue had been increased by about 30 per cent. during the year, showing that the business had made steady if slow progress. The rent roll on the 30th June amounted to £7,300, excluding excess calls and other sources of income. This position showed a considerable advance on the previous year. The revenue derived from the increase in business was, to a great extent, applied in increasing the efficiency of the public exchange service. The board deemed it wise on reviewing the working conditions of the exchanges in consultation with the Post Office authorities to make this expenditure without delay, so as to give further satisfaction to subscribers, rather than defer the work, and show a small profit in the accounts. That this special expenditure had been justified was demonstrated by the steady decline in electrical and mechanical faults. The provincial business, particularly in Liverpool and Manchester, was making headway, and nearly 100 machines were in active use in those two cities in connection with the cotton trade. As evidence of the satisfaction given by the instruments to members of the Liverpool Cotton Association, at which institution the Telewriter had been adopted for the dissemination of the official market prices, he might mention that except in one or two instances, where the firm retired from business, they had not lost a single subscriber since the service was inaugurated. On the other hand, new firms were joining from time to time, which was encouraging. In Manchester a cotton report service had been established on the same lines as that in force in Liverpool. The use of their new instrument, known as the "Universal" type, was being extended throughout the various services and was everywhere giving good results. Their causes of trouble were now practically narrowed down to the extraneous conditions which they encountered and over which they had no control, such as unsteady current and line interruption. The experimental department was constantly evolving improvements for attaining greater efficiency in working, and a number of current difficulties had recently been overcome. In London they had entered into an agreement with Telenews, Ltd., a company which was recently formed in order to work a patent taken out by them for an optical device for news distribution and advertising purposes, in connection with which the Telewriter was employed. Under this arrangement they supplied instruments at an agreed rental and, in addition, received a royalty on the gross income derived by that company from the use of their machines. The device was extremely ingenious and attractive, and was already producing revenue to the company. The restriction by the police of illuminated advertisement signs in darkened London was considerably hampering this particular business, otherwise some of them would by this time be familiar with the Telenews signs. In order to provide for further working capital from time to time as the business expanded, the board

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decided in February last to make a small issue of debentures, and accordingly £15,000 six per cent. and profit-sharing debentures were created. Of these debentures, £2,750 had up to the present been issued to the shareholders. As to the effect of the war on the company's business, he regretted to say that their forward policy had been greatly retarded and they were practically employing no canvassers. They found considerable difficulty in securing new business, and in a number of instances their subscribers, whose business was adversely affected, had given notice of their intention to terminate their contracts. They knew that in some cases those were merely precautionary measures, but they had, nevertheless, in consequence considerably reduced their expenses in every department in order to ensure their financial position by keeping their total expenditure on revenue and capital account within their income. The business on the Continent, which was small, had for the time being ceased. The steps they had taken should enable them, unless something exceptional occurred, to tide over the period of the war and be ready to avail themselves of their share in the improved trade conditions which it was generally hoped would follow. The directors decided, on the outbreak of the war, to reduce their fees by one half during the period of the war.

Mr. E. B. Ellice-Clark seconded the motion, which was adopted without discussion.

Burmah Electric Tramways and Lighting Co., Ltd.

The directors' report that for the year ended the 31st July, 1914, the total gross receipts amounted to £20,335, and the expenditure under all heads to £11,592, leaving £8,743, out of which there has been transferred to depreciation account £4,000, leaving £4,743 plus £908 brought forward.

In considering the question of dividend, whilst the directors have given due weight to the effect of the war conditions now prevailing, which has resulted in a decrease of £1,602 in the traffic receipts for the four months August to November, and which effect may continue to be felt during the whole of the current year's working, they at the same time fully appreciate the desirability under existing circumstances of distributing as large an amount as is safely possible to the shareholders. Having regard to the sound financial position they recommend a 5 per cent. dividend on the preference shares, leaving £1,180 to be carried forward. While the prospects for the expansion of business under normal circumstances continue to be good, the traffic receipts have sustained a considerable set-back during the first four months of the current year. It is probable, therefore, that if the present adverse conditions continue, the earnings available for dividend on the preference shares for the current year will show a considerable reduction.

Against the reserve fund, which now stands at £16,879, will be charged the balance of the cost of the Diesel engine, represented by local freight and erection charges.

Whilst the traffic receipts have increased by only £2, the sundry receipts for lighting, power, etc., show an increase of £1,188. Power expenses show an increase of £373, due almost entirely to the extra cost incurred in running the steam plant during the times when the No. 1 Diesel engine was under repair. The No. 2 Diesel engine is now in commission and is running satisfactorily, whilst a thorough overhaul of the No. 1 engine has been made under the supervision of the erector, who remained in Mandalay for the purpose.

Mr. F. C. Kennedy, a director, has resigned owing to ill-health, and Mr. A. J. J. Pfeiffer has been appointed in his place.

At the annual meeting, held on December 17th at the offices, 1, Queen Victoria Street, E.C., Mr. C. Ellis, who presided, said that the accounts showed a considerable improvement on the last year's earnings, which then constituted a record. They had been specially pleased this year with the increase in the light and power receipts, as it was not anticipated. They had made new connections to a number of Mosques and Pagodas, and extensions to existing Pagodas, Government and Municipal Buildings, and European and native shops and houses. They had entered into an arrangement with the Municipality for street lighting, and had also come to an understanding with them in regard to a proposed pumping scheme for working a number of wells to be sunk for the supply of water to the town, the preliminary operations for the sinking of one well having now been commenced, the results of which would determine whether the scheme would be proceeded with. The only item of expenditure which called for comment was the increase of £373 in the power expenses, which was due to the necessity for the increased use of steam sets while No. 1 Diesel engine was under repair. This would disappear now that they had got the second Diesel engine in commission and the overhaul of the No. 1 Diesel completed. Both the engines were running satisfactorily. Before coming to the decision regarding the preference dividend the directors gave the subject the most careful consideration, and considered that they were acting in the best interests of the preference shareholders in paying as full a dividend as was warranted by the results of the working for the year under review. In regard to the prospects for the current year, it was, of course, impossible to say what might be in store for them. They knew how far their traffic receipts, which constituted the major part of their revenue, had been adversely affected for the first four months by the war conditions, and it was only reasonable to assume that they would continue to show decreases for the remainder of the year. Their lighting and power receipts had, however, not shown themselves so sensitive to outside influences, and they were therefore hopeful of maintaining their revenue from this source, at least at the same figure as for the year under review, but they must expect that the combined results for the current year would mean that the earnings available for dividend on the preference shares would show a considerable reduction.

Mr. H. R. Kindersley seconded the motion.

Replying to questions, the Chairman said that with regard to the election on the board of a representative of the preference shareholders, he regarded such a suggestion as an insinuation that he and his colleagues had not looked after their interests. That was not the case in any way, their sole aim having always been to have regard to the interests of both classes of shareholders. They considered that four directors for a small company like that was quite sufficient.

Mr. A. J. J. Pfeiffer, a director, replying to questions on the subject of the amount set aside for depreciation, said he did not think it could be said that the board had made too large a provision. He estimated that within about eight years from now it would be necessary to spend between £40,000 and £50,000 on replacement of permanent way, cars, and overhead fittings, and so far they had only accumulated £16,000 towards the cost.

The report was adopted.

Mersey Railway Co.

Mr. James Falconer, M.P., presided on December 17th, at Worcester House, E.C., over a combined meeting of the four classes of debenture holders of the Mersey Railway Co. for considering and, if thought fit, passing a resolution approving of the provisions of the Bill deposited in Parliament for the purpose of extending the period fixed by the Act of 1910, by which the payment of interest on the debenture stocks, other than the Mersey Railway New First Perpetual Debenture Stock, shall be contingent on the revenue of the company.

Separate meetings of each class of stockholders were then held, and a resolution formally approving of the Bill was passed at each.

Official Notices re Companies.—Unless cause is shown to the contrary, the following companies will be struck off the register at the expiration of three months :—

British Tungsten Metals Syndicate.
Coal Substitute.
Electrical Regulators and Economisers.
Epicurean and Electric Café.
Frank Suter & Co.
Indestructible Accumulators.
Indicating Fuse and General Manufacturing Co.
Industrial Inventions Syndicate.
International Electric Transport and Enterprise Co. of Alsace Lorraine.
Kellogg Manufacturing Co. (Europe).
Leeds and Bradford District Electric Railways.
Reis Oil Fuel, Gas Producer and Burner.
Scientific Illumination.
Telephone Disinfecting Co.

Douglas Southern Electric Tramways, Ltd.—The net profits for the past year were £565, making, with £141 brought forward, a total of £706. The directors recommend a dividend of 1½ per cent. on the 7 per cent. non-cumulative preference shares, and £317 is to be carried forward.

Fuller Accumulator Co., Ltd.—According to the *Times*, the directors report a net profit of £8,622, out of which it is proposed to pay a dividend on the ordinary shares at the rate of 9 per cent., and to place to reserve fund, including £2,500 now on deposit at bankers, £3,344.

STOCKS AND SHARES.

Saturday Afternoon.

Seeing that it is less than four days since we last described the Stock Exchange markets—and more particularly those connected with the electrical industries—it will be well surmised that there is not a great deal fresh to say this afternoon. One might descant at length, and with an inflammable vocabulary, upon the conditions under which Stock Exchange men have had to conduct their business during the last few days of rain, cold, wind, hail, mud and similar samples of weather. But the able reader, if not the able editor, would probably put this down as padding, even if it could be worked up—the subject, we mean, and not the mud—in an interesting fashion.

If there is any feature at all to be found in the departments with which we deal, it is the continued strength of stocks and shares connected with the manufacturing group. British Westinghouse Preference are again better at 37s. 6d., while for Castner-Kellners, Edison & Swan and one or two others there is a wide circle of buyers. Electric Constructions, exceptionally, have moved back a little. People want to get shares as cheaply as they can, which is natural enough ; but with markets in their present condition, both buying and selling limits can easily be missed for lack of a little elasticity in the instructions of the client giving them. The re-opening of the Stock Exchange will certainly have the effect of enlarging all the markets, and therefore improving the position of the outsider, whether he wish to buy or to sell.

The Metropolitan Railway issue is said to have gone satisfactorily, but, so far, there is no definite information available as to the amount which the public have taken. The Ordinary stock

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is quietly steady at 31½. Central London Ordinary stands in the neighbourhood of 78, the Deferred at 76. Districts are 18½. The South-Western 5 per cent. Preference stock, which was issued to pay for the electrification work now in progress, is too dear in proportion to the similar stock recently offered by the South-Eastern Railway; and holders of the first will be well advised to exchange into the second, since the latter may be expected to rise to a substantial premium, whereas the South-Western Preference can never go much above par, since it is redeemable at the Company's option at 100 in 5 years or 10. Underground Electric Income bonds keep very steady at 80; the £10 fully-paid shares are 2, and the 1s. shares 6s. 3d.

Mention was made here a fortnight ago of the energy and enterprise displayed by one of the gas companies in sending representatives to private houses in order to make suggestions as to what might be added for the convenience of the household. To one of these visits hangs an amusing sequel. The representative duly called, and recommended two particular gas stoves for two rooms; and the householder decided to take one of them. He sent to the local office of the gas company, with instructions to have the stove fitted, but this local branch at first tried to maintain that the stove ordered was the wrong size, and, therefore, unsuitable. The householder laughed, and referred the matter to the head office, which confessed that, although their representative had suggested this very stove, the company had none in stock, its last few having been taken recently. Some sort of stove, however, was faithfully promised for the next day, but nobody appeared, though on the following day a workman arrived to take fresh measurements, and so on. Finally the stove was fitted, but only after an expenditure of time, muddle and misunderstanding that would have done credit to the Post Office Telephone Service itself.

After which interlude, we may give our usual list of representative stocks and shares in the various electrical markets:—

HOME ELECTRICITY SUPPLY COMPANIES.

Brompton Ordinary	8¾	Kensington Ordinary	7⅞
do. 7 per cent. Pf.	8¾	London Electric	1¼
Charing Cross Ordinary	4⅜	do. do. 6 per cent. Pf.	5
do. do. do. 4½ Pf.	4¼	do. do. 4 Deb.	89½
do. do. City Pf.	4	Metropolitan	8⅜
do. 4 Deb.	86½	do. 4½ per cent. Pf.	4¼
Chelsea	4¼	do. 4½ Deb.	91⅜
do. 4½ Deb.	91½	do. 3½ Deb.	81⅜
City of London	14¼	St. James' and Pall Mall	9
do. do. 6 per cent. Pf.	13	do. do. 7 per cent. Pf.	6¾
do. do. 5 Deb.	115	do. do. 3½ Deb.	88
do. do. 4½ Deb.	98	South London	8
County of London	11½	South Metropolitan Pf.	1⅜
do. do. 6 per cent. Pf.	11¾	Westminster Ordinary	8¾
do. do. 1st Deb.	99	do. 4½ Pf.	4⅜
do. do. 2nd Deb.	97		

MANUFACTURING COMPANIES.

Brit. West. Pf.	1⅞	Electric Construction	10/-
do. 4 Deb.	72	do. do. Pf.	1
do. 6 p. lien	98	Gen. Elec. Pf.	10
Callenders	11½	Henleys	18
do. 5 Pf.	4⅝	,, 4½ Pf.	4¾
do. 4½ Deb.	97½	,, 4½ Deb.	97½
Edison & Swan, £3 pd.	8/6	Telegraph Con.	36⅜
do. do. fully pd.	2	Castner-Kellner	2¾
do. do. 4 Deb.	60		
do. do. 2nd Deb.	60		

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pf.	104	Gt. Northern Tel.	29⅛
do Def.	22	Indo-European	57
Chili Telephone	7	New York Tel 4½	97
Constantinople Tel.	4¼	Oriental Tel. Ord.	2
Cuba Sub. Ord.	8⅜	do. Pf.	1⅞
do. Pf.	15½	Tel. Egypt Deb.	97
Eastern Extension	12	United R. Plate Tel.	6
do. 4 Deb.	94	do. Pf.	5
Eastern Tel. Ord.	122½	West India and Pan.	1⅛
do. 8½ Pf.	71⅛	Western Telegraph	12⅜
do. 4 Deb.	95	,, 4 Deb.	95⅜
Globe Tel. and T. Ord.	10¼		
do. Pf.	12⅜		

FOREIGN TRAMS, &c.

Anglo-Arg. Trams 1st Pf.	4⅜	Bombay Electric Pf.	11
do. 2nd Pf.	4⅜	do. 4½ Deb.	96
do. 4 Deb.	86½	Mexico Trams.	45
do. 4½ Deb.	95½	do. 5 per cent. Bds.	70
do. 5 Deb.	93	do. 6 per cent. Bds.	65
Brazil Tractions	61	Adelaide Sup. 6 per cent. Pf.	5⅛
		do. 5 Deb.	100½xd

It will be noticed that County of London Preference have hardened to 11¾, and, moreover, there has been a buyer of the new shares, bidding £11 for these. The bid seems to be a cheap one, and holders might wait for a more substantial price. A parcel of Hendon Preference changed hands at £5 a share a few days ago. Calcutta Electric Supply Ordinary are being dealt in on the basis of 6½, and the Preference at 4¾, the latter price representing the present value of Calcutta Tramways Preference shares, which have been in demand also.

British Electric Traction Debenture stock changes hands, with a certain amount of freedom, between 88½ and 89. The block of London Electric Supply 4 per cent. Debenture stock which has been on tap for some time past is said to have been all taken by now, the sellers getting 88½, and sometimes better, for it. Details were given here last week of the coming issue to be made by the Melbourne Electric Supply Company; and it may be added that the present price of the Ordinary stock is 175, though extremely nominal at that. The Preference shares are 5¼ middle, and less difficult to negotiate than the Ordinary stock. Brazil Tractions have reverted to 61 after having touched 64½.

Marconis keep firm at 1⅛, tender buyers occasionally giving this price for them. The American variety is better at 9s. 6d., while Canadians remain at 4s. The developments in Egypt, whereby

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a Copper Sulphate
a Lead, Nitrate
a ,, White Suga
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b The British Alum
c Thos. Bolton & S
d Frederick Smith
e F. Wiggins & son
f India-Rubber, G
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h Edward Till & C

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EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING NOVEMBER, 1914.

In view of the times through which we are passing and the diversion of the manufacturing resources of our engineering firms from their normal channels, the November export returns are probably better than might have been anticipated, while the increase in the imports, especially from America, is quite understandable.

The electrical exports from this country reached a total of £349,254, as compared with £401,107 in October, there being a considerable falling-off in the machinery sections, while goods, cables, fittings, &c., also reached higher values in the previous month. On the other hand, some improvement is shown in the telegraphic, telephonic and battery exports.

The re-exports at £29,447 reached something like their old form. The imports at £201,569 compare with a total of £167,195 in the previous month, the increase being more particularly due to the activity of the U.S.A. in machinery imports. Lamp, cable and fittings imports were less in value than in October. For the most part business with our usual customers showed some falling off; in one or two cases abnormal business was due to telegraphic purchases.

As regards the imports, the Scandinavian countries doubled their business; Dutch, French and Italian imports fell off; Belgium was just represented, while the U.S.A. sent us some £199,000 worth of material, of which £129,000 worth was machinery.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	144	2,257	433	4,959	...	1,661	11,370	864	198	302	122	3,230	25,540
Germany	...	...	...	...	...	...	...	...	...	...	...	...	...
Netherlands, Java and Dutch Indies ...	294	3,487	442	13	77	39	1,217	...	36	...	38	...	5,643
Belgium	...	209	...	149	...	250	...	...	...	...	...	4,712	5,320
France	212	4,334	84	...	...	...	1,764	...	109	86	1,058	...	7,647
Portugal	98	52	...	298	...	582	652	386	...	18	1,200	221	3,507
Spain, Canary Isles and Spanish N. Africa...	59	140	46	17	...	46	1,050	50	24	...	90	81	1,603
Switzerland, Italy and Austria-Hungary ...	67	253	881	8	13	1,725	3,707	20	270	122	...	...	7,066
Greece, Roumania, Turkey and Bulgaria ...	...	2,397	...	...	...	...	180	...	...	...	...	12,895	15,472
Channel Isles, Gibraltar, Malta and Cyprus...	36	214	56	...	...	...	...	315	24	...	...	18,176	18,821
U.S.A., Philippines and Cuba	506	...	781	12	...	36	521	...	10	13	198	394	2,471
Canada and Newfoundland	872	990	268	3,270	...	73	3,207	12	618	...	...	142	9,482
British West Indies and British Guiana ...	26	19	21	35	...	...	113	...	61	...	98	309	682
Mexico and Central America	15	...	...	...	...	...	62	155	15	...	...	1,302	1,549
Peru and Uruguay	...	19	132	29	...	...	839	230	...	...	457	279	1 985
Chile	52	213	230	...	...	...	896	...	28	...	26	25	1,470
Brazil	350	3,788	941	51	...	63	1,533	285	46	...	51	301	7,413
Argentina	3,479	3,516	2,028	210	117	77	2,956	3,898	1,567	18	9,684	...	27,550
Colombia, Venezuela, Ecuador and Bolivia...	24	...	132	448	...	...	516	...	47	...	136	1,344	2,647
Egypt, Tunis and Morocco	882	385	102	6	10	...	911	...	277	61	156	542	3,332
British West Africa	...	33	...	47	...	...	46	...	12	14	574	17,457	18,183
Rhodesia, O.R.C. and Transvaal	892	...	279	216	...	819	5,160	...	123	...	70	...	7,559
Cape of Good Hope	325	931	222	1,079	...	58	2,281	...	453	...	43	4,824	10,206
Natal	575	1,462	213	176	...	211	5,626	705	27	38	6	262	9,301
Zanzibar, Brit. E. Africa, Mauritius & Aden	285	...	8	107	...	22	24	...	96	...	...	29	571
Azores, Madeira and Portuguese Africa ...	76	...	19	13	...	120	...	...	...	...	...	72	300
French African Colonies and Madagascar...	21	...	...	...	...	...	231	...	...	...	...	...	252
China and Siam	40	278	757	122	...	31	3,006	282	...	57	180	...	4,753
Japan and Korea	28	216	20	...	...	1,204	67	5,540	99	32	...	270	7,476
India	1,828	6,385	2,268	852	17	...	17,891	3,276	7,335	222	3,508	3,833	47,415
Ceylon	367	127	354	...	28	196	2,038	8	58	4	324	28	3,532
Straits Settlements, Fed. Malay States and Sarawak	1,214	777	356	229	...	...	1,698	66	93	93	192	924	5,642
Hong Kong	52	540	126	...	...	220	732	18	40	...	718	696	3,142
West Australia	305	585	251	233	...	13	537	4	163	...	83	106	2,280
South Australia	70	738	566	94	159	177	56	719	50	12	...	515	3,156
Victoria	1,012	9,153	562	1,210	...	1,724	4,489	184	701	...	3,720	1,032	23,787
New South Wales	762	12,091	1,058	1,151	128	343	10,681	165	3,653	14	1,503	1,694	33,243
Queensland	484	17	92	27	...	208	6,643	300	23	...	1,540	156	9,490
Tasmania	...	...	...	44	...	...	142	...	...	...	400	40	626
New Zealand and Fiji Islands	502	853	1,502	1,173	32	744	3,281	102	405	...	224	322	9,140
Total, £	15,954	56,449	15,234	16,278	581	10,612	96,123	17,584	16,691	1,106	26,399	76,213	349,254

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	474	153	...	32	277	...	4,655	...	759	506	13,381	20,237
Germany	...	...	...	...	...	...	...	...	...	...	...	...
Holland...	48	250	...	3,675	3,126	8	457	127	109	...	904	8,704
Belgium	...	...	...	...	...	...	...	...	...	...	495	495
France	115	90	269	95	1,587	...	123	...	7,304	1,061	201	10 845
Switzerland	74	240	66	13	...	2,169	3,428	...	...	852	222	7,064
Italy	195	860	...	...	...	...	1,018	...	...	297	552	2,922
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...	...
United States	7,461	48	530	1,612	2,102	...	21,409	107,663	2,354	3,991	1,587	148.757
Total, £	8,367	1,641	865	5,427	7,092	2,177	31,090	107,790	10,526	6,707	17,342	199,024

Additional imports: Spain: carbons, £2,180 Victoria: electrical machinery, £18. Canada: electrical goods, £13; wires and cables, £273; meters, £6; machinery, £23; carbons, £32.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above... ...	1,359	177	...	3,267	...	...	8,510	...	71	189	15,875	29,447

TOTAL EXPORTS: £349,254 TOTAL RE-EXPORTS: £29,447 TOTAL IMPORTS: £201,569

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

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ELECTRICAL ACCIDENTS IN MINES FOR THE YEAR 1913.

(*Concluded from page* 834.)

In the Northern Division there were no fatal accidents, but six non-fatal accidents. The Inspector, however, gives no particulars as to their cause, so that no lesson may be derived from them.

In the Yorkshire Division there were seven separate accidents causing a loss of eight lives, two being on the surface and five below ground.

Dealing first with those which occurred on the surface, one occurred whilst a derrick pole was being erected in order to lift some material for the building of a new hopper.

The deceased was employed holding one of the guide ropes clear of a travelling chain, and through the rope accidentally making contact with an electric switch connected to a 5-H.P. three-phase motor at 400 volts, he was electrocuted. Artificial respiration was resorted to at once, but proved ineffectual. The colliery electrician stated at the inquest that the switch had a wood cover before the accident occurred, but afterwards the lid of the cover was found wrenched off. There was no evidence to show exactly when or how the cover was displaced, and Mr. Nelson's view, after visiting the colliery, was that if a serious attempt had been made to protect the apparatus from accidental contact when it was first installed, the fatality would have been avoided.

In the other case, a boy of 13 years of age was sent from the coal screens on to a platform at the washer to assist another lad of the same age to clear away some dirt into a wagon standing below the stage. The platform consisted of a steel plate 10 ft. sq., with a dirt hole in the middle, the outer sides of the platform being fenced by three rails to a height of about 4 ft. above the floor. About 2 ft. beyond one corner of the platform and fence, and 4 ft. 6 in. above the floor, bare copper wires to supply an arc lamp at 220 volts D.C. were carried by insulators on a projecting bracket. It seems both lads had been warned by the surface contractor a few days before the accident that the wires were dangerous, though they could not be touched without deliberately reaching beyond the fence. After the lads had cleared away the dirt the deceased boy dared his fellow-worker, Sellers, to put his hand on the wires first, and, without saying anything, got on to the fence with both feet, grasped the wire with his right hand, and received a fatal shock.

Had the wire been accidentally touched in any other way —for instance, by workmen engaged in painting ironwork —there would have been good reason for attaching blame to the officials for not providing against such a contingency, but as the deceased, after having been previously warned about the danger, deliberately reached beyond the fence in order to touch the wire, the management under such circumstances were not to blame, though the accident illustrates the necessity for enclosing wires which exist within the reach of lads.

Of the underground accidents the first resulted in the death of a young man 21 years of age. The deceased was walking along a girder inside an underground engine house, which was under repair, to convey oil to a motor man, when he stumbled, and, while endeavouring to recover his balance, grasped a lighting wire above his head, tore the wire out of a connector, and was electrocuted. The wires had been temporarily placed for lighting some fitters engaged in installing a motor. The electricity was generated at 500 volts A.C., but was probably about 440 volts pressure where the accident occurred. As the wire was covered or taped over, he probably received the shock at the bare end, as the wire slipped through his hand.

As the wires were not protected by a metallic covering they were not in accordance with the regulations governing the use of electricity. Had they been so enclosed the accident would have been avoided. It was stated, however, that the wires were in use before the new regulations came into force, and were, therefore, exempted from the application of the new regulations. The risk attending lighting wires carrying unnecessarily high voltage has been commented upon by H.M forming to low voltage instances.

The second fatality occurred at Langwith electricity was supplied current for lighting th phase alternating curre lighting. The victim standing talking to a wire cage cover in wh and received a fatal e of a series of four sup rent; it had an iron ba by the wire cage refer screw to a prop, the l zontally from the prop

An examination show leads, where it had be cover of the lamp, a evidence of fusing due lamp cover was unear the lamp cage, was accident.

At the inquest, th in the circuit were or 500 volts), there was to earth the lamps fi and irrelevant, for the by the voltage of the but by the voltage of

As a result of this mine made by Mr. Mines, accompanied ings were taken again

1. Failing to "earth use in the mine, as requ

2. For failing to pu mine, so as to prevent from arcs, as required

The Magistrates fi to the unearthed lar plaints on payment

The third accide electrically driven. by a 25-H P. motor switch supplied w unarmoured cables to the gate-end bo shaft cable armouri surface, and to in wire rope. The t wire, connected at other to the machi

The deceased m of the coal cutte done during the cutting arrangem back along the fa fellow-worker to s and received a s handle and was el at either end, an off he also receiv to the gate-end s machine dead.

It seems that viously reported making repeated find no defect. at work until th

When examin that he had kn before, and the mittent earth. the accident, ac of Mines, infor ing against sh resistance betwe He further sa

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case was due to the high resistance of the earth wire and not to any lack of continuity. He recommended—and Mr. Nelson strongly agreed with him—that the voltage for portable motors should be transformed to something like 200 volts, in which case the risk of fatal shock would be very much reduced. The verdict of the jury was that deceased's death was accidental, and no one was to blame, but they recommended that a lower voltage should be used, and that earth conductors of lower resistance should be put in.

A fourth fatality occurred to a dataller named Alfred Taylor, aged 25. In the main gate of the South Tupton seam there was a Thompson conveyor at work upon a face of 140 yards in length. This conveyor working during the day, ran backwards and forwards along the face; it had to be started, stopped and reversed about every six minutes, and was worked by a 12½-H.P. motor geared down and situated in the cross road, 100 yards back from the face. The same motor also worked a coal cutter on the afternoon shift. The current supplied was at about 450 volts D.C.

It seems that when deceased was running to knock the main switch out of the conveyor switch gear, he lost his balance, and through falling with his head on to an earth wire broke the connection on the coal-cutter switch, and, at the same time, pulled out the main lead of the coal-cutter box. This live cable came in contact with the metal of the switch-box, and the current by passing through Taylor to the controller of the conveyor, which was still earthed, killed him.

Had the joints and the connections been properly made by lugs of sufficient mechanical strength to resist rough usage, this accident would have been avoided. Since the plant was installed the use of lugs had been compulsory by the new rules.

The fifth accident was the most serious of all, and involved the loss of two lives at a coal-cutting machine, electrically driven. The electrical supply was at 550 volts three-phase, 50 periods per second. The coal cutter of the Hurd bar type, was situated 1½ miles in-bye, and there was an estimated drop of 20 to 30 volts in that distance. Armoured cable was used up to the gate-end box, and the earth from that point to the machine was by means of an extra core or cores in the trailer.

Four attendants usually worked the machine, but on this occasion only three were present. The machine had been examined on August 11th by an assistant electrician, who reported it to be in good order.

When commencing work on the night of the accident, the men proceeded to rack the bar out of the "cut" with the haulage off, for the purpose of changing the cutters. Trouble was encountered in switching on, and as the handle of the controller would not pass what the men termed the second "notch" (finger), the machine only moved slowly. One of the men was sent to report the matter to the foreman cutter, and on returning to the machine he found that the two men whom he had left there had been killed during his absence. Spaulton, the coal-cutter driver, was found lying against the front end of the machine with his shoulder against the face-fender, while his fellow-worker was found beneath the cutter-bar of the machine, mutilated beyond recognition by the bar. Sparks were flying from the revolving bar, and also coming from the plug-box.

Investigations by Mr. Nelson, H.M. Electrical Inspector of Mines, and Mr. Fraser, H.M. Inspector of Mines, showed that the controller-handle had been forced from the first stop to the fourth, and that presumably in the process a controller "finger" had been broken off. This finger, when it had fallen to the bottom of the controller, made contact between some live part and the frame of the controller, thus making (in the absence of an effective earth connection) the whole machine live.

The absence of an effective earth connection was due to the fact that the earth conductor had been allowed to become detached from the plug-connector of the trailing-cable at the motor end.

As regards the ineffective earth connection, it looked at first sight as though there had been a serious deficiency in the upkeep of the electrical plant. But the evidence at the inquest showed that the trailing-cable plug in question had been examined by the electrician on August 8th, and Rule 14 (1) (now General Regulation 131), clearly imposes upon the man in charge of a coal-cutter the duty of examining the trailing-cable to see that it is in proper working order before he begins his shift.

Mr. Nelson was of opinion that it was almost impossible that the defect which was found to exist could have been caused during the shift, and, therefore, the balance of evidence inclines one to the view that the deceased men themselves put into use a faulty cable.

In addition to the above-named fatalities, there were nine non-fatal accidents causing injury to 10 persons, as compared with 10 non-fatal accidents causing injury to 11 persons in the previous year. Of the nine non-fatals, five occurred underground. One of these happened by the bursting of a thick peep-hole glass at a coal-cutter, and the breakage was thought to be due to the short-circuiting of armature lugs, which exploded inflammable gas produced by the heating of a shellac covering or varnish, which had been applied to the wires in several coats inside the coal-cutter. It was subsequently found that methylated spirits had been mixed with the shellac varnish. Another accident was due to shock, where the trailing cable of a coal-cutter was not connected to earth. Of the surface accidents, one causing injury to two persons was occasioned by a spanner being dropped across live bus-bars. The short circuit thus caused threw out the switch, causing a large flame which badly burnt both men.

In the Manchester district there were two non-fatal accidents, but no particulars are given by the inspector, whilst in the Liverpool district there were no accidents due to electricity, although electrical machinery is employed to the extent of nearly 22,000 H.P.

In the South Wales Division there were one fatal accident and four non-fatal accidents underground, and one fatal and three non-fatal accidents on the surface.

The fatal accident underground resulted in the death of a pumpman. There was found to be a fault in the circuit which rendered the motor frame alive. The earthing of the motor frame was inefficient. Proceedings were taken for breaches of the electrical regulations, and the electrician was fined.

The surface accident resulted in the death of a labourer, working near an electric haulage engine-house; when heavy rain came on, he and others went into the engine house for shelter. When leaning on an iron fence surrounding the motor he must have put his hand on the stator leads, which carry a current at 1,750 volts. The leads were insulated, but a small hole was found in the insulation after the accident, and the deceased was seen to stretch his hand inside the iron fence in the direction of the motor and in the neighbourhood of the place where the fault was subsequently found.

No particulars are given of the non-fatal accidents.

In the Midland and Southern Division two fatal and four non-fatal accidents occurred, and one non-fatal accident on the surface. As regards the non-fatal accidents no particulars are given.

In the first fatal accident, deceased was repairing in a pass-bye on the main haulage road, which has a wet floor, when he came into contact with a bare part of one of the power cables and received a fatal shock. The current was two-phase, and the voltage 200. The cables were suspended by strings from insulators fixed on the bars, and apparently the suspending strings had stripped off the insulation of the cable where deceased touched it.

Mr. Nelson, who investigated this accident and subsequently attended the inquest, was of the opinion that the cables were too light for use underground, and that the conditions which obtained at the scene of the accident were perfect for an electric shock. The cables did not comply with the existing regulations, but it was stated at the inquest that they were in use prior to June, 1911, and were, therefore, exempted from these regulations by Regulation 137 (*b*).

In the other case the deceased was engaged in moving a concentric cable forward at the stall face, when from a stupid misunderstanding about the recognised signals, the current was switched on when he was handling the bare wires at the splicing. The switch-box was about 300 yards up the hill, and had a removable handle. Deceased ought to have removed this and retained it in his possession, but it

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appeared to be doubtful whether he knew that the handle was removable. If not, it was clearly the duty of his superiors to have instructed him. The system was direct current at 580 volts.

This accident would clearly never have occurred if reasonable and proper precautions had been taken. It emphasises the necessity for the entire control and direction of electrical apparatus during repairs or extensions being in the hands of a properly trained expert. The non-fatal accidents do not call for special comment here, further than that every one of them might have been prevented had proper care been exercised.

It is also interesting to note that in this division the inspector instituted proceedings against the owner and manager for contraventions of the electrical regulations, which resulted in convictions against the owner on all the charges, and fines amounting to £105 and £10 10s. costs were imposed, whilst the charges against the manager were dismissed.

RECENT ADVANCES IN ELECTRICAL CRANE AND LIFT DESIGN.

[COMMUNICATED.]

(*Continued from page* 831.)

TURNING now to the electrical equipment which is necessary for the control of crane motors, it will at once be apparent that many of the controls which simply consist of more or less effective transpositions of, or modifications to, ordinary motor control gear, are not quite the best that can be imagined for crane service, inasmuch as such designs are far too fragile for such work under the rough handling to which crane gear is subjected. While it is impossible to convey in a brief article of this nature any idea of the almost multitudinous number of designs of crane-control apparatus which have been put into operation, it will be interesting by reference to one or two examples to show the lines on which the most recent practice has advanced. For the usual type of installation where continuous and uninterrupted service under severe conditions is desired, the "Vickers" ironclad crane panel made by the Electric and Ordnance Accessories Co., Ltd., of Birmingham, is a fair type, and it

FIG. 4.

has an additional advantage in its small size. The 50-ampere panel constructed to control a four-motor crane measures only 10 in. high by 20 in. wide by 9 in. deep, which is less than half the size of the ordinary panel, and accompanying this reduction in size there is a considerable saving in weight, which is obtained without impairing the efficiency. Fig. 4 shows the external appearance of this control panel with the front cover closed, while fig. 5 shows the apparatus open. It consists essentially of a double-pole main switch and fuses of a good "make-and-break" type. There are also three or four double-pole branch fuses, according to the number of motors, together with plug and socket with a double-pole tumbler switch and fuse for the inspection lamp and two pilot lamps. The main switch and fuses and branch fuses are enclosed in a cast-iron case, divided by a slate fillet into two sections, positive and negative, containing the branch fuses, and their respective positive and negative main leads. The mains are led to the

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venting the barrel from dropping from the fingers due to wear in the seating. The barrel itself is of cast-iron assembled on a square steel shaft, and insulated therefrom by mica. The barrel contacts are of hard-drawn copper, and are so fixed by means of screws that they are easily replaced. The fingers consist of pressed brass carriers pivoted on to brass terminals, and provided with solid and substantial copper tips. Pressure is applied to the finger by means of a coiled spring fitted between the terminal block and the carrier, adjustments being made by a square adjusting nut, working in a screwed steel pin, the side of the nut butting against the shoulder of the finger bracket, so that, except when the finger is lifted exceptionally high, it is impossible for it to turn and upset the adjustment of the finger. This arrangement, besides providing a self-locking device for the adjusting nut, at the same time makes it quite easy to alter the lift on the fingers or take up wear, simply by lifting up the end of the finger and turning the nut by hand, no tools of any sort being required. The tips, which are of substantial design, so as to be able to withstand heavy spark wear, can be readily and cheaply renewed. Incombustible arc shields are placed between adjacent fingers so as to prevent any possibility of short-circuiting by arcs.

The resistances have elements assembled on iron rods, from which they are insulated by mica. In the case of heavy-current resistances, these elements consist of cast-iron grids, but for lighter capacities, either the wire-woven net type is used, or the porcelain pot type resistance. In the latter pattern, heavy English porcelain tubes of large diameter, to withstand the rough usage, are wound with high-resistance wire, having a negligible temperature coefficient. Substantial cast-iron end-plates are fitted, and the whole resistance is held together by means of mild steel rods. Separate terminals clamped on to mica-insulated steel bars are fitted on this type.

The type of controller used depends on the duty and conditions under which the crane is required to work. For cross traverse and longitudinal travel, either a plain series controller can be used having power running positions in either direction, the regulation being obtained by means of resistance in series with the armature, or in the case of high-speed crane work, rheostatic braking may be employed to bring the crane quickly to rest. For this purpose controllers are supplied having, besides the usual power running positions, several rheostatic braking positions, in either direction.

For the hoisting motion it is usual to have the controller provided with power running positions on the hoisting side and rheostatic braking points and a few power points on the lowering side. For foundry work where specially low speeds are necessary, a controller should be used having a few dead slow positions and ordinary series regulating positions on the hoisting side, whilst on the lowering side the controller either may have rheostatic braking points and some power lowering positions, or it may be arranged in a similar manner to the hoisting side.

On the controllers for compound-wound machines, a special contact is arranged for inserting a resistance in parallel with the shunt field at the same moment as the main circuit is opened. On cranes where the duties are arduous and load heavy, it is usual nowadays to control the motors by means of solenoid-operated relay type gear. Fig. 7 is an illustration of a recent panel together with its operating controller manufactured by Messrs. The Electric and Ordnance Accessories Co., Ltd. Where this design is used the solenoid panel may be mounted at any convenient position on the crane, and only a small master controller need be fitted in the driver's cabin. This prevents any cramping in the cabin, and has the additional advantage that the master controller is much easier to operate than a heavier controller dealing with the main currents would be. Also as the making and breaking is necessarily quick, the spark wear and consequently the necessity for renewals is considerably decreased.

The resistances may either be combined with the controller or separately installed. Where they are combined with the controller they may be either of two-minute or five-minute rating, but where supplied separate from the controller they may be either two-minute, five-minute, or continuously rated. They are designed to carry the full-load current on any step for the period mentioned out of every 15 minutes with a maximum temperature rise of 200° C. For crane work they are usually made either of the open type, when they are fixed in some out-of-the-way position on the girders, or the protected type, when they are required to be fixed in the cage; but they may be made weather-proof, provided they are not rated for longer than five minutes.

For lift work, the control gear may be operated either by hand rope in the cage, car switch, or push-button. As a typical example of the rope-operated lift controller, we may refer to the standard design of the Electric and Ordnance Accessories Co., Ltd., who employ barrel-type gear identical with that used on their standard crane controllers throughout. The controller consists essentially of two barrels suitably interlocked, one being used for reversing the armature connections, and the other for cutting out the resistance connected in series with the armature. When

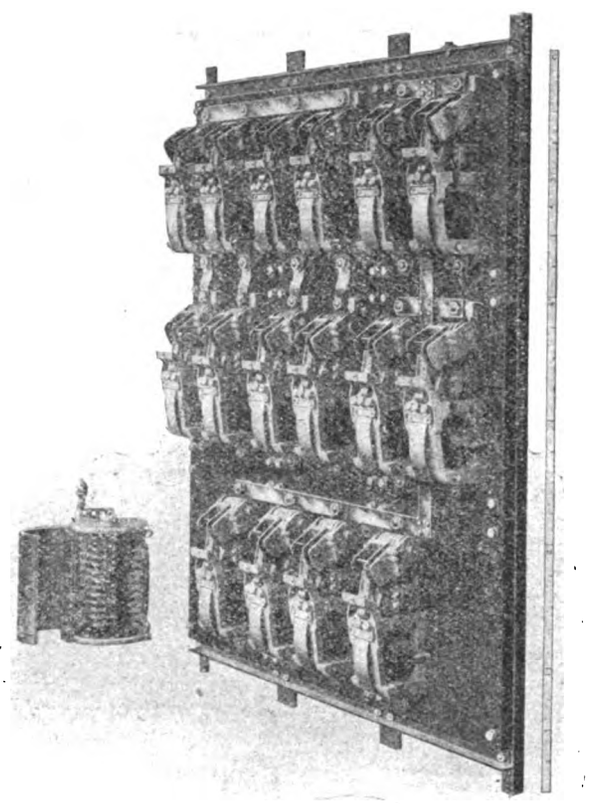

Fig. 7.

the operating rope is pulled from the "off" to the "full" running position in either direction, the reversing switch is set to give the required direction of rotation for the motor. As soon as this switch is quite home, a mechanical interlock releases the starting barrel, and allows a weight which is connected by means of gearing to the starting barrel and retarded by an adjustable oil dash-pot, to fall slowly. The first movement of this barrel closes the single-pole main switch, which is then held closed by the no-volt coil. A further movement of the weight gradually cuts out the armature resistance step by step until the motor is finally connected across the mains and running at full speed.

The connections are so arranged that a limit switch may be coupled up in series with the no-volt coil, so as to prevent over-running of the lift in either direction, but when the controlling rope is pulled to reverse the lift, the limit switch, which had previously been opened, is automatically short-circuited on the controller, and so enables the motor to be started up.

The interlocking is arranged so as to make the controller quite fool-proof, and to prevent any possibility of closing the main switch until the whole of the resistance is in series with the motor. With this design it is possible to use gate switches which prevent the lift from being started up unless all the gates are properly closed. For car-switch and push-button control, a combination of solenoid switches similar to those already described and an automatic solenoid-operated starting switch can be used.

(To be continued.)

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NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

23,653. "Method for localisation of bullets and other foreign bodies by means of X-rays." G. G. Blake. December 7th.

23,671. "Telegraphic recorders and relays." A. Orling & Orling's Telegraph Instruments Syndicate, Ltd. December 7th.

23,675. "Apparatus for electro-plating iron and steel plates with other metals." S. O. Cowper-Coles. December 7th.

23,676. "Electrical heating elements." F. S. Grogan. December 7th.

23,719. "Commutators of electric motors." F. Scales. December 8th.

23,726. "Electric fire alarm apparatus." N. Bendixen & M. B. Mountain. December 8th.

23,739. "Construction of electric switch." J. Harrington. December 8th.

23,749. "Protective arrangements for electrical systems." J. F. Watson, E. G. Waters, & Callender's Cable & Construction Co., Ltd. December 8th.

23,759. "Induction coils." E. E. Collins. December 8th.

23,761. "Joints for metallic telegraphic posts and other like posts or poles." Bullers, Ltd., & H. C. R. Dagnall. December 9th.

23,778. "Electric thermostats." G. Wilkinson. December 9th.

23,791. "Electric ignition apparatus for internal-combustion engines." C. B. Burdon. December 9th. (Siemens & Halske Akt. Ges., Germany.)

23,798. "Process for banding projectiles." S. O. Cowper-Coles. December 9th.

23,799. "Process for rendering iron and steel surfaces incorrodible." S. O. Cowper-Coles. December 9th.

23,804. "Electric incandescent lamps." N. V. Philips Metaalgloeilampenfabriek & G. Holst. December 9th. (Convention date, June 11th, 1914, Holland.) (Complete.)

23,810. "Electric starters for internal-combustion engines." A. H. Midgley & C. A. Vandervell. December 9th.

23,813. "Safety apparatus for electric lighting installations." Soc. Anon. des Automobiles et Cycles Peugeot. December 9th. (Addition to 21,445/13. Convention date, December 16th, 1913, France.) (Complete.)

23,819. "Resistances." J. R. Quain. December 9th.

23,822. "Telephone receivers." A. Rosenberg. December 9th.

23,865. "Method and auxiliary apparatus for the working of telephone systems." A. R. Upward. December 10th.

23,868. "Slot-keys or slot-closing devices for use in dynamo-electric machinery." C. B. Burdon. December 10th. (Siemens Schuckertwerke G.m.b.H., Germany.)

23,873. "Apparatus for controlling the lighting power of an electric lighting plant." Soc. Anon. des Automobiles et Cycles Peugeot. December 10th. (Addition to 9,175/14. Convention date, December 26th, 1913, France.) (Complete.)

23,881. "Electric connections." British Thomson-Houston Co., Ltd. December 10th. (General Electric Co., United States.)

23,884. "Electrically-actuated tools." W. J. Mellersh-Jackson. December 10th. (Commonwealth Electric Tool Co., United States.) (Divided application on 18,738/14. August 17th.) (Complete)

23,894. "Series-parallel controlling systems for electric motors and like apparatus." G. R. Radley. December 10th. (Divided application on 1,975/14. January 24th.) (Complete.)

23,904. "Lamp-holders and the like." J. G. Hodgson. December 11th.

23,914. "Magneto-electric ignition generators." W. C. Berling. December 11th. (Complete.)

23,917. "Safety apparatus for electric-lighting installations." Soc. Anon. des Automobiles et Cycles Peugeot. December 11th. (Addition to 21,445/13. Convention date, December 26th, 1913, France.) (Complete.)

23,930. "Selecting devices for telephone or other circuits." O. Imray. December 11th. (Siemens & Halske Akt. Ges., Germany.) (Complete.)

23,938. "Electric meters." British Thomson-Houston Co., Ltd. December 11th. (General Electric Co., United States.)

23,948. "Electric cooking apparatus." H. H. Holmes, C. H. Smith, R. C. Griesbach & Jackson Electric Stove Co., Ltd. December 12th.

23,958. "Primary electric cells and batteries." F. Westwood. December 12th.

23,967. "Reversing motor equipment for electrically-driven metal-planing machines and the like." J. G. Stirt. December 12th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

26,546. Electrical Resistances particularly applicable to Electric Heating Elements adapted to be Immersed in Liquids. F. B. Cox. November 19th.

26,575. Electro-magnetic Switches. A. H. Curtis, F. N. Pickett, V. M. Colton, & Igranic Electric Co., Ltd. November 19th.

26,835. Electrically-heated Cooking and Sterilising Apparatus. C. E. Hearson. November 21st.

27,249. Electric Switches for Train Lighting and like installations. J. Stone & Co., Ltd., and A. H. Darker. November 26th.

27,258. Ozoniser. B. R. B. Von Tagueeff. November 26th. (September 12th, 1913.)

27,480. Receivers for Wireless Telegraphy. Marconi's Wireless Telegraph Co. & H. J. Round. November 28th.

27,633. Absorption Pyrometers. G. A. Alder & A. O. Cochrane. December 1st.

28,004. Signalling Devices for use in Coal Mines. F. Smith. June 4th, 1914. (June 4th, 1914.)

29,245. Telephonic Connections. S. G. Brown. December 18th.

29,545. Indicating Apparatus for Electric Measuring Instruments. Evershed & Vignoles, Ltd., and S. Evershed. December 22nd.

1914.

2,629. Method of Rendering Water or other Liquid Radio-active. J. Landin. January 30th. (February 10th, 1913.)

3,328. Securing Arrangement for Electric Cables. St. Helens Cable & Rubber Co. and J. C. White. February 9th.

6,303. Apparatus for Indicating the Quantity of Water in the Holds of Ships, Tanks, or Floating Docks, and elsewhere. A. G. Weyll. March 12th (May 29th, 1913.)

6,356. Telephonic Systems. E. A. Graham, W. J. Rickets, & E. A. Sanftleben. March 12th.

8,038. Electric Switches. G. W. Hart. March 30th. (April 1st, 1913.)

10,633. Automatic Electric Controlling Devices. A. H. Curtis, A. H. Mackley, & Igranic Electric Co. April 30th. (Patent of Addition not granted.)

10,868. Electrical Condensers and the Process of Manufacture therefor. G. Giles. May 2nd. (July 3rd, 1913.)

15,195. Water-level Indicator and Alarm for Boilers and the like. M. B. Cooper. June 24th.

17465. Control Systems for Electric Motors. N. W. Storer. July 23rd. (July 29th, 1913.)

19,193. Wall Junction Boxes for Electric Cables. J. C. White & St. Helens Cable & Rubber Co. August 28th. (Addition to 22,198/13.)

The Apprenticeship System at the Works of the British Westinghouse Co.—In summarising recently the report of the Institution of Civil Engineers on the education and practical training of engineers, we pointed out that several conferences had already taken place on this subject, although no definite scheme had yet been evolved. The question of trade apprenticeship has not received the same attention, and it has been left largely to individual manufacturing firms to formulate and adopt their own systems, seeing that the original system in vogue in the early days of manufacturing has fallen into disrepute and become practically obsolete. We have from time to time given details of the apprenticeship systems adopted in various works, and we give below an outline of the system in vogue at the British Westinghouse works, the source of our information being Mr. A. P. Fleming's contribution to the discussion which recently took place at the Manchester Association of Engineers on "The Education of Engineers." The system has not been in use long enough to show any very striking results, but the general method may be of interest to others who are considering the matter.

Before being "bound," candidates for apprenticeship serve a probationary period of three to six months in a works department, and then, if satisfactory, they are eligible for admission to an apprentice school provided in the works, in which about 300 youths are taught during working hours under the supervision of a body of instructors recruited from the staff of the company.

The school work comprises two divisions, viz :—(1) General instruction; and (2) trade instruction. The general instruction includes shop arithmetic, elementary physics and mechanics, properties of materials, the names and uses of tools, explanation of shop terms, elementary ideas of cost, the importance of discipline, thoroughness and method, the prevention of waste, and sufficient knowledge of drawing to be able to read a blue print.

In the second division matters which are more or less common to all trades are dealt with, and shop problems explained and discussed. A course of lectures is also given in each of the principal trades by shop engineers and leading foremen, dealing specifically with shop methods and processes, and with the manufacture of certain classes of apparatus.

The total period of instruction is planned to cover two years, the hours varying from seven per week in the elementary and two per week in the advanced section. All costs of tuition are borne by the firm, and the regular rate of wages is paid during the time spent in school.

In addition to the foregoing, a special course of instruction, occupying about three hours each week, is given to youths who are "bound" as apprentice draughtsmen, and another course for those promoted to the testing departments.

Instruction in book-keeping and costing is also given to juniors on the clerical staff.

As regards practical instruction in the shops, this is in the hands of the foremen, whose interest in the youths is aroused and stimulated by the discussions which take place in the classes on their shop talks or lectures.

The preparation of these lectures cannot fail to be of educational value to the foremen themselves. Records of students' progress, ability, conduct and timekeeping are kept and marks awarded accordingly. The marks in conjunction with those obtained in the school determine the apprentice's standing.

Youths showing exceptional merit are not necessarily kept in one department, and may be promoted to the drawing office or testing departments. They may also qualify by competitive examination to attend the Apprentices' Day Course at the Manchester Municipal School of Technology, the fees and expenses being paid by the firm in addition to ordinary wages during absence from the works.

Whilst the foregoing system in its entirety is too elaborate for any but very large works, the apprentice school method of training with suitable modifications to suit local conditions is in operation in other works. It is, however, open to question as to whether or not these are the best lines on which to settle the general question of apprenticeship, and we regard all such schemes as merely tentative, and serving as steps only in the evolution of a national system, which shall eventually take the place of the old system which has become obsolete owing to the industrial revolution brought about by mechanical methods of production.

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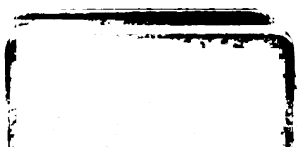

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